U.S. Fish & Wildlife Service

DRAFT HABITAT MANAGEMENT PLAN AND ENVIRONMENTAL ASSESSMENT FOR

FELSENTHAL NATIONAL WILDLIFE REFUGE

Ashley, Bradley, and Union Counties, Arkansas

Felsenthal NWR (Credit: Chuck Harrelson)

Felsenthal National Wildlife Refuge

Draft Habitat Management Plan and Environmental Assessment

U.S. Department of the Interior
Fish and Wildlife Service
Southeast Region

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CHAPTER I. INTRODUCTION

SCOPE AND RATIONALE

The U.S. Fish and Wildlife Service (Service) prepared this Draft Habitat Management Plan (HMP) for Felsenthal National Wildlife Refuge (NWR or Refuge) to guide habitat management over the next 15 years. Established in 1975 as mitigation for the creation of the United States Corps of Engineers' (USACE) Ouachita and Black Rivers Navigation Project and Felsenthal Lock and Dam, Felsenthal NWR is located in southeast Arkansas, approximately eight miles west of the town of Crossett (Figure 1). This 65,000 acre refuge is named for the small Felsenthal community located at its southwest corner and contains an abundance of water resources dominated by the Ouachita and Saline Rivers and the Felsenthal Pool.

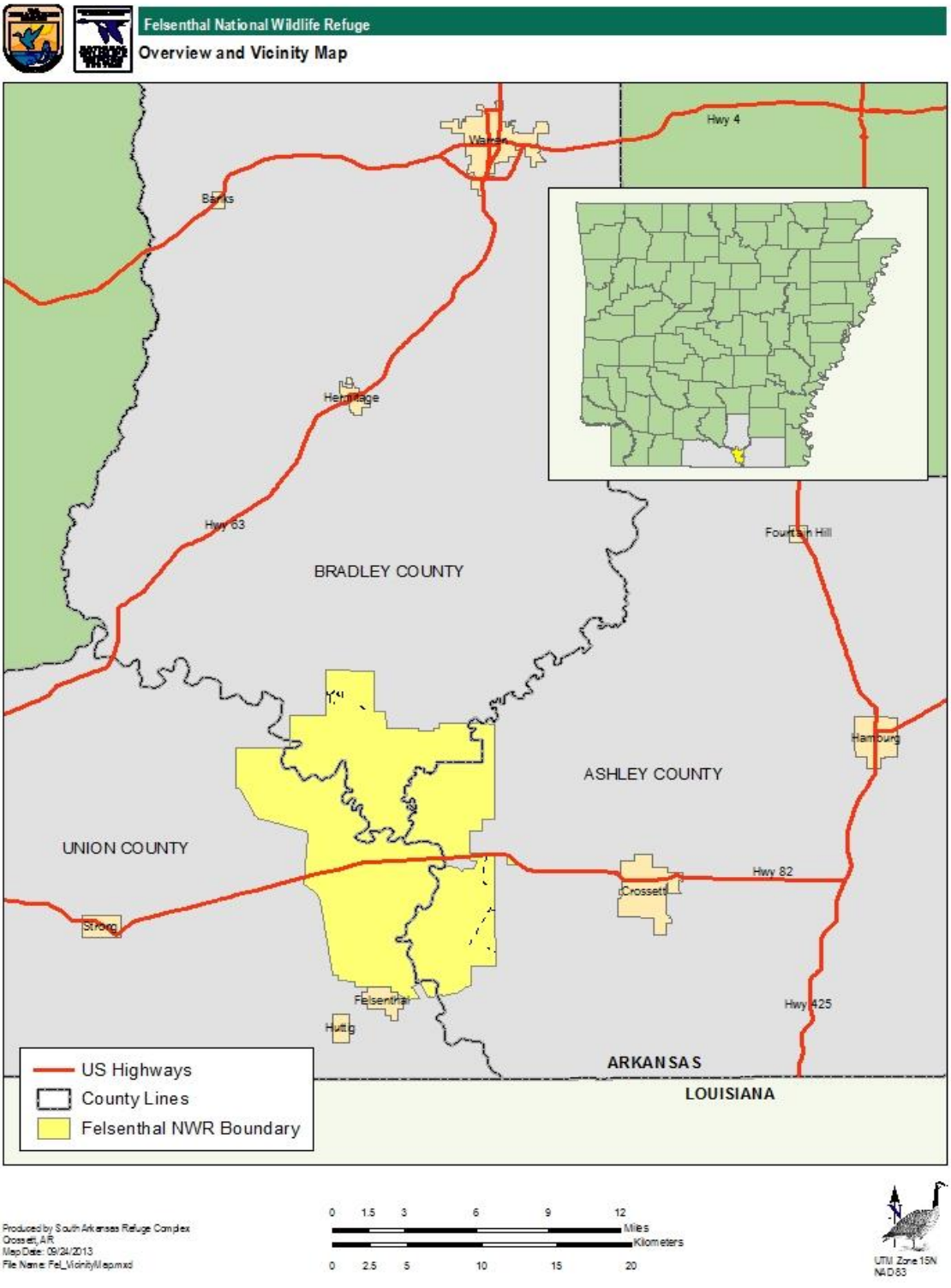
The purpose and establishing authorities of Felsenthal NWR are:

> 16 U.S.C. § 664 (Fish and Wildlife Coordination Act)"... shall be administered by him [Secretary of the Interior] directly or in accordance with cooperative agreements ... and in accordance with such rules and regulations for the conservation, maintenance, and management of wildlife, resources thereof, and its habitat thereon ..."
>
> 16 U.S.C. § 460k-1"... suitable for incidental fish and wildlife-oriented recreational development; the protection of natural resources; and the conservation of endangered species or threatened species ..."
>
> 16 U.S.C. § 460k-2 (Refuge Recreation Act (16 U.S.C. § 460k-460k-4), as amended)"... the Secretary ... may accept and use ... real ... property. Such acceptance may be accomplished under the terms and conditions of restrictive covenants imposed by donors ..."

In the past, the primary focus of the Refuge has been the management and restoration of wetland habitats and the management of waterfowl. Although waterfowl management will always be a priority, future habitat management efforts will also ensure the protection, management, and enhancement of native plant communities to benefit shorebirds, secretive marsh birds, wading birds, landbirds, raptors, the endangered red-cockaded woodpecker (RCW), and resident wildlife. During the development of the 2010 comprehensive conservation plan (CCP) (USFWS 2010), our conservation partners and members of the public helped the Service and refuge staff develop a future management vision statement. This Refuge Vision Statement serves as a starting point and provides future direction for habitat management planning and implementation.

> *The South Arkansas National Wildlife Refuge Complex (Complex) provides a diversity of habitats for wintering waterfowl, migratory birds, threatened and endangered species, and resident wildlife, and provides enhanced wildlife-dependent public use opportunities. The Complex protects, manages, and restores an intricate system of rivers, creeks, sloughs, buttonbush swamps, and lakes throughout a vast bottomland hardwood forest that gradually rises to an upland forest community.*

Figure 1. Location of Felsenthal National Wildlife Refuge, Crossett, Arkansas.



The Complex will continue to serve the American people by continuing opportunities for compatible, wildlife-dependent recreation such as hunting, fishing, wildlife photography and

observation, as well as environmental education and interpretation. In addition, the Complex will seek partnerships that promote environmental stewardship, foster research opportunities to enhance resource management and restoration efforts, and protect historical and cultural resources of the Complex.

The Refuge's CCP (USFWS 2010) and this HMP are the primary tools used to guide refuge staff in achieving refuge objectives and the mission of the National Wildlife Refuge System (Refuge System). We have used the most recent refuge biological information and data, scientific literature, and ecological principles in developing this HMP to conserve and protect functional communities of native fish, wildlife, and plants. We view the highest measure of biological integrity, diversity and environmental health (BIDEH) as those natural habitats and associated wildlife populations that existed under historic conditions before humans altered the landscape. We have considered a range of habitat management strategies to meet our specific habitat goals and objectives and conducted a survey of current refuge habitat conditions using scientific reports, conservation partners' professional opinions, and Service wildlife management expertise. We will provide for or maintain all appropriate native habitats and species.

This Habitat Management Plan is a dynamic working document with a long-term vision that provides guidance for the management of refuge habitats on an annual basis. The plan will provide direction for the next fifteen years (2015 – 2030), with subsequent reviews every five years, and use of adaptive management principles to assess and modify management activities as required.

We also have considered and incorporated the role of refuge habitats in international, national, regional, state, and local ecosystem plans. To the extent practicable, we craft our goals and objectives to be consistent with these plans, to assist in attaining the goals and objectives of conservation partners and the larger conservation community, in addition to achieving refuge objectives.

LEGAL MANDATES

The National Environmental Policy Act (NEPA) mandates our consideration of the impacts of our habitat management on environmental and cultural resources in planning federal actions. This process ensures compliance with NEPA, and serves as the basis for development of the HMP. In conjunction with the preparation of an Environmental Assessment (EA) under the requirements of NEPA, the HMP process includes intra-Service Section 7 Consultation (Appendix C) to fulfill the requirements of the Endangered Species Act (ESA). The ESA provides a program for the conservation of threatened and endangered plants and animals and the habitats in which they are found.

The National Wildlife Refuge System Improvement Act of 1997 (Refuge Improvement Act) (described below) provides the Service the authority to establish policies, regulations and guidelines governing habitat management planning within the System. The Refuge Improvement Act 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…"* {Section 4(a)(3)} and that *"In administering the System, the Secretary shall monitor the status and trends of fish, wildlife and plants in each refuge"* {Section 4(a)(4)}. The Service has established Habitat Management Planning Policy derived from the statutory authority of the Refuge Improvement Act and in June of 2002 published Chapter 620: Habitat Management Practices within the NWR System (620 FW 1) in the Service Manual.
The Service and its Mission

The U.S. Fish and Wildlife Service administers the National Wildlife Refuge System (Refuge System). The Service is an agency under the Department of the Interior and its purpose is to conserve the nature of America.

The Service's commitment to safeguard the nation's fish, wildlife and their habitats is reflected in its vision statement: "We will continue to be a leader and trusted partner in fish and wildlife conservation, known for our scientific excellence, stewardship of lands and natural resources, dedicated professionals, and commitment to public service. The Service's mission is: "Working with others, to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people."

The Service is the primary Federal agency responsible for conserving, protecting and enhancing America's fish and wildlife populations and their habitats. These trust resources include migratory birds, federally listed endangered or threatened species, interjurisdictional fish, wetlands, certain marine mammals, and national wildlife refuges. The Service oversees the enforcement of Federal wildlife laws and international treaties on importing and exporting wildlife, management and protection of migratory bird populations, restoration of national fisheries, administration of the Endangered Species Act, and restoration of native plant habitats. The Service also assists states with their fish and wildlife programs and helps other countries develop conservation programs.

The Service Manual, http://www.fws.gov/policy/manuals/, contains the standing and continuing directives to implement its authorities, responsibilities, and activities. Special Service directives that affect the rights of citizens or the authorities of other agencies are published separately in the Code of Federal Regulations (CFR); the Service Manual does not duplicate them (see 50 CFR 1-99 at http://www.gpoaccess.gov/cfr/index.html).

Federal laws also require the Service to identify and preserve its important historic structures, archaeological sites, and artifacts. The National Environmental Policy Act (NEPA) mandates our consideration of cultural resources in planning Federal actions. The National Historic Preservation Act (Pub. L. 102–575; 16 U.S.C. 470) requires Federal agencies to locate and protect historic resources—archaeological sites and historic structures eligible for listing or listed in the National Register of Historic Places and museum property—on their land or on land affected by their activities. It also requires agencies to establish a program for those activities and carry them out in consultation with state historic preservation offices (SHPOs).

Our Regional Historic Preservation Officer in Savanna, Georgia, oversees our compliance with the National Historic Preservation Act and our consultations with state preservation offices. We must also comply with the Archaeological Resources Protection Act (pub. L. 96–95, 16 U.S.C. 470aa-mm) which requires that we protect our archaeological sites from vandalism or looting and issue permits for site excavation.

The National Wildlife Refuge System: Mission and Policies

The Refuge System is the world's largest collection of lands set aside specifically for the conservation of wildlife and ecosystem protection. The Refuge System began in 1903, when President Theodore Roosevelt designated Pelican Island, a pelican and heron rookery in Florida, as a bird sanctuary. Today, this unique wildlife conservation system consists of over 560 national wildlife refuges. These refuges encompass more than 150 million acres of lands and waters in all 50 states and several island territories, and represent the world's largest collection of lands specifically managed for fish, plants, and wildlife. More than 40 million visitors hunt, fish, observe and photograph wildlife, or

participate in environmental education and interpretive activities on refuges across the nation each year.

The Refuge System is home to more than 700 species of birds, 220 species of mammals, 260 reptile and amphibian species, and more than 200 species of fish. This unique network of conserved lands also provides critical habitat for more than 250 threatened and/or endangered plants and animals. As a result of international treaties for migratory bird conservation, such as the Migratory Bird Conservation Act, many refuges have been established to protect migratory birds. Refuges are also places where people can enjoy wildlife-dependent recreational and educational opportunities about the great outdoors, and the Refuge System provides some of the best places across the country where people can hunt, fish, observe, and enjoy wildlife throughout the year.

In 1997, the Refuge System Improvement Act was passed. This law established a unifying mission for the Refuge System, a new process for determining compatible public use activities on the refuges, and the requirement to prepare a CCP for each refuge. The Refuge Improvement Act states first and foremost that the Refuge System must focus on wildlife conservation. This law established several new mandates to make the management of the Refuge System more cohesive and standardized to ensure that wildlife is considered first when managing refuges.

The Refuge System Improvement Act directs the Secretary of the Interior to ensure that the mission of the Refuge System and purposes of the individual refuges are carried out. It states that the national mission, coupled with the purpose(s) for which each refuge was established, will provide the principal management direction for each refuge. It also requires the Secretary to maintain the biological integrity, diversity, and environmental health of the Refuge System. The mission of the Refuge System is:

> *"To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans."*

Refuge Improvement Act, Public Law 105-57

The desired conservation end point of the Refuge System mission is articulated through Service goals describing the results the Service expects to achieve by managing the Refuge System. These Refuge System goals have been designed to help guide the development of CCPs and HMPs and improve the administration, management, and growth of the Refuge System in a unified and consistent manner. These goals are:

- Conserve a diversity of fish, wildlife and plants and their habitats, including species that are endangered or threatened with becoming endangered.

- Develop and maintain a network of habitats for migratory birds, anadromous and interjurisdictional fish, and marine mammal populations that are strategically distributed and carefully managed to meet important life history needs of these species across their ranges.

- Conserve those ecosystems, plant communities, wetlands of national or international significance, and landscapes and seascapes that are unique, rare, declining, or underrepresented in existing protection efforts.

- Provide and enhance opportunities to participate in compatible wildlife-dependent recreation (hunting, fishing, wildlife observation, photography, environmental education and interpretation).

- Foster understanding and instill appreciation of the diversity and interconnectedness of fish, wildlife, plants, and their habitats.

Maintaining Biological Integrity, Diversity and Environmental Health Policy (BIDEH policy)

This policy provides guidance on maintaining or restoring the biological integrity, diversity and environmental health of the Refuge System, including the protection of a broad spectrum of fish, wildlife and habitat resources found in refuge ecosystems. Refuge managers are provided with a process for evaluating the best management direction to prevent the additional degradation of environmental conditions and restoring lost or severely degraded environmental components. They accomplish this by assessing the current status of biological integrity, diversity, and environmental health on each refuge through baseline vegetation surveys and studies and by understanding historic conditions, i.e., those conditions which were, and would be present and self-sustaining without human changes to the landscape. Historic conditions serve as a frame of reference to understand the functional processes that naturally shaped the refuge's ecosystem and the scale and frequency of such processes (e.g., fire, flooding, and plant succession) to ascertain the refuge's natural ecosystem. First and foremost, refuges are directed to preserve habitats that maintain a high degree of biological integrity and environmental health. Lost or severely degraded habitats shall be restored, via natural processes or by using management measures which mimic natural ecosystem processes or functions. Guidelines are also provided for dealing with external threats to the biological integrity, diversity, and environmental health of a refuge and its ecosystem. The BIDEH policy (601 FW 3) can be viewed online at http://www.fws.gov/policy/601fw3.html.

Compatibility

This policy (603 FW 2) and its regulations, including a description of the process and requirements for conducting compatibility reviews, can be viewed on-line at http://www.fws.gov/policy/603fw2.html. The refuge manager must first determine that a use is appropriate before undertaking a compatibility review of that use. If the proposed use is not appropriate, the refuge manager will not allow the use and will not prepare a compatibility determination. A compatible use is one "that will not materially interfere with or detract from the fulfillment of the mission of the Refuge System or the purposes of the refuge." The refuge manager may allow or deny any use, even one that is compatible, based on other considerations such as public safety, policy, or available funding. Refuge management economic activities such as commercial timber harvest are subject to compatibility. Two compatibility determinations (CD) will be updated as a result of this process, commercial forest management and ATV/UTV use. The CDs can be located in Appendix A.

RELATIONSHIP TO OTHER PLANS

Service Migratory Bird Strategic Conservation Initiatives

The 1988 amendment to the Fish and Wildlife Conservation Act mandates the Service to, "identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act (ESA) of 1973." Publication of the Birds of Conservation Concern (BCC) 2008 is the most recent effort to carry out this mandate (USFWS 2008). The goal of the BCC report is to accurately identify the migratory and non-migratory bird species (beyond those already designated as federally

threatened or endangered) that represent our highest conservation priorities. The underlying philosophy behind BCC 2008 is that proactive bird conservation actions are necessary at a time when human impacts are at an all-time high to ensure the future of healthy avian populations and communities. BCC data and information serve as a barometer of the condition of the nation's avifauna from a national landscape scale funneled down to regional details (USFWS 2008).

The national BCC priority bird list provides an early warning of what bird species have the potential to decline to levels requiring ESA protection (USFWS 2008). The BCC priority bird list is to be consulted before actions are taken on Federal lands, and for research, monitoring, and management funding in accordance with Executive Order # 13186 (Responsibilities of Federal Agencies to Protect Migratory Birds). The national list serves as an outreach tool for educating the public about the precarious status of selected bird species across the United States and as a general rule is not used to foster bird conservation at smaller geographic scales; that is the purpose of the BCR and Service region lists.

Funneling the national bird list down to regional levels, the BCC report generates two other lists that include the refuge geographically: the (BCR-25) Bird Conservation Region of the West Gulf Coastal Plain/Ouachitas and the Service Region 4 list (USFWS 2008). The BCR 25 list identifies 28 species of conservation concern, of which 19 occur on the refuge. The Region 4 list identifies 63 species of concern, of which 21 occur on the refuge as either nesters or migrants in their annual life cycle (High Priority BCR 25/R4 Composite Lists of Bird Species breeding or migrating on Felsenthal NWR). These bird species in need of additional conservation actions were targeted as resources of concern in the development of this draft HMP/EA and were also incorporated in upgrading goals and objectives that will direct and guide the future of refuge management.

High Priority BCC Bird Species Nesting on Felsenthal NWR based on BCR 25/R4 Composite Lists (USFWS 2008):

- American Kestrel
- Chuck-will's-widow
- Red-headed Woodpecker
- Loggerhead Shrike
- Bewick's Wren
- Wood Thrush
- Cerulean Warbler
- Prothonotary Warbler
- Louisiana Waterthrush
- Kentucky Warbler
- Bachman's Sparrow
- Painted Bunting
- Orchard Oriole
- Bald Eagle

High Priority BCC Migrant Bird Species on Felsenthal NWR based on BCR 25/R4 Composite Lists (USFWS 2008):

- Little Blue Heron
- Brown-headed Nuthatch
- Sedge Wren
- Blue-winged Warbler
- Prairie Warbler
- Worm-eating Warbler
- Swainson's Warbler
- Canada Warbler
- LeConte's Sparrow
- Rusty Blackbird

In tandem with the BCC effort, the Service has also developed a 10-year national strategic migratory management plan to collaborate with its partners to recommit and set a successful course for migratory bird conservation over the next decade. The finalized plan, A Blueprint for the Future of Migratory Birds: A Strategic Plan 2004-2014 (USFWS 2004), describes the challenges facing migratory bird conservation, with associated management strategies to meet these future challenges. The Service's plan formulates a strong recommitment to migratory bird conservation with the following vision statement "Through careful management built on solid science and diverse

partnerships, the Service and its partners will restore and sustain the epic sweep of bird migration and the natural systems on which it depends —fostering a world in which bird populations continue to fulfill their ecological roles while lifting the human spirit and enriching human lives in infinite ways, for generations to come."

Identified were the major future challenges to conserve migratory birds. Declines in abundance of many landbird, shorebird, and waterbird populations are indicative of ecosystems that have been highly stressed and altered. Reductions in natural habitat quantity and quality are acknowledged as the primary causes of negative population trends in many bird species and are exacerbated by the direct loss of bird life from an array of environmental contaminants. The Blueprint document explains that meeting these challenges will require consistent adherence to the principles of sound science. The refuge and its partners will focus on these challenges in the most cost-effective manner to perpetuate avian populations.

Strategic Habitat Conservation/National Ecological Assessment Team Report Guidance

Strategic habitat conservation (SHC) is a science-driven framework for the strategic pursuit of defining and implementing conservation priorities for sustainable landscapes. This framework provides a scientific approach in identifying habitat conservation deficits on the landscape and filling in the gaps. SHC involves both cross-programmatic Service groups and conservation science partners' participation to restore, enhance, and manage local wildlife habitats. It features stepping down ecosystem-level Geographical Information Systems (GIS) analysis to coordinate local, on-the-ground conservation actions. SHC is trust-resource-centric, which focuses on under-represented habitats across the landscape, and relying on cross-pollination from all Service programs, state partners, and other conservation science expertise.

The SHC approach has been used in the development of this draft HMP/EA to formulate proposed refuge-specific habitat objectives and management strategies. This was done by stepping-down the combined habitat goals of national and regional plans, and the Arkansas wildlife action plan. We focused on conservation target species of greatest conservation need and under-represented habitats identified in both ecosystem and State comprehensive wildlife plans, and used ecosystem-level GIS analysis and refuge vegetation mapping to produce Felsenthal NWR specific habitat objectives and management strategies. These objectives include conservation assessment elements of measurable biological outcomes, so we can develop an effective inventory and monitoring step-down plan after finalization of the HMP. Development of an inventory and monitoring plan will enable us to monitor and assess successes and failures of future conservation actions, and adjust or adapt new management strategies accordingly.

SHC provides an iterative framework of planning, implementation, and evaluation actions. It is an adaptive conservation management scheme that rotates around four main components: strategic biological planning, conservation design, conservation delivery, and monitoring and research. The framework provides for refinement of management strategies at each iteration, constantly improving the achievement of desirable outcomes and examining the consequences of site-specific actions on landscape-scale functions.

The practice of SHC provides improved and defensible methods of habitat management planning and execution, with the greatest transparency possible to explain the rationale for refuge-specific habitat objectives and management strategies contained in this document.

Fulfilling the Promise: The 1999 report, Fulfilling the Promise- The National Wildlife Refuge System

Visions for Wildlife, Habitat, People, and Leadership (USFWS 1999), was a culmination of a year-long process by teams of Service employees to evaluate the Refuge System nationwide. This report was a result of the first-ever Refuge System conference held in Keystone, Colorado in October 1998 and was attended by refuge staff, politicians and scores of conservation organizations. The report contains 42 recommendations packaged with three vision statements dealing with wildlife and habitat, people, and leadership.

Conserving the Future-Wildlife Refuges and the Next Generation: Published in October 2011,

Conserving the Future: Wildlife Refuges and the Next Generation established the new course that the Service will follow as it moves into the next decade of conservation following Fulfilling the Promise (USFWS 1999). This document builds upon the framework of Fulfilling the Promise. It is the result of 18 months of study and public conversation about conservation and the future of the Refuge System. It was drafted by Service employees and their conservation partners with input from Service employees, other state and federal agencies, tribes, conservation agencies, and private citizens. When developed, this new course had to consider changes that occurred since Fulfilling the Promise was published, such as, an increasing and more diverse population, a challenged economy, a changing climate, and U.S. involvement in war. The report contains 24 recommendations packaged with eight vision statements. It seeks not only to further the System's mission, but also to raise the Service's profile in the broader national conservation effort. This new vision embraces bold new ideas to realize the full conservation potential of the National Wildlife Refuge System. It relies strongly on utilizing partnerships with both traditional and non-traditional partners. It also acknowledges that strategic, collaborative, science-based landscape conservation - along with effective public outreach, education and environmental awareness is the only path forward to conserve America's wildlife.

North American Waterfowl Management Plan (NAWMP)

The NAWMP was originally written in 1986 to help protect continental habitat conditions that could sustain and improve waterfowl populations, has been updated in 1994, 1998, 2004, and 2012. This plan outlines the strategy among the United States, Canada, and Mexico to protect North America's remaining wetlands and restore waterfowl populations through habitat protection, restoration, and enhancement actions. The intent in preparing the 2004 plan was to define and update the needs, priorities, and strategies with a 15-year planning horizon, increase stakeholder confidence in the direction of plan actions, and guide partners in strengthening the biological foundation of North American waterfowl conservation (USFWS 2004). The 2004 update can be accessed at http://www.fws.gov/birdhabitat/NAWMP/Planstrategy.shtm. The 2012 Plan renewal is termed a revision to differentiate it from the previous updates because for the first time since its inception, it fundamentally reexamined the NAWMP's goals. This revision developed renewed goals through extensive consultation with stakeholders, including Federal, Provincial/Territorial, State and non-government organization representatives from the continental waterfowl management community. The 2012 revision can be accessed at http://www.NAWMPrevision.org.

Implementation of this plan is accomplished at the regional level within designated regional habitat joint venture areas. Recovery actions identified in the plan, such as habitat restoration and enhancement, occur through these regionally based, self-directed partnership joint ventures that involve Federal, State and provincial governments, tribal nations, local businesses, conservation organizations, and individual citizens for the purpose of protecting habitat within joint venture areas. Felsenthal NWR is located within the Lower Mississippi Valley Joint Venture (LMJV) area, which covers six states within the Mississippi Flyway from Kentucky and Missouri to Louisiana and

Mississippi. The Lower Mississippi Valley Joint Venture implements and communicates the goals and objectives of relevant national and international bird conservation plans for the purpose of sustaining bird populations and their habitats in the Lower Mississippi Valley and the West Gulf Coastal Plain. Waterfowl objectives were stepped down from the NAWMP in the Lower Mississippi Valley Joint Venture Operational Plan and the West Gulf Coastal Plain/Ouachitas (WGCPO) Waterfowl Objectives.

Because Felsenthal NWR does not have the capability to provide cropland or managed moist-soil habitat, step-down objectives that were established for the refuge in 2010 were entirely comprised of the bottomland forest habitat type which consists of approximately 21,000 acres. Duck-energy days (DEDs) are used to estimate waterfowl foraging habitat and carrying capacity and are based on the daily energy requirements of mallard ducks. The DED standard value used for the bottomland forest habitat type in the Felsenthal NWR CCP was 126 DEDs/acre, which established a management objective of providing 2,646,000 DEDs annually for the refuge. Mallards and wood ducks make up the largest portion of the DEDs on Felsenthal NWR. It is worth noting that this DED value is thought by many wetland managers to represent a conservative estimate of waterfowl foraging habitat actually available in the bottomland forest type, when resources such as moist-soil vegetation and invertebrates are factored in. Therefore, the refuge's actual DED capability should exceed the stated objective. Besides the value that bottomland forests provide as foraging habitat for waterfowl, they play an even more important role by isolating birds during pair bonding, providing thermal protection on cold, windy days, and providing escape cover.

North American Waterbird Conservation Plan (NAWCP)

The North American Waterbird Conservation Plan is the product of an independent partnership of individuals and institutions wanting to conserve waterbirds and their habitats (version 1.0 – 2002). The plan provides a continental framework for the conservation and management of 210 species of waterbirds utilizing aquatic and wetland habitats. It sets goals and priorities for waterbirds during nesting, migration and non-breeding periods. The plan provides an overarching framework for regional conservation planning, provides focused guidance for local conservation planning and action, and gives a larger context for local habitat protection. The plan can be accessed online at http://www.waterbirdconservation.org; accessed January 2012.

From this plan the Southeast U.S. Waterbird Conservation Plan (Kushlan, et al 2002) was prepared. The plan sets population objectives by bird conservation region (BCR). Several long legged waders, great blue heron, great egret, and little blue heron are common sights at Felsenthal NWR. At this time no known rookeries exist on the refuge.

Partners in Flight (PIF) North American Landbird Conservation Plan

The Partners in Flight North American Landbird Conservation Plan reviewed the conservation status of 448 native landbird species that regularly breed in the U.S. and Canada. The purpose of this continental plan is to provide an overview of the highest priority landbirds in North America. These birds include not only those species that are of conservation concern due to population declines and small ranges, but also those that are characteristic of major habitat types and are essential to the biological integrity and long-term ecological stability of entire eco-regions. Following the lead of the NAWMP, PIF have made the commitment to conserve the resident, short-distance, and neotropical migrant landbirds and their regional habitats on the continental landscape (Rich et al. 2004). The PIF vision states, "Populations of native birds will occur in their natural numbers, natural habitats, and natural geographic ranges, through coordinated efforts by scientists, government, and private citizens."

Partners in Flight developed a “Watch List” that identified two groups of bird species as having high conservation importance: species with the greatest conservation need; and stewardship species that are particularly characteristic of regional avifauna. Watch List species are considered to be in immediate trouble and are at risk of extinction or serious decline, while stewardship species are native bird species that are characteristic of unique ecosystems.

Of the 210 PIF-Watch List species, 55 species are on the Red List, which includes species of the highest national conservation concern. Three of the identified bird species are known to occur on Felsenthal NWR. Red-cockaded woodpecker and Bachmann’s sparrow are identified as breeding species and Henslow's sparrow is identified as a migrant species.

Yellow List-Watch List species consists of 117 species of conservation concern and are not as imperiled as the bird species identified on the Red List. Felsenthal NWR has eight breeding (red-headed woodpecker, wood thrush, prairie warbler, cerulean warbler, Swainson's warbler, Kentucky warbler, and painted bunting), and two migrant birds (blue-winged warbler and Le Conte's sparrow) identified on the Yellow List.

West Gulf Coastal Plain–Physiographic Area 42

Several regional PIF plans have been stepped-down from the national effort and the regional plan pertinent to the refuge is the West Gulf Coastal Plain–Area 42 Plan, which covers portions of Louisiana, Arkansas, southeast Oklahoma, and eastern Texas has not been completed. An executive summary can be located at http://www.partnersinflight.org/bcps/pl_42sum.htm.

The habitat loss within this area suggests that future success of conservation planning will require swift identification and preservation of remaining habitat patches. Priority bird species were sorted by habitat to delineate the highest priority habitats in need of critical conservation attention to conserve regionally important PIF bird populations. Priority habitats pertinent to Felsenthal NWR conservation planning with birds of conservation concern are: Pine Savannah, which has a habitat association with red-cockaded woodpecker, Henslow's sparrow (*Ammodramus henslowii*), Bachman's sparrow, brown-headed nuthatch, chuck-will's-widow (*Caprimulgus carolinensis*), and prairie warbler (*Dendroica discolor*); and Hardwood Forests, which has a habitat association with Swainson's warbler, Kentucky warbler, prothonotary warbler, worm-eating warbler, hooded warbler, and white-eyed vireo (*Vireo griseus*).

Partners in Amphibian and Reptile Conservation (PARC)

Partners in Amphibian and Reptile Conservation is a diverse partnership of public and private organizations, and is the most comprehensive herpetofauna conservation effort undertaken in the United States. PARC, which is a unique national and international conservation network of comprehensive information on all reptiles and amphibians, is solely habitat focused. It provides the best available science to conserve and protect herpetofaunal habitats and species.

PARC keys in on endangered and threatened species but also advocates keeping common native species common. Their mission is “to conserve amphibians, reptiles and their habitats as integral parts of our ecosystem and culture through proactive and coordinated public and private partnerships.” PARC’s partners include Environmental Protection Agency (EPA) Office of Wetlands, Service-Northeast Region, U.S. Geological Survey Biological Resources Division, and many more. (See http://www.parcplace.org; accessed January 2012.)

This information, along with Habitat Management Guidelines for Amphibians and Reptiles of the Southeast (Bailey et al. 2006), was used to develop habitat management objectives and strategies to maintain the native species and protect some of the rarest herpetofaunal species documented on the refuge. Two species of concern that reside on the refuge include: alligator snapping turtle and western chicken turtle.

Arkansas's Comprehensive Wildlife Conservation Strategy (CWCS)

Supported by the State Wildlife Grants (SWG) Program, Arkansas's CWCS (also known as the Wildlife Action Plan) identifies the challenges facing Arkansas's diverse wildlife species and devises strategies to conserve those "species with the greatest conservation need," and their habitats. The CWCS is a guide to conserving the species of fish and wildlife that have immediate conservation needs or are key indicators of the diversity and health of the state's wildlife. The CWCS emphasizes a cooperative, proactive approach to conservation, inviting local governments, businesses and conservation-minded organizations and individuals to join in the task of maintaining fish and wildlife resources. Arkansas's Wildlife Action Plan addresses the conservation needs of 369 species of greatest conservation need in the context of 45 terrestrial habitats and 18 aquatic habitats in the seven ecoregions in the state. Of the 369 species identified, just over 30 species of greatest conservation concern have a portion of their life cycle on Felsenthal NWR.

Red-Cockaded Woodpecker (RCW) Recovery Plan

The ultimate recovery goal of the RCW Recovery Plan is red-cockaded woodpecker (*Picoides borealis*) viability. Once this goal is met, the size, number, and distribution of RCW populations will be sufficient to counteract threats of demographic, environmental, genetic, and catastrophic stochastic events; thereby, maintaining long-term viability for the species as defined by the current understanding of these processes. The RCW Recovery Plan states the refuge has 6,800 acres of fire managed-RCW habitat acres available and establishes a population goal of 34 RCW clusters (200 acres/cluster) for Felsenthal NWR.

The RCW Safe Harbor Program identifies regions and habitat types currently occupied by the species given habitat limitations and seeks private cooperators and private lands to facilitate the recovery efforts of the RCW.

The Nature Conservancy's (TNC) Upper West Gulf Coastal Plain Ecoregional Plan

This plan represents the Nature Conservancy's ecoregional conservation planning effort for the Upper West Gulf Coastal Plain. The plan provides a portfolio of conservation areas, including priority or action areas, the data compiled and created during this planning effort, methodology, the data gaps identified, and strategies for plan implementation. It is intended that conservation planners, site-based conservation staff, and TNC partners use this plan to effectively manage the biodiversity of the ecoregion. Successful use requires a commitment of cooperation, resources and time, as well as, the sharing of responsibility and effort.

Northern Bobwhite Conservation Initiative (NBCI)

The NBCI is a range wide habitat plan for recovering bobwhites to target densities to the baseline year 1980. A ranking system was developed to demarcate priority landscapes where bobwhite conservation has a relatively high potential for success. The NBCI identified several habitat management opportunities for increasing and improving bobwhite quail habitat including the increased use of prescribe fire and forest management practices compatible with bobwhite quail

habitat requirements. 16% of North American Bird Conservation Initiative-Bird Conservation Region landscape was thought to have high potential for successful conservation of Northern bobwhites. Felsenthal NWR resides within that 16% landscape.

Southeast Aquatic Resources Partnership (SARP)

The Southeast Aquatic Resources Partnership includes fish and wildlife agencies from 14 southeastern states; the Gulf and Atlantic States Marine Fisheries Commissions; the Gulf of Mexico and South Atlantic Fishery Management Councils; the U.S. Fish and Wildlife Service; and the Fisheries Division of the National Oceanic and Atmospheric Administration (NOAA). The SARP focuses on six key issue areas: Aquatic Habitat Conservation; Public Use; Imperiled Fish and Aquatic Species Recovery; Fishery Mitigation; Interjurisdictional Fisheries; and Aquatic Nuisance Species (ANS). These partnering entities work together for the conservation and management of aquatic resources in the Southeast.

Arkansas Department of Environmental Quality (ADEQ) Strategic Plan (2004-2014)

The ten-year strategic plan outlines ADEQ's guiding principles, objectives, and strategies for improving the environment in Arkansas. This strategic plan is built around four environmental goals: Air; Water; Land; and Environmental Management. In accomplishing this plan ADEQ partners with the U.S. Environmental Protection Agency, the Arkansas Pollution Control and Ecology Commission, the Arkansas Natural Resources Commission, the Arkansas Department of Health, the Arkansas Forestry Commission, the Arkansas Geological Commission, the Arkansas Game and Fish Commission, the Arkansas Oil and Gas Commission, and many others.

West Gulf Coastal Plains and Ozarks Landscape Conservation Cooperative (LCC)

The West Gulf Coastal Plain is part of the larger Gulf Coast Coastal Plain LCC. Pines dominate this area, shortleaf pine in the north, including the Ouachita Mountains, and longleaf pine in the south. This westernmost part of the eastern United States forest also includes hardwood-dominated bottomlands along the Ouachita and Red Rivers and other drainages. Red-cockaded Woodpecker is the highest priority bird in pine habitat, which is also inhabited by Bachman’s Sparrow, northern bobwhite, and Brown-headed Nuthatch. Conversion of the native pine forests to industrial loblolly plantations provides some bird habitat but is less useful for the highest priority species. The river and stream bottoms provide habitat used by Swainson’s Warbler and large numbers of nesting herons and egrets. Bottomland hardwoods and associated wetlands support substantial wintering populations of a number of waterfowl species—principally mallards, and breeding and wintering wood ducks—and are a primary migration corridor for significant numbers of other dabbling ducks. The primary threats to bottomland hardwood wetlands in the region are from reservoirs and timber harvest and subsequent conversion to pine plantation, pasture, or other land uses.

CHAPTER II. REFUGE OVERVIEW

INTRODUCTION

Felsenthal NWR is located in Ashley, Bradley, and Union counties, Arkansas, about 8 miles west of Crossett, Arkansas on U.S. Highway 82 (See Figure 1). Felsenthal NWR is one of four refuges forming an administrative complex, which also includes Pond Creek National Wildlife Refuge to the northwest, Overflow National Wildlife Refuge to the east, and the Oakwood Unit National Wildlife Refuge to the northeast.

Felsenthal NWR occupies a low-lying area dissected by an intricate system of rivers, creeks, sloughs, buttonbush swamps and lakes throughout a vast bottomland hardwood forest that gradually rises to an upland forest community. Historically, periodic flooding of the "bottoms" (bottomland hardwoods) during winter and spring provide excellent wintering waterfowl habitat. These wetlands, in combination with the pine and upland hardwood forest on the higher ridges, support a wide diversity of native plants and animals, providing habitat for migrant and resident waterfowl, marsh and water birds, and neotropical migratory birds. The refuge has the highest density of federally endangered red-cockaded woodpeckers in the state and provides habitat and protection for the federally threatened American alligator. The refuge also contains some of the region's richest cultural resources with more than 200 known archeological (Native American) sites.

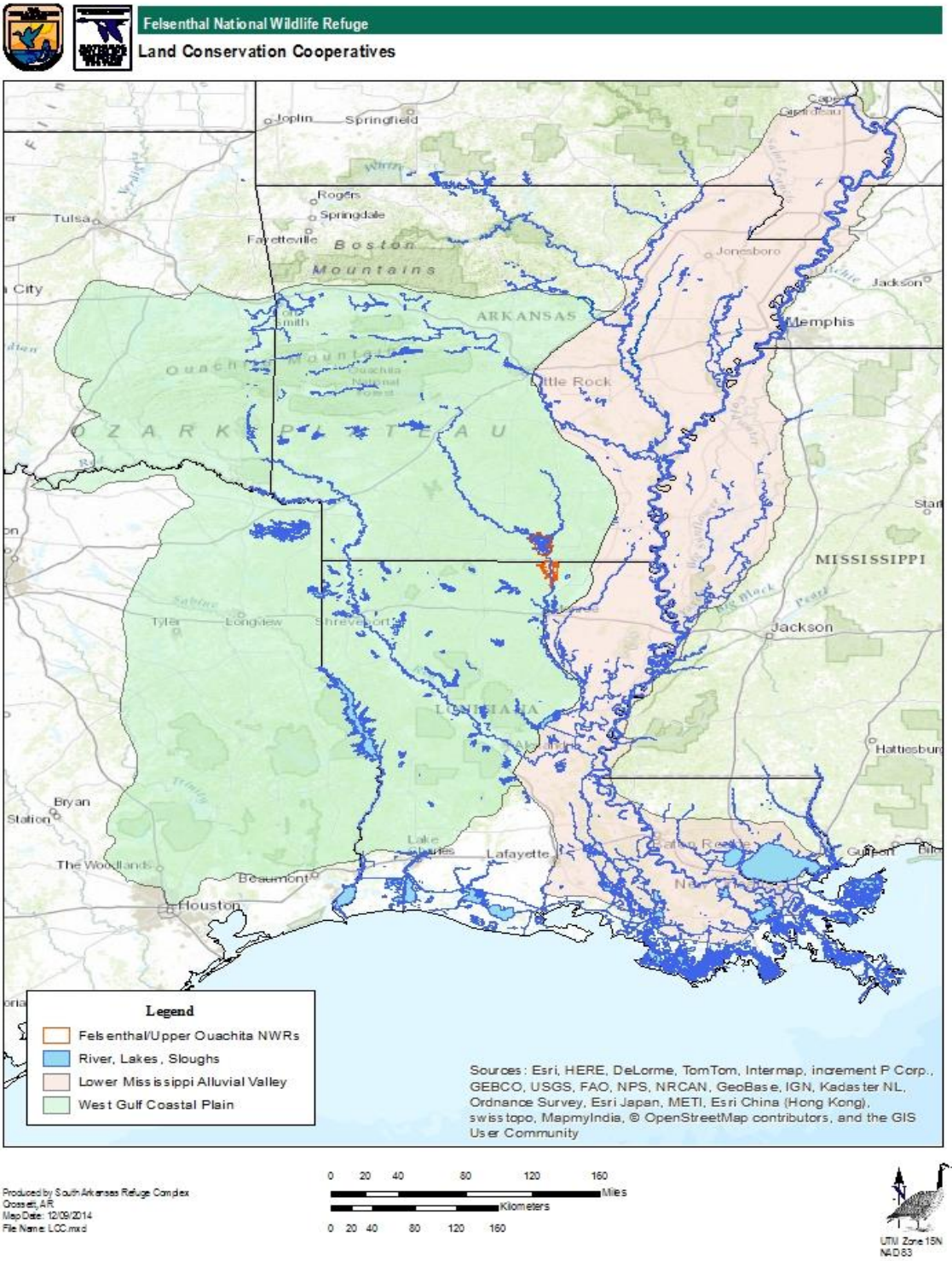
Few species surveys have been conducted on the refuge. Although actual numbers are hard to accurately quantify, comparisons with other similar refuges with similar habitats envisage that the current wildlife list for Felsenthal would contain at least 200 species of birds, 40 species of mammals, 70 species of reptiles and amphibians, and 90 species of fish. See the species list provided in Appendix I, Refuge Biota of the CCP (USFWS 2010).

LOCATION

The refuge is located within the West Gulf Coastal Plain and Ozarks LCC, which includes with the West Gulf Coastal Plain (BCR 25 and PIF Physiographic Region 42) within Ashley, Bradley, and Union Counties in southern Arkansas (Figure 2). The refuge resides within the South Arkansas National Wildlife Refuge Complex. The refuge, established in 1975, historically consisted of bottomland hardwood and upland forests. The landscape was dominated by forest industry lands, which continues today. The Crossett, Arkansas area has the reputation of being the forestry capital of the South.

Natural habitats are dominated by bottomland hardwoods, backwater sloughs, and open water in the wetlands and upland pine and hardwood representative of the West Gulf Coastal Plain. The refuge’s wetlands are influenced by the Ouachita and Saline River watersheds as well as the Felsenthal lock and dam.

Figure 2. West Gulf Coastal Plain and Ozarks Landscape Conservation Cooperative which includes the West Gulf Coastal Plain and Felsenthal National Wildlife Refuge.



Conservation lands immediately adjacent and/or near Felsenthal NWR (Figure 3) include:

1) Beryl Anthony Lower Ouachita WMA (7,020 acres Ashley County)
2) Upper Ouachita NWR (53,000 acres Morehouse and Union Parishes, LA)
3) Overflow NWR (13,000 acres Ashley County, AR
4) Moro Big Pine Natural Area WMA (16,000 acres Calhoun County, AR)
5) Crossett Experimental Forest (USFS) (1,675 acres Ashley County)
6) Warren Prairie Natural Area WMA (4,616 acres Bradley and Drew Counties)
7) Cut-Off Creek WMA (8,725 acres, Desha County)
8) Longview Saline Natural Area WMA (3,837 acres Bradley County)
9) The Nature Conservancy lands (3,794 acres Ashely and Union County)

The West Gulf Coastal Plain supports open pine savannas and grasslands through which flow medium to low gradient streams and rivers, with flooding and fire integral to managing these healthy habitats.

REFUGE HISTORY

Established in 1975 as mitigation for the creation of the U.S. Corps of Engineers' (USACE) Ouachita and Black Rivers Navigation Project and Felsenthal Lock and Dam, Felsenthal NWR is located in southeast Arkansas, approximately eight miles west of the town of Crossett. This 65,000 acre refuge is named for the small Felsenthal community located at its southwest corner, and contains an abundance of water resources dominated by the Ouachita and Saline rivers and the Felsenthal Pool.

Geographically, the refuge is located in what is known as the Felsenthal Basin, an extensive natural depression that is laced with a vast complex of sloughs, bayous and lakes (Figure 4). The region's two major rivers, the Saline and Ouachita, flow through the refuge. These wetland areas in combination with the refuge's diverse forest ecosystem of bottomland hardwoods, pine forests and uplands support a wide variety of wildlife and provide excellent fishing, hunting, boating, wildlife observation and environmental education opportunities. This low lying refuge area is dissected by an intricate system of rivers, creeks, sloughs, buttonbush swamps and lakes spread throughout a vast bottomland hardwood forest that gradually rises to an upland forest community. Historically, periodic flooding of the "bottoms" during winter and spring provided excellent wintering waterfowl habitat. These wetlands, in combination with the pine and upland hardwood forest on the higher ridges, support a wide diversity of native plants and animals. About 60% of the refuge (~40,000 acres) is bottomland hardwood, 25% open water (~15,000 acres), and 15% uplands (~10,000 acres).

SPECIAL DESIGNATIONS

The Saline River, from its confluence with the Ouachita River in Felsenthal NWR, upstream to the Grant/Saline County line in central Arkansas (a distance of 157 miles), has been designated as one of Arkansas' state Natural and Scenic Rivers. These rivers are classified as natural, scenic, or pastoral. The criteria involve the stream's length, adjacent forest cover, biological characteristics, water quality, present use, and accessibility. A river, or river segment designated as a Natural and Scenic River is protected from any permanent dam or structure that would impound waters or any channelization or realignment of the principal channel of the stream. Similarly, the Nationwide Rivers Inventory (NRI) also lists the Saline River from its confluence with the Ouachita River, in Felsenthal NWR, upstream to its confluence with Alum Fork and North Fork (a 179 mile segment) as having outstanding remarkable values of scenery, recreation, fish, wildlife and history. Immediately below

Figure 3. Conservation Lands near and around Felsenthal National Wildlife Refuge.

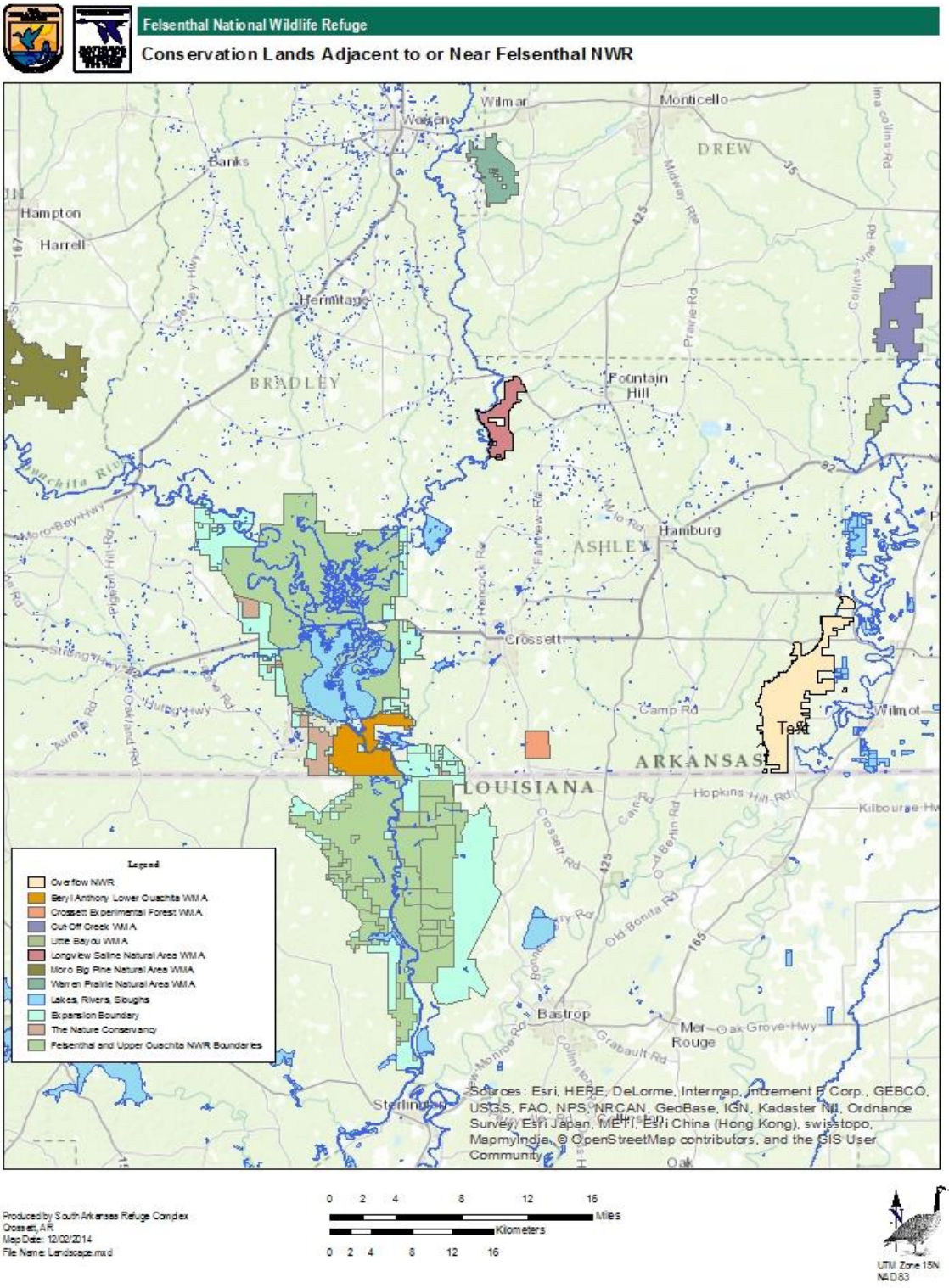
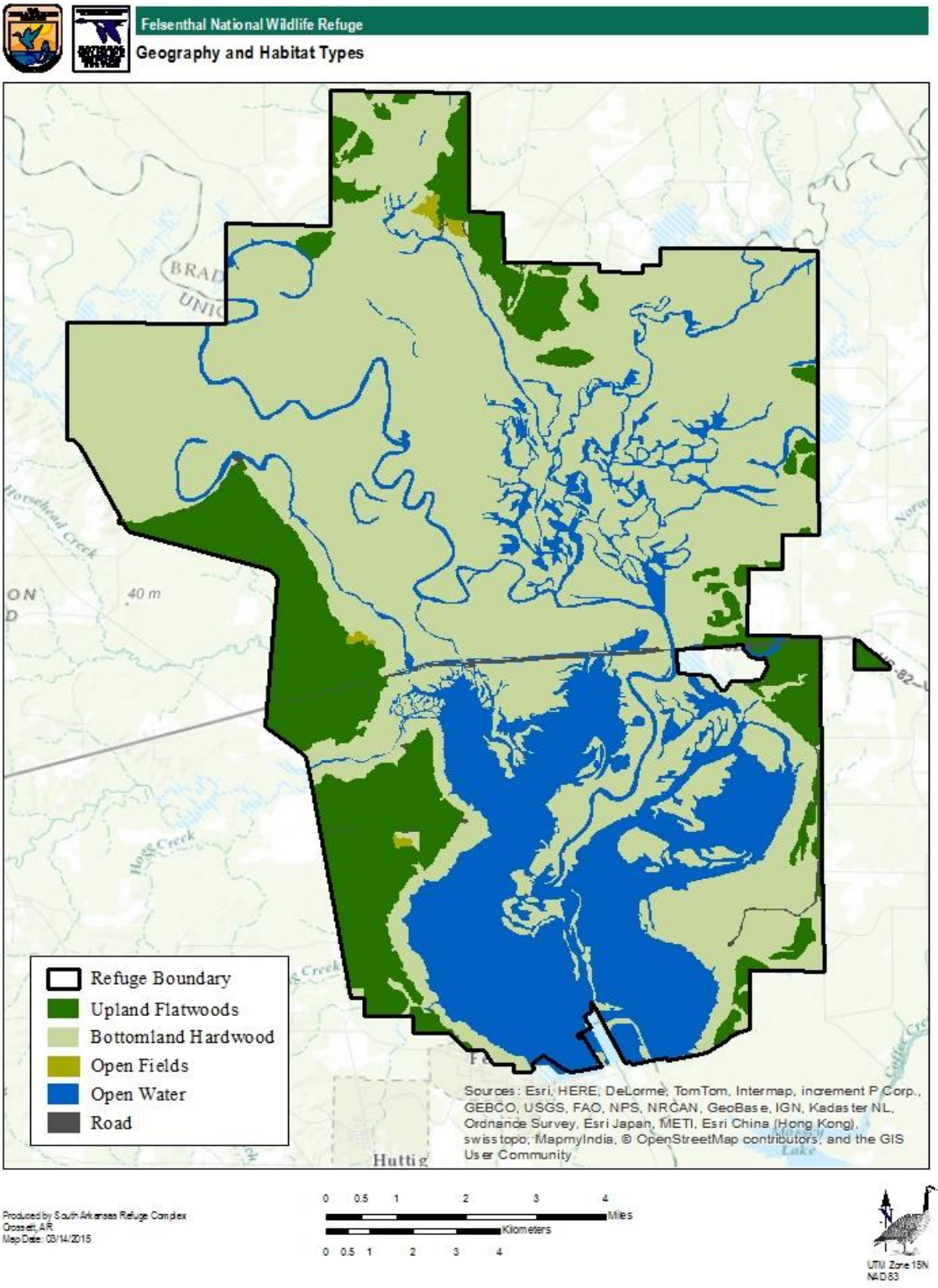


Figure 4. Felsenthal National Wildlife Refuge Geography and Habitat Types.



Felsenthal NWR, the Ouachita River flows into Louisiana, where it is a state-designated scenic stream.

Approximately 5,551 acres of Felsenthal NWR are part of Georgia-Pacific's (GP), Sustainable Forestry and Certification Program. Within this program, GP has developed a practice to ensure the protection of forests with high conservation value, including endangered forests and special areas, and maintenance of natural hardwood forests. As these endangered forests, which represent unique and rare areas are identified, Georgia-Pacific has committed not to procure wood or wood fiber from these areas. In unique situations where credible scientific evidence demonstrates that ecological restoration activities are needed to improve habitat for endangered, rare and/or vulnerable species within certain endangered forests and special areas, Georgia-Pacific may procure fiber from these endangered forests and special areas as a result of such restoration activities. These areas on Felsenthal NWR will be passively managed as part of this designation and contain over 2,000 acres of baldcypress and late successional to mature oak/cypress/tupelo bottomlands (Figure 5).

THE WEST GULF COASTAL PLAIN AND FELSENTHAL NATIONAL WILDLIFE REFUGE

The West Gulf Coastal Plain is composed of rolling plains that are broken by nearly flat fluvial terraces, bottomlands, sandy low hills, and low cuestas; its terrain is unlike the much more rugged Ouachita Mountains to the north or the flatter, less dissected Mississippi Alluvial Valley to the east. Uplands are underlain by poorly-consolidated, Tertiary- through Cretaceous-age, coastal plain deposits and marginal marine sediments (laid down as the Gulf of Mexico opened and North America's southern continental margin subsided). Bottomlands and terraces are veneered with Quaternary alluvium or windblown silt deposits (loess). The lithologic mosaic is distinct from the Paleozoic rocks of the Ouachita Mountains and the strictly Quaternary deposits of the Mississippi Alluvial Valley. Potential natural vegetation is oak–hickory–pine forest on uplands and southern floodplain forest on bottomlands. Today, more than 75% of the ecoregion remains wooded. Extensive commercial loblolly pine–shortleaf pine plantations occur. Lumber and pulpwood production and livestock grazing, are the major land uses. Cropland may dominate the drained bottomlands in some areas. Fish communities typically have a limited proportion of sensitive species; sunfishes are dominant, and darters and minnows are common.

In the immediate vicinity of Felsenthal NWR, the ecosystem is characterized by floodplains and low terraces. It is nearly level, veneered by Holocene alluvium, and contains natural levees, swales, oxbow lakes, and meander scars. Longitudinal channel gradients are low and large parts are frequently flooded. Forested wetlands are characteristic, but pastureland also occurs. The potential natural vegetation is southern floodplain forest as seen in the Mississippi Alluvial Valley where cropland is less common.

Felsenthal NWR is located in the U.S. Fish and Wildlife Service's West Gulf Coastal Plain and Ozarks Landscape Conservation Cooperative (See Figure 2). The Service's ecosystem approach is comprehensive. It is based on all of the biological resources within a watershed and it considers the economic health of communities within that watershed

MANAGEMENT UNIT DESCRIPTIONS

The refuge is divided into 47 habitat management units (Figure 6) delineated into manageable blocks of habitat. These units or compartments may have several different distinct habitat types (sand prairie, open field, bottomland hardwood, upland pine, etc.) within each compartment.

Figure 5. Georgia Pacific's Endangered Forest Designation and Felsenthal National Wildlife Refuge.

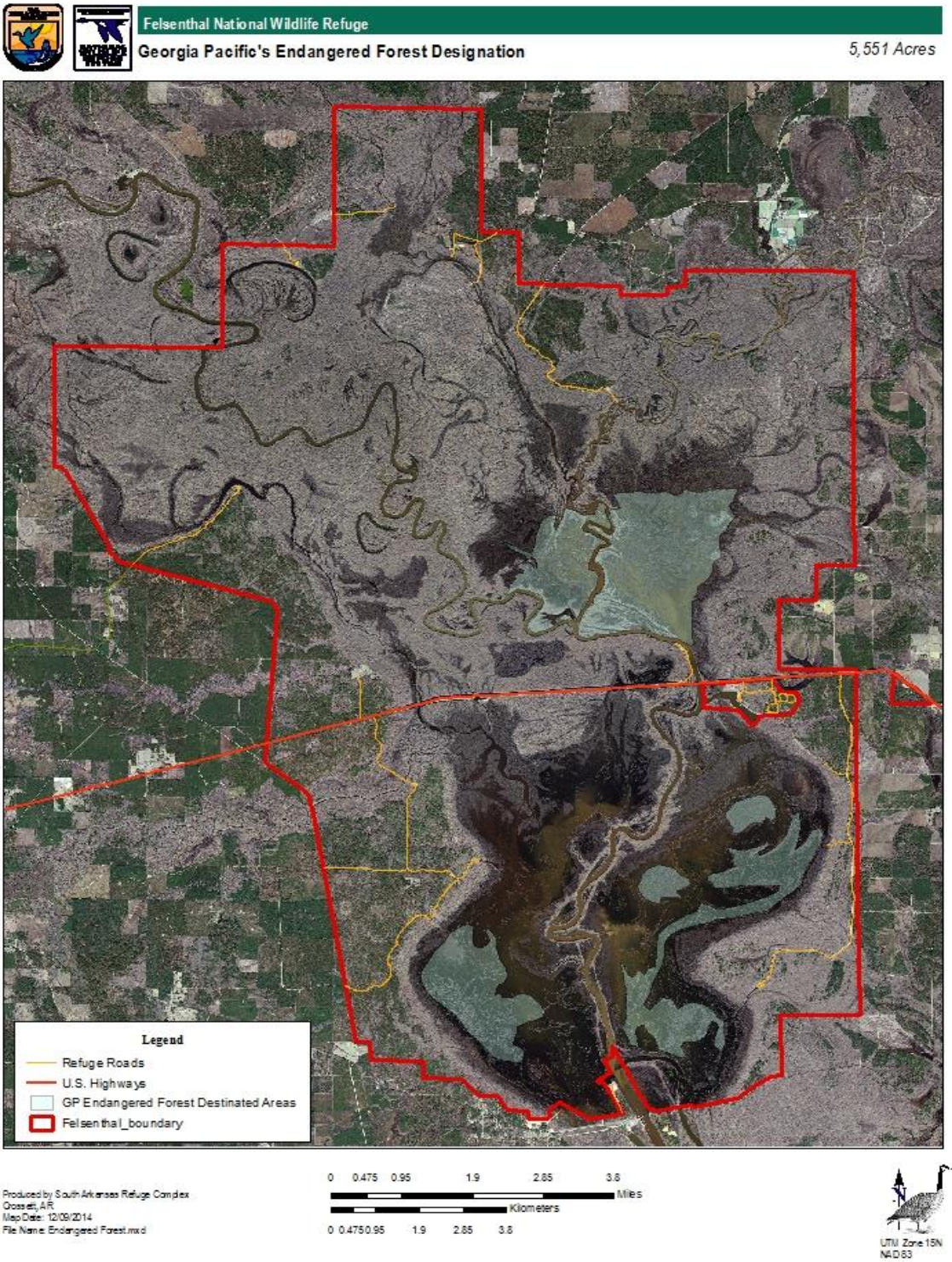
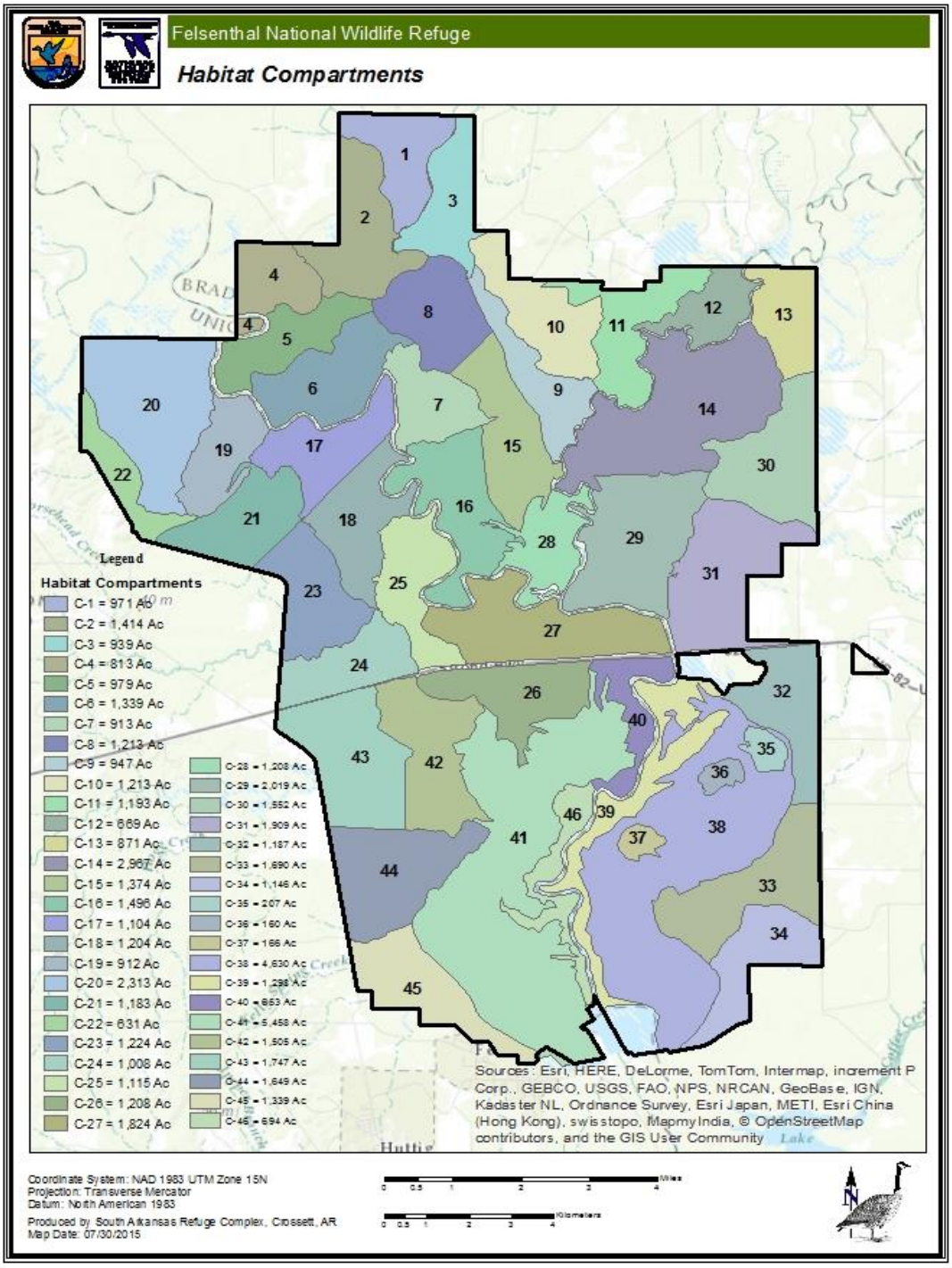


Figure 6. Habitat Management Units/Compartments on Felsenthal National Wildlife Refuge.



PHYSICAL OR GEOGRAPHIC SETTING

CLIMATE

The climate of southeast Arkansas can be characterized as humid and subtropical. Monthly mean temperatures are generally around 80° Fahrenheit (F) in the summer. Winter monthly mean temperatures are around 45° F. Winters are short and generally quite mild, but cold periods (below 0° F) of brief duration have occurred. Summers are hot and very humid, with daily highs frequently exceeding 100° F in July and August. In southeast Arkansas, the growing season is very long (over 230 days), encouraging vegetative growth, especially unwanted weeds, in mid to late summer. The southern and eastern areas of Arkansas tend to have extended warm and humid periods; with higher humidity and more cloudiness than the rest of the state.

Annual precipitation totals range roughly from 45 to 55 inches across the state, with totals increasing from northwest to southeast (due to the greater availability of Gulf of Mexico moisture in the southeast). Average annual rainfall in the Felsenthal NWR area is between about 54 and 58 inches. Rainfall is generally abundant throughout the year. The driest months tend to be August and September, although these totals for these two months still average more than three inches (Table 1). The number of days with measurable precipitation averages about 100 per year. Most of the precipitation falls as rain. Heavy local storms that produce totals of five to ten inches over extensive areas are not uncommon. Snowfall does occur, but is generally light and remains on the ground only briefly. Snowfall accumulation averages only about one and a half inches a year in southern Arkansas. Tornadoes are most frequent from March through May, with about 15 to 20 reported each year. The temperature and precipitation data summarized in Table 1 were collected in Crossett and El Dorado from 1971 through 2000.

Table 1. Monthly mean, maximum and minimum temperatures, and average rainfall and snowfall in Crossett and El Dorado, Arkansas.

	NORMAL				
Month	**Mean (°F)**	**Minimum (°F)**	**Maximum (°F)**	**Rainfall (inches)**	**Snowfall (inches)**
Jan	43.7	1	82	4.33	T
Feb	47.7	7	88	4.43	0
Mar	56	14	91	4.87	0
Apr	63.9	26	96	4.31	0
May	71.6	36	97	5.18	0
Jun	78.8	48	104	4.5	0
Jul	82.1	55	106	3.58	0
Aug	81.7	51	112	3.07	0
Sep	75.2	39	110	3.13	0

Month	NORMAL				
	Mean (°F)	Minimum (°F)	Maximum (°F)	Rainfall (inches)	Snowfall (inches)
Oct	64	26	94	4.55	T
Nov	53.9	15	88	4.46	0
Dec	45.9	3	82	5.04	0
Annual	63.8	3	112	51.28	2

GEOLOGY AND TOPOGRAPHY

There are six major physiographic divisions in Arkansas: the Ozark Mountains, the Arkansas River Valley, the Ouachita Mountains, the West Gulf Coastal Plain, the Mississippi Alluvial Valley, and Crowley's Ridge. The first three divisions are part of a larger region called the Interior Highlands physiographic region of northwest Arkansas, and the latter three are part of the Gulf Coastal Plain physiographic region of southern and eastern Arkansas.

The rock and sediments of the Gulf Coastal Plain are much younger (of Cenozoic age) than those of the Interior Highlands (of Paleozoic age). The Interior Highlands are generally characterized as hilly to mountainous topography on Paleozoic rock substrates dominated by upland hardwood and upland pine-hardwood forests, with extensive prairies. The Gulf Coastal Plain is a belt of land that had been inundated by the Gulf of Mexico at some time since the Jurassic period, generally during the Tertiary period or more recently. The surface geology includes areas of sandstone, limestone, or chalk, but more typically consists of unconsolidated sand, gravel, or clay sloping gently from toward the south and east. The surface is underlain by rocks that range from unconsolidated to poorly consolidated clastic rocks. The oldest rocks are Jurassic in age and are deeply buried in the subsurface. The rocks dip gently toward the Gulf of Mexico or toward the Mississippi embayment. Diapiric flowage of salt strata, which is caused by the salt being overloaded by thick accumulations of younger sedimentary strata, has resulted in the formation of salt domes. Typical plant cover is pine forest on sandy hills and bottomland hardwood forest along streams and rivers. The refuge lies within this southern and eastern physiographic region. Specifically, Felsenthal NWR lies within the West Gulf Coastal Plain physiographic division.

The surface geology of the West Gulf Coastal Plain in the vicinity of Felsenthal NWR is characterized by unconsolidated deposits of sand, gravel, silt, and clay from the ocean bottom, beaches, and estuaries that have eroded into rolling, sandy hills that were covered with pine forests. The surface geology is characterized by Tertiary and Cretaceous sediments which underlie most of this area. These sedimentary rocks, deposited mostly in a marine environment, were later uplifted and now tilt seaward. The predominant Quaternary units are Pleistocene (Qt) and Holocene (Qal) alluvial deposits. The predominant Tertiary unit, lying mostly to the west of the refuge, is the Claiborne Group (Tc).

The topography of this area can be described as nearly level or gently rolling uplands, terraces, and floodplains. The area is composed of rolling plains that are broken by nearly flat fluvial terraces, bottomlands, sandy low hills, and low cuestas. The terrain is unlike the much more rugged Ouachita Mountains to the north or the flatter, less dissected Mississippi Alluvial Valley to the east. Uplands

are underlain by poorly-consolidated, Tertiary- through Cretaceous-age, coastal plain deposits and marginal marine sediments. These sediments were laid down as the Gulf of Mexico opened and North America's southern continental margin subsided. The bottomlands and terraces are veneered with Quaternary alluvium or windblown silt deposits and loess. The lithologic mosaic is distinct from the Paleozoic rocks of the Ouachita Mountains and the strictly Quaternary deposits of the Mississippi Alluvial Plain. The uplands are intricately dissected by streams. Broad floodplains and terraces are along some streams. Elevation typically ranges from about 60 to 90 feet above mean sea level, increasing gradually from southeast to northwest. Local relief is generally less than 10 feet.

SOILS

Soils directly influence the kind and amount of vegetation and the amount of water available; in this way they indirectly influence the kind of wildlife that can live in an area. Soils are organized into a taxonomic classification system by the U.S. Department of Agriculture, Natural Resources Conservation Service in which each soil is categorized by order, suborder, great group, subgroup, family, and soil series. Nationwide, there are twelve soil orders, two of which—Alfisols and Inceptisols—are predominantly found on the Felsenthal and Overflow refuges. The soils in the area dominantly have a thermic soil temperature regime, a hydric soil moisture regime, and siliceous or mixed mineralogy. They are very deep, poorly to very poorly drained, and loamy or clayey. Within these two orders there are two dominant soil series found on Felsenthal NWR: Guyton series and Una silty clay loam.

The Guyton series consists of loamy poorly drained, slowly permeable soils that formed in silty marine sediments. These soils are formed in alluvium with high silt content. These level soils are found on broad uplands flats and flood plains (bottom lands and stream terraces) subject to frequent or occasional flooding. They are often saturated with water in the late winter and spring. The native vegetation found here is mixed hardwoods and pines.

Una soil is formed in acid clayey alluvium. These soils are poorly drained, with very slow runoff and permeability and are found on floodplains of streams. During the winter and early spring, these soils are often flooded and the water table is within a foot of the surface. Most areas with this type soil are pasture or forest, with the forested and wooded areas being bottomland hardwoods. The Guyton soil series is found in the Alfisols order, Aqualfs suborder, and the Glossaqualfs great group. The Una soil series is in the Inceptisols order, Aquepts suborder, and Epiaquepts great group.

Most of the soil series that have been located on Felsenthal NWR may be characterized as being subject to frequent flooding, having a high water table and of being highly acidic. Soil series and associations that have been found on Felsenthal Refuge by the Soil Conservation Service are listed and described below:

Amy-Felker Association (Am F)

Amy Part: This is a deep, poorly drained, level, slowly permeable soil. The surface layer is grayish brown silt loam approximately 4 inches thick. The upper part of the subsoil is gray mottles silt loam about 20 inches thick. The lower part of the subsoil is gray, mottled silty clay loam about 15 inches thick. The underlying material is gray mottled silty clay loam.

Felker Part: This is a deep, somewhat poorly drained, nearly level, moderately slowly permeable soil. The surface layer is brown silt loam about 7 inches thick. The upper part of the subsoil is mottled yellowish brown and brownish yellow silty clay loam about 16 inches thick. The lower part of the subsoil is mottled gray yellowish brown and red silty clay loam.

Amy and Felker have a good potential for growing loblolly pine, shortleaf pine and sweetgum. Amy has a sever seedling mortality and a sever equipment limitation. Felker has moderate seedling mortality and a moderate equipment limitation. In both soils the limitation is due to wetness.

Bibb (BI)

This is poorly drained, level moderately permeable soil located on flood plains. The surface layer is brown sandy loam about 4 inches thick. The subsurface layer is mottled dark gray and dark grayish brown sandy loam about 8 inches thick. The upper 25 inches of the subsoil is gray sandy loam with strong brown mottles and thin strata of silt loam to loamy sand. The lower subsoil is gray silt loam with strata of sandy loam and loamy sand. Bibb soils have a good potential for growing loblolly pine, sweetgum and water and willow oaks; but, this soil is subject to flooding for brief periods during the winter and spring months. This flooding causes severe seedling mortality on the Bibb soils.

Chastain Association (Ch)

The soils classed with the Chastain association are deep, poorly drained, slowly permeable soils on level flood plains along the Ouachita and Saline Rivers. The surface layer is grayish brown silt loam about 7 inches thick. The subsoil is light brownish gray mottled silty clay that extends to a depth of 72 inches.

Soils associated with Chastain association have a fair potential for growing bottomland hardwoods. Wetness causes severe seedling mortality and a severe limitation for equipment use.
Cravasse Loamy Sand (Cr)

The cravasse loamy sand is a deep, excessively drained bottomland soil. The soil profile is loose loamy sand overlaying rapidly permeable, loose, loamy sand. This soil has a low amount of available moisture.

The acreage of this soil type is very limited on Felsenthal Refuge. While this soil has the potential to grow a good quality loblolly pine, most of these sites that have been located on this refuge have been strip-mined for sand.

Guyton (Gu)

The Guyton series consists of very deep, poorly drained and very poorly drained, slowly permeable soils that formed in thick loamy sediments. These soils are on Coastal Plain local stream flood plains and in depressional areas on late Pleistocene age terraces. Slopes range from 0 to 1 percent. Guyton soils are poorly drained, except where ponded. Where runoff is ponded, drainage is very poor. Runoff is slow to ponded. Permeability is slow. A seasonal high water table is at 0 to 1.5 feet below the surface from December through May, except where ponded. Where ponded, it is from 1 foot above the surface to 0.5 foot below the surface most of the time. In places, the soils are subject to rare, occasional, or frequent flooding.

Most areas are in woodland. Water oak, baldcypress, water tupelo, and loblolly pine are dominant in the drainages. On broad terraces, baldcypress and water tupelo generally are absent and sweetgum dominates.

Kalmia (Ka)

Kalmia series consists of moderately well drained acid to strongly acid soils that are sited on stream terraces. The alluvium from which they were derived was washed from upland soils. The surface is dark-brown to yellowish-brown to brown sandy clay loam to sandy loam. The lower part of the subsoil is mottled with gray and various shades of brown. These soils have good drainage. They are moderately permeable. Tilth is good. Most of Kalmia soils that have been located in Bradley County have been in cultivation. Most of the areas of these soils on the refuge have either reverted to woodland or they are now used as pasture. The soil is productive of loblolly pine or shortleaf pine.

Lafe (La)

The soils of the Lafe series are very poorly drained, slightly acid to moderately alkaline soils on terraces. Most of their parent material came from fine-textured soils on the uplands. The surface is dark grayish-brown very fine sandy loam to silty loam. The subsoil is clay and is mottled in various shades of brown and gray. Concentrations of calcium carbonate are numerous throughout the profile. Circular mounds from 50 to 100 feet in diameter and 3 to 4 feet in height occupy more than 20 percent of the surface. The plastic subsoil layer is constant in elevation. The acreage of this soil is a poor producer of either a pine or hardwood forest.

Myatt (M)

The Myatt series consists of poorly drained, medium acid to strongly acid soils. They were developed on stream terraces from alluvium washed from the uplands. These soils have a dark-gray to gray surface soil that ranges in texture through silt, silt loam to very fine sandy loam. The subsoil is gray to pale-brown silty loam to silty clay mottled with shades of brown. Permeability, internal drainage, and runoff are slow.

Native woodland covers most of the acreage of the Myatt soil series. The soil is productive of pine. After it is drained, it is fairly well suited to small grains and pasture.

Pheba (Ph)

The Pheba series consists of somewhat poorly drained, medium acid to strongly acid soils developed in unconsolidated beds of sand, silt, and silty cay. The surface soil is dark-gray to pale-brown very fine sandy loam to silt loam. The subsoil is gray to yellowish-brown silty clay mottled with various shades of brown.

These soils are slowly permeable. Internal drainage is slow. Productivity is low. Pheba soils occupy level to nearly level parts of the uplands. Native woodlands consisting of loblolly pine, shortleaf pine, red-oak, white-oak, post-oak, hickory, sweetgum and blackgum cover most of the acreage of the Pheba soil series.

Prentiss (Pr)

The Prentiss series consists of moderately well drained, medium acid to strongly acid soils on stream terraces. They were derived from sediments that washed from the uplands. The surface soil ranges from silt loam to fine sandy loam and is dark grayish brown to light brownish gray. The yellow to yellowish-brown subsoil ranges from silty clay to loam. The subsoil contains a pan layer that begins 20 inches to 36 inches below the surface. Surface drainage is good. Internal drainage is moderate to slow. Production and tilth is good. Most of the acreage of the soil series is stocked with pine and hardwood species. The soil is productive of pine.

Savannah (Sa)

The Savannah series consists of moderately well drained, medium acid to strongly acid soils that were derived from unconsolidated beds of sand, silt and sandy clay. The surface soil is grayish-brown to yellowish-brown silt to fine sandy loam. The subsoil is yellowish-brown sand clay loam to sandy clay. The subsoil contains a pan. The productivity of these soils is moderate. Tilth is moderately good. The acreages of this soil that have been located on the refuge are stocked with pine and hardwood species.

Stough (St)

The Stough series consists of somewhat poorly drained medium acid to strongly acid soils on stream terraces. They were derived from sediments that washed from the uplands. The surface soil is light yellowish-gray to yellowish-brown silt loam to fine sandy loam. The subsoil ranges from silt to sand clay loam; it is mottled in yellow, brown and gray colors. A pan-like formation 2 to 20 inches thick lies in the subsoil at depths of 12 to 40 inches. In some areas, mounds 2 to 4 feet in height and 50 to 100 feet in diameter occupy more than 20 percent of the surface. Internal drainage is slow, and permeability is slow. Productivity is low. A natural vegetation of pine and hardwood species covers the acreage of this type.

Una (Un)

The Una series consists of deep, poorly drained soils on floodplains of streams in areas of the Southern Coastal Plain and Blackland Prairie Major Land Resource Areas. Permeability is very slow. Soils formed in acid clayey alluvium. The seasonal high water table is near the surface during wet periods. Slopes range from 0 to 4 percent. During the winter and early in spring, these soils are subject to occasional or frequent flooding for brief to long duration and the water table is within one foot of the surface. Most areas are in the forest or pasture. Wooded areas are in bottomland hardwoods. Common trees are sweetgum, eastern cottonwood, green ash, cherrybark oak, Nuttall oak, willow oak, water oak and water tupelo.

Figure 7 depicts the location of each soil association within the refuge. Figure 8 depicts those soils with hydric attributes.

All soils that have been found to occur on Felsenthal Refuge, except the Chastain series have been described as having the ability to grow loblolly pine. However, most of these sites are stocked with pure stands of hardwoods. The ability of a soil to grow and reproduce a pine forest is determined by the frequency, duration and depth of the floods. The flood frequency and duration is determined by the elevation of the soil above mean sea level (MSL).

The only significant areas of any soil found to occur on the refuge that are recommended for agriculture by the Soil Conservation Service are located near Eagle Lake in Bradley County. These are the Myatt and Prentiss soil series.

HYDROLOGY AND WATER QUALITY

Groundwater

Two major aquifer systems provide groundwater in southeastern Arkansas: the Surficial Aquifer System and the Mississippi Embayment Aquifer System (encompassing the Sparta Aquifer). The Surficial Aquifer System is the uppermost aquifer system in the region. It consists of alluvial aquifers

and includes one major and three minor aquifers: the Mississippi River Valley aquifer (a highly productive and the most important aquifer); and three minor aquifers (the Arkansas River, the Ouachita-Saline Rivers, and the Red River alluvial aquifers). These surficial aquifers consist of unconsolidated to poorly consolidated Coastal Plain strata of gravel, sand, silt and clay of Holocene age; and are capable of yielding large quantities of water to wells. The Mississippi Embayment Aquifer System is made up of poorly consolidated sedimentary rocks of Late Cretaceous to middle Eocene age, and underlies the Surficial Aquifer System. The Mississippi Embayment Aquifer System is the most widespread system in the Coastal Plain and it thickens with depth as it extends toward the Gulf of Mexico into the deep subsurface.

Groundwater provides over 60% of the total freshwater withdrawn in Arkansas. The majority of groundwater withdrawals in southeastern Arkansas are from the shallower and more transmissive surficial alluvial aquifer because it is more cost effective to pump. However, water-level declines in the alluvial aquifer are causing decreased well yields. Withdrawals of large quantities of groundwater

Figure 7. Location of each Soil Association on Felsenthal National Wildlife Refuge.

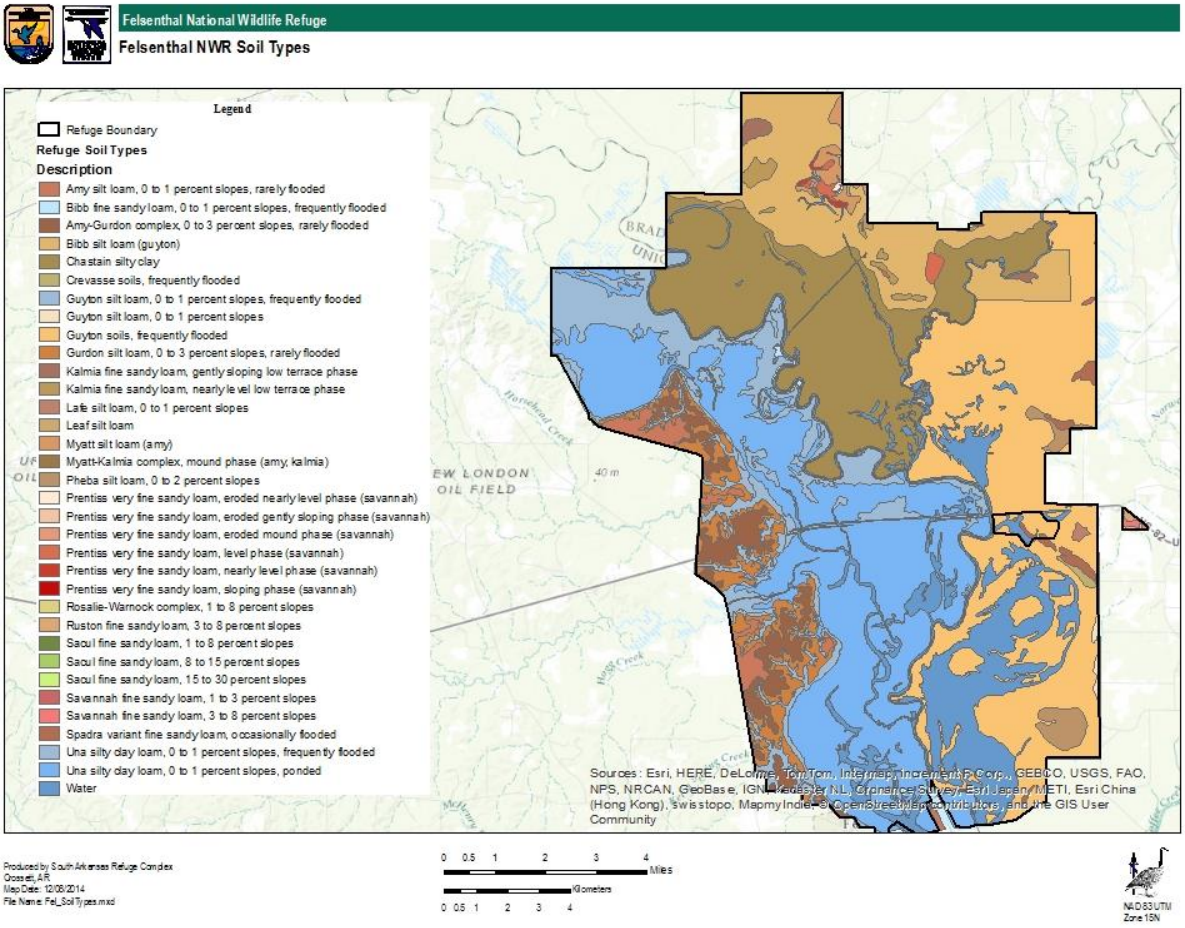
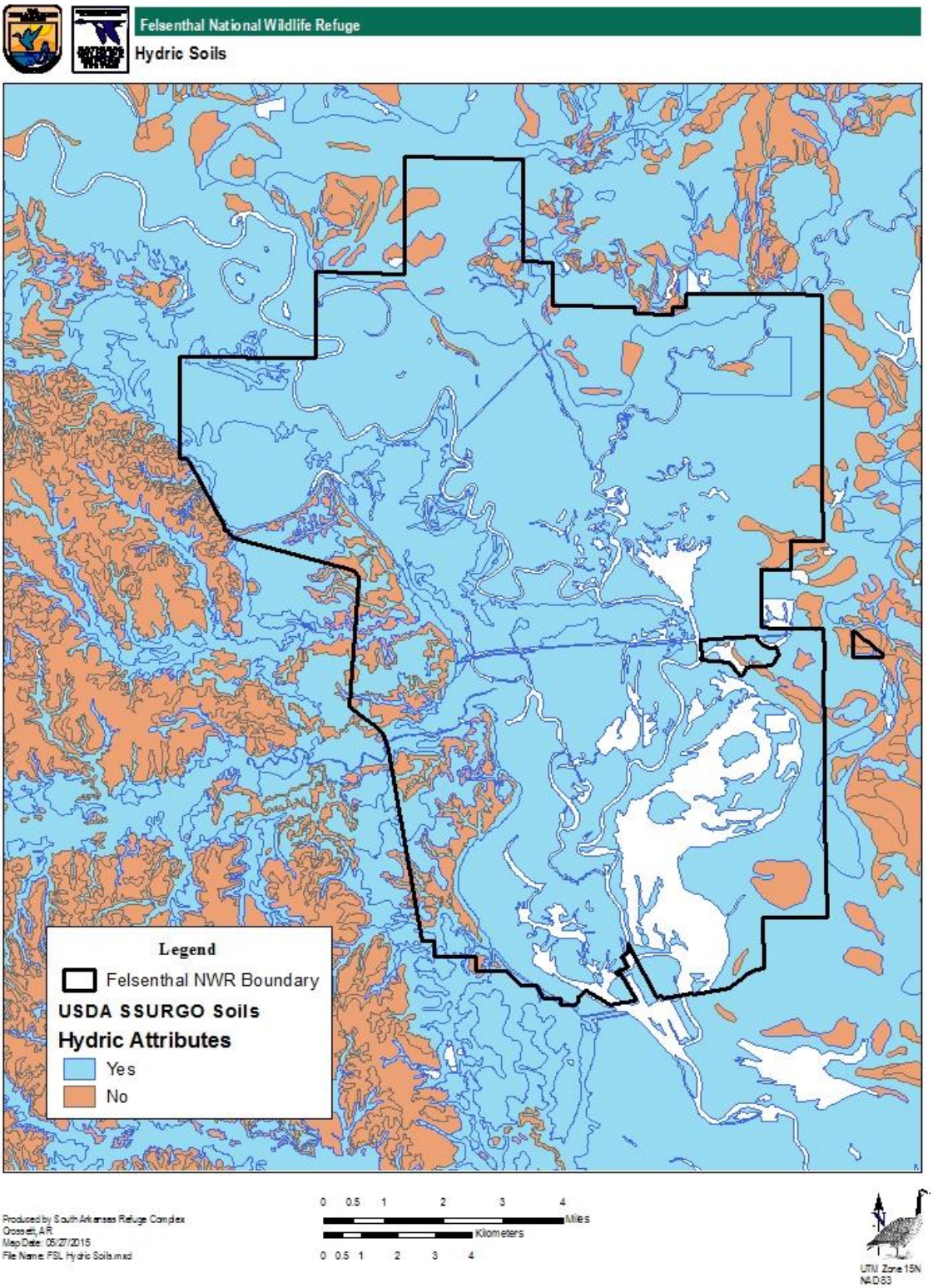


Figure 8. Hydric Soils on Felsenthal National Wildlife Refuge.



(the majority of which is used for irrigated agriculture like rice and soybeans) have not only lowered water levels, but also decreased the saturated thickness of aquifers, and even altered patterns of regional groundwater flow. Within the Mississippi Embayment Aquifer System, the Sparta aquifer (an aquifer of regional importance in southeastern Arkansas) is increasingly used to supplement supplies needed for crop irrigation. Wells in the Sparta aquifer (excluding those wells located within areas of large drawdowns) generally yield 100 to 500 gallons per minute (gal/min). In 2000, approximately 85 percent of total groundwater use in southeastern Arkansas came from the alluvial aquifer with the remaining 15 percent from the Sparta aquifer. Long-term pumping stresses in the Sparta aquifer have resulted in reduced amounts of water in storage, decreased well yields, regionally extensive water-level declines, and the formation of regional-scale cones of depression such as the cone that has formed between El Dorado, Arkansas, and Monroe, Louisiana. In Union County, the Sparta aquifer has been used increasingly since development began in the early 1920s, resulting in water-level declines of more than 360 feet (ft) in some areas. Cones of depression continue to grow. Extreme drawdowns have resulted in increased chloride concentrations of some Sparta aquifer wells in Union County because of upcoming of brackish water from below. In response to the declining water levels and degraded water quality, the Arkansas Natural Resources Commission designated the Sparta aquifer as a Critical Ground-Water Area in five counties of southern Arkansas in 1996.

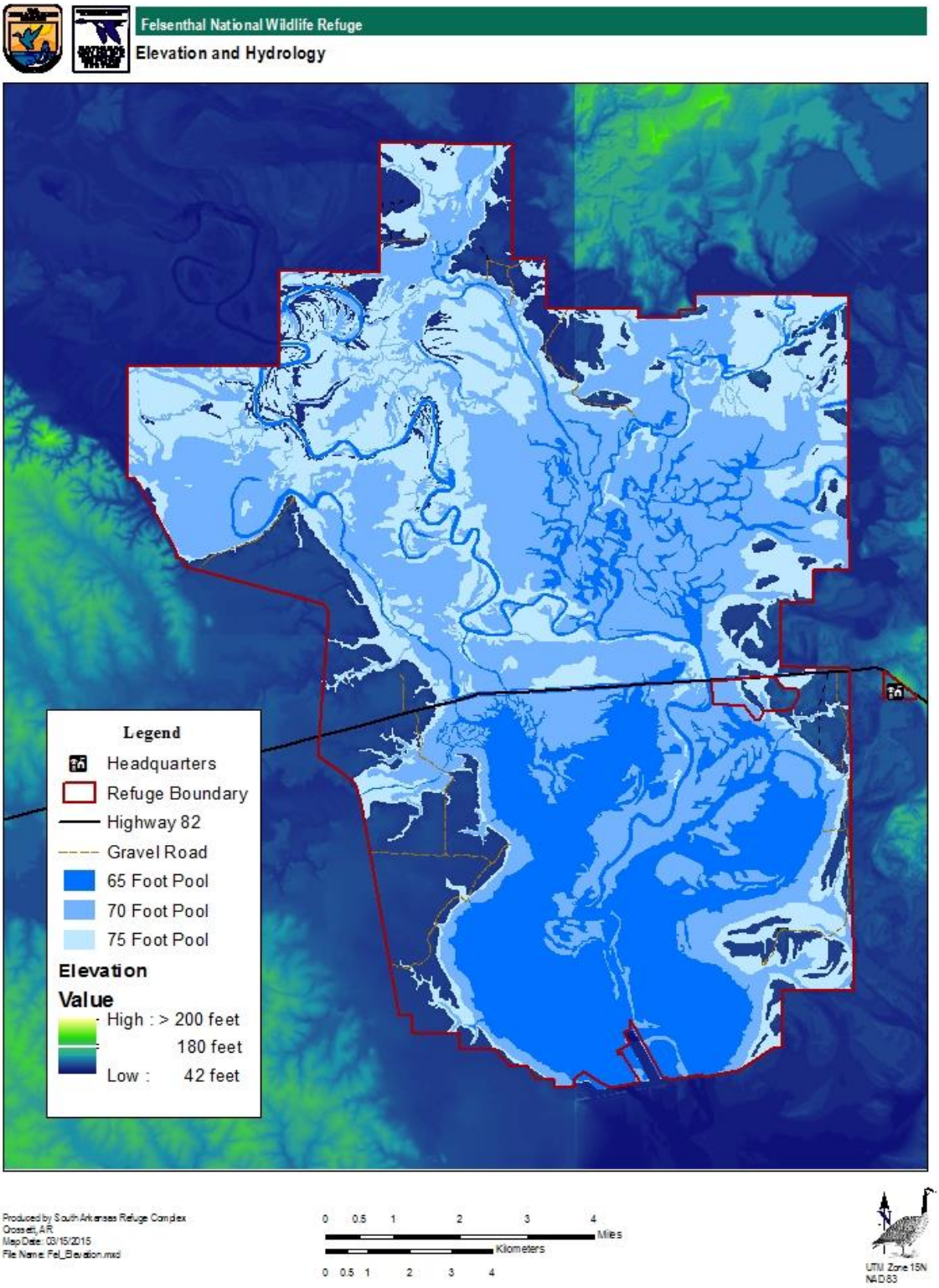
Surface Water

The Ouachita-Saline River basin which drains Felsenthal NWR is part of the dynamic Surficial Aquifer and the Mississippi Embayment Aquifer hydrological system that includes interactions between aquifers, streams, reservoirs and wetlands. Many tributary streams receive a substantial contribution of water from groundwater base flow during dry periods and withdrawal of groundwater can, under certain condition, also result in reduction in surface water flow. Felsenthal NWR lies within the Lower Ouachita River watershed. Located in the Coastal Plain, the Lower Ouachita and the Saline Rivers are the primary sources of surface freshwater for Felsenthal NWR. These two rivers (Lower Ouachita and Saline) and their tributaries drain Felsenthal NWR, as well as large portions of southeastern Arkansas. The mean flow of the Ouachita River and the Saline River, respectively, is: 7700 cfs (near Camden) and 2600 cfs (near Rye). The State of Arkansas has designated the Lower Ouachita River and its tributaries, and the Saline River and its tributaries as all suitable for the propagation of fish and wildlife; primary and secondary contact recreation; and public, industrial and agricultural water supplies. Figure 9 depicts the elevation and hydrology of the refuge.

The Ouachita River's source is found in the Ouachita Mountains of west central Arkansas near the Oklahoma border and flows south-south east 600 river miles before joining the Black and Red rivers in north-central Louisiana. The Ouachita basin covers over 10,000 square miles of drainage area. The Saline River is about 204-stream miles long and is a tributary to the Ouachita River. It is the last free-flowing river in the Ouachita drainage basin. Its origin is in the Ouachita Mountains in central Arkansas and it flows southward until it flows into the Ouachita River at Felsenthal NWR, forming a delta-type bayou. The Saline River basin covers about 3,350 square miles of drainage area. Lapile Creek, Lapoile Creek, and Caney Bayou (Blue Lake Slough and Deep Slough) drain the western part of the refuge and flow ultimately into the Ouachita River. Eagle (L'Aigle) Creek and Charivari Creek drain the northern portion of the refuge and Big Brushy Creek drains the eastern portion of the refuge. These three drainages flow into the Saline River.

Section 303(d) of the Clean Water Act requires states to assess the water quality and prepare a list of impaired waters. The lower Ouachita River and Saline River, including Felsenthal NWR, have impaired water quality due to mercury contamination and are listed under Section 303(d) of the Clean Water Act. This has resulted in the issuance of fish consumption advisories for about 66 miles of the lower Ouachita River and about 90 miles of the lower Saline River. Historically the oil, brine, and

Figure 9. Elevation and hydrology of Felsenthal National Wildlife Refuge.



bromine extraction industries have contributed point and nonpoint source contamination (high ammonia, nutrients, and dissolved solids) to waters in the area. Recent management practices have improved water quality for these parameters. In the vicinity of Felsenthal NWR, elevated zinc and copper concentrations in the Ouachita River are limiting aquatic life; and high concentrations of copper, beryllium and dissolved solids in the Saline River are limiting aquatic life and use of the river for drinking water and a source of water for agriculture and industry. A 26-mile pipeline has been constructed to discharge wastewater from the city of El Dorado's Water Utilities (2 sewage treatment facilities), El Dorado Chemical Company, Lion Oil Company, and the Chemtura Chemical Company into the Ouachita River 25-miles upstream from the Felsenthal National Wildlife Refuge. The city of El Dorado's 2 sewage treatment plants as well as El Dorado Chemical Company could not meet National Pollutant Discharge Elimination System (NPDES) guidelines, in association with the Clean Water Act, for the small streams into which they have historically discharged. The other two pipeline partners, Lion Oil Refinery and Chemtura Chemical Company have had NPDES discharge issues in the past with Total Dissolved Solids and high temperatures of discharges, respectively. The two latter companies' discharge essentially consists of cooling tower water. It seems that their motivation for joining the pipeline partnership is to be good corporate citizens, as well as, to avoid future NPDES issues associated with evolving environmental laws. It is their discharge that provides dilution for the other two entities to be able to go into the pipeline. Since 2013, refuge staff and cooperators have monitored the effects of pipeline effluent on water quality and fisheries resources. Monitoring results to date suggest that effluent from the pipeline is not currently negatively impacting water quality in the Ouachita River or the refuge.

AIR QUALITY

The Clean Air Act of 1970 (as amended in 1990 and 1997) requires the U.S. Environmental Protection Agency (EPA) to implement air quality standards to protect public health and welfare. National Ambient Air Quality Standards (NAAQS) were set for six pollutants commonly found throughout the United States: lead, ozone, nitrogen oxides (NOx), carbon monoxide (CO), sulfur dioxide (SO2), and particulate matter less than 10 and 2.5 microns in diameter (PM10 and PM2.5). The State of Arkansas Department of Environmental Quality (ADEQ), Air Division, conducts monitoring to satisfy Clean Air Act monitoring requirements. The Arkansas Ambient Air Monitoring Network currently collects data at 20 monitoring locations in 15 counties. Arkansas is only one of a handful of states in the country that currently and consistently meets all federal air quality standards for criteria pollutants.

The two nearest air quality monitoring sites in the vicinity of the Felsenthal NWR are in El Dorado (Union County) and Crossett (Ashley County). The data is displayed in Table 2 for 2010-2014. Areas that meet the NAAQS standards are designated "attainment areas," while areas not meeting the standards are termed "non-attainment" areas. The monitoring results indicate that these areas qualify as attainment areas for all monitored pollutants.

The Air Quality Index (AQI) is a summary index for reporting daily air quality. It tells how clean or polluted the air is, and what the associated health effects of concern might be. The AQI focuses on health effects that may be experienced within a few hours or days after breathing polluted air. The EPA calculates the AQI for five major air pollutants regulated by the Clean Air Act: ground-level ozone, particle pollution (also known as particulate matter), carbon monoxide, sulfur dioxide, and nitrogen dioxide. (Because all areas of the United States are currently attaining the NAAQS for lead, the AQI does not specifically address lead.) For each of these pollutants, the EPA has established national air quality standards to protect public health. Based on this index, in 2007, the air quality in the Ashley County area was categorized as "good" 77% of the time and as "moderate" 23% of the time. The Union County area's air quality was categorized as "good" 92% of the time and as

"moderate" 8% of the time. There were no "unhealthy for sensitive groups" reports for either of the monitoring locations.

Table 2. 2010-2014 Air Quality Data for Ashley and Union Counties, Arkansas.

Year/State/County			SO2	SO2	PM2.5	PM2.5 24-hr
			99th Percentile	2nd	98th Percentile	Weighted Mean
			1-hr	Max 24-hr	24-hr	24-hr
2010	AR	Ashley County			20	11.1
2011	AR	Ashley County			27	11.2
2012	AR	Ashley County			21	10
2013	AR	Ashley County			21	9.1
2014	AR	Ashley County			23	8.9
2010	AR	Union County	26	4	21	11.6
2011	AR	Union County	25	6	24	11.7
2012	AR	Union County	27	14	25	10.9
2013	AR	Union County	20	4	20	9.6
2014	AR	Union County	32	8	21	9.1

BIOLOGICAL RESOURCES

HISTORIC HABITAT CONDITIONS

Bottomlands

The forested wetlands in southern Arkansas 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.

Typical Virgin River Bottom Hardwoods in Ashley County Arkansas 1937 (courtesy of the Forest Service).

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. Bragg (2003) reported that the government land office (GLO) records contained references to baldcypress, oaks, gums, and other hardwoods 36” to 50” inchers, with some individuals exceeding 70”. South Arkansas was known for its large baldcypress. One surveyor noted 144 inch baldcypress in Ashley County and another noted 140 inch baldcypress on the Ouachita River in Union County.

Cypress Brake Southern Arkansas ca. 1910 (photo courtesy of Forest History Society, Durham, NC)

Uplands

Bragg (2003) analyzed General Land Office surveys from 1818-1855 in Ashley Co., Arkansas which is adjacent to the refuge. He found that pine was often underrepresented in the GLO records (17%) 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 pine with a dbh of 72 inches (Bragg 2003). Species of pine was seldom identified within the GLO records specifically; however surveyors would periodically include mention of long-needled pine or short-needled pine in their narratives. Areas located above the overflow were dominated by hardwoods with pine interspersed. Good hardwood sites were located closer to the bottomlands often yielding very large >39 inch trees. Drier sites would have had a considerable pine component, resulting in much of the area being considered mixed pine/hardwood.

Catastrophic events, such as tornadoes and fires, created openings where loblolly pine would come into a disturbed area. 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). 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 and grew in patches where fire had not occurred.

Typical View of Shortleaf Pine Timber, Property of the Union Saw Mill Company, Huttig, AR 1905 (courtesy of the Forest History Society)

CURRENT HABITAT CONDITIONS

Current Refuge Vegetation

Felsenthal NWR is located in an extensive natural depression and low-lying area dissected by an intricate system of rivers, creeks, sloughs, buttonbush swamps and lakes throughout a vast bottomland hardwood forest that gradually rises to an upland forest community (Figure 10). The region's two major rivers, the Saline and Ouachita, flow through the refuge. Historically, periodic flooding of the "bottoms" (bottomland hardwoods) during winter and spring provided excellent wintering waterfowl habitat. These wetlands, in combination with the pine and upland hardwood forests on the higher ridges, support a wide diversity of native plants and animals. The habitat types represented on Felsenthal NWR are shown in Table 3 and Figure 10.

Table 3. Felsenthal NWR habitat types and their acreages.

Habitat Types	Acres
Permanent Water	15,000
Pine	9,490
Pine-Habitat	705
Bottomland Hardwood	39,275
Upland Hardwood	188
Open Fields, Prairies and Administrative Areas	342
TOTAL	65,000

During winter, up to 21,000 acres of the bottomland hardwoods may flood providing wintering waterfowl habitat.

Description of Forest

Felsenthal Refuge consists of approximately 65,000 acres of land and water. Forested areas on the refuge consist of pine sites on the uplands and hardwood sites on the overflow plain of the Ouachita and Saline Rivers (Table 4). The establishment of these two habitat types is a function of their elevation above mean sea level. The pine and bottomland hardwood forest types are, in general, separated by the 72-feet above MSL elevation line. Due to the frequency of long-term flooding to 72 feet above MSL, pine seedlings do not survive below this elevation. Most of the refuge lands that are higher than 72 feet above MSL are suitable for growing pine forest. However, no active management will be initiated to expand the existing acreage of this habitat type.

The upland forest cover types, or those types located above 72 feet above MSL, are: white oak-red oak-hickory (SAF Type 52), loblolly pine (SAF Type 81), and loblolly pine-hardwood (SAF Type 82). The bottomland types, or those types that occur below 72 feet above MSL, are: sweetgum and Nuttall oak-willow oak (SAF Type 92), black willow (SAF Type 95), overcup oak-water hickory (SAF Type 96), and bald cypress-water tupelo (SAF Type 102). Forest cover types are listed by acreage in Table 4 (Figure 10). These maps were developed in the mid to late 1970s and are used as our baseline. Compartment/habitat unit maps are available for review at the refuge office. These maps are updated as new information becomes available.

Figure 10. Habitat Cover Types on Felsenthal National Wildlife Refuge.

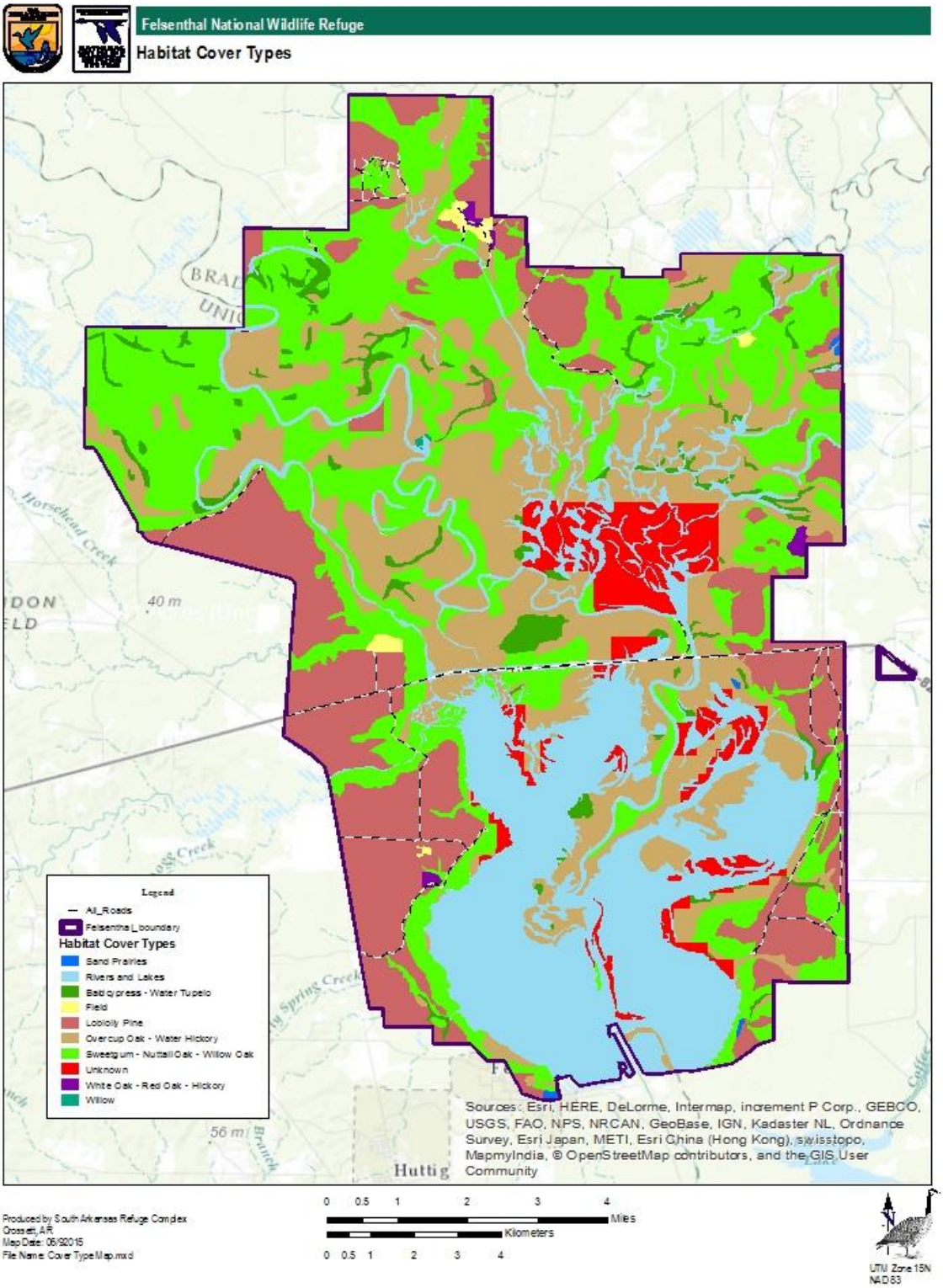


Table 4. Acreages of Forest Cover Types on Felsenthal National Wildlife Refuge.

Sweetgum, Nuttall Oak, Willow Oak	Overcup Oak, Water Hickory	Cypress, Tupelo	Pine	Pine, Hardwood	White Oak, Red Oak, Hickory	Willow
20,318	17,225	1,732	9,490	705	188	10

The white oak-red oak-hickory type is the climax type over a significant portion of the refuge upland sites. Currently, this type of forest type is found on tracts that were privately owned and never managed intensively for pine timber production or on tracts where the pine timber was removed during the acquisition program. White oaks, red oaks, and hickories predominate in this type. Trees occurring in association with the white oak-red oak-hickory type are: white oak (*Quercus alba*), post oak (*Quercus stellata*), southern red oak (*Quercus falcata*), winged elm (*Ulmus alata*), red maple (*Acer rubrum*), pignut hickory (*Carya glabra*), mockernut hickory (*Carya tomentosa*), blackgum (*Nyssa sylvatica*), and sweetgum (*Liguidambar straciflua*). The white oak-red oak-hickory type is one of the better mast producing plant associations on the refuge. However, as the oaks and hickories constitute the majority of the plant species in the overstory, production of wildlife foods is limited to nuts. Because of its composition, high intensity fires must be excluded from this forest type. Approximately 188 acres of the white oak-red oak-hickory type have been located on the refuge.

The loblolly pine-hardwood forest type is one of the most difficult refuge forest types to manage. Plant composition of this type is similar to the loblolly pine type. Loblolly pine (*Pinus taeda*) is the key tree species but it is not predominant. This type contains no less than 20 percent and no more than 59 percent, by volume, of pine trees. This is a transition type and is a product of pest management--management that has made no effort to control hardwoods. Because of the predominance of hardwoods in this type, high intensity fires must be excluded. There are currently about 702 acres of this type growing on refuge lands. When this type converts naturally to the white oak-red-oak-hickory type, there will be, in combination with the 188 acres presently stocked with white oak-red oak-hickory, about 900 acres of this upland hardwood habitat.

The loblolly pine forest type totals about 9,940 acres. Loblolly pine is predominant in this type. Sweetgum, shortleaf pine (*Pinus echinata*), and southern red-oak (*Quercus falcata*) are common associates. This habitat type will be managed to produce wildlife foods and benefits other than nuts. A prescribed burning program will maintain desirable understory plants, and grasses and shrubs growing on the forest floor will produce various seeds and browse. In addition to food produced in the loblolly pine habitat, this type will be managed to produce and maintain the trees needed for cavity construction, roosting, and foraging by the RCW.

The sweetgum-Nuttall oak-willow oak forest type contains more acres (about 20,313) than any other cover type on the refuge. This type occurs on the higher, better-drained sites in the bottomlands and is probably the climax type on these areas. Willow oak (*Quercus phellos*) is the predominant oak associated with this type. Nuttall oak (*Quercus nuttalli*) is not always present. Sweetgum is generally not as common as the oaks. Other trees commonly associated with this type are green ash (*Fraxinus pennsylvanica var. lanceolata*), overcup oak (*Quercus lyrata*), and common persimmon (*Diospyros virginiana*). The sweetgum-Nuttall oak-willow oak type grows on the better-drained bottomlands that are located below 72 feet above MSL. This is probably the most important bottomland cover type for wildlife on the refuge. The oaks that commonly occur in this type produce acorns that are preferred by wildlife. Management of this type will strive to either maintain or increase the percentage of oaks.

The black willow type is of minor importance on Felsenthal Refuge. In this type, black willow (*Salix nigra*) occurs in almost pure stands. This is a temporary pioneer type that occupies new ground formerly deposited by a meandering waterway.

The overcup oak-water hickory forest type occupies the backwater basins and poorly drained flats of the refuge. Overcup oak and water hickory (*Carya aquatica*) are the predominant species in this type. Trees commonly associated are willow oak, Nuttall oak, green ash, sugarberry, persimmon, and, occasionally, red maple. Flooding is frequent and often of long duration on the overcup oak-water hickory sites. The dominant trees produce food less desirable than food produced by the species that grow on higher elevations.

The bald cypress-water tupelo forest type occurs on the lower elevations. After the navigation pool was filled in 1985, this type was flooded. While individual trees will exist in the permanent pool for a long period of time, this type will not reproduce on these permanently flooded sites. Reproduction of this type at the edge of navigation pool is highly probable. Bald cypress (*Taxodium distichum*) and water tupelo (*Nyssa aquatica*) predominate on this type. The most common trees associated are red maple, water locust (*Gleditisa aquatica*), and water-elm (*Planera aquatica*). Both bald cypress and water tupelo produce seeds that are utilized as food by wildlife. However, these species may be more valuable as a provider of nesting and denning sites for wildlife. Due to the location of this type, it is very difficult to harvest forest products on the bald cypress-water tupelo sites during most years. Because of this, many areas occupied by this type consist of large trees that contain hollows and cavities. Trees in this type that were not salvaged before the completion of the Felsenthal navigation pool will never be harvested. Before establishment of the present navigation pool, there were large stands of the bald cypress type (SAF 101) growing in the Felsenthal Basin. Most of this timber was salvaged before the completion of the Felsenthal lock and dam in 1985. Because these sites were permanently flooded, this type did not reproduce. It is doubtful that pure stands of cypress will ever reproduce on Felsenthal Refuge. However, cypress will always be a common species in association with the other types and around the perimeter of the permanent pool.

The refuge lands above the permanent pool and excluding the demonstration areas are divided into 40 management compartments. The compartment boundaries adjacent to the permanent pool were based on the most appropriate subdivision of the original public land survey. Timber salvage operations within the permanent pool were based on these boundary lines. The waterline can be mapped with the use of aerial photographs and compartment boundaries were amended to reflect the actual waterline.

For the purpose of this plan, tree sizes are described by the terms "regeneration," "pulpwood," and "sawtimber". These terms are used as there are no known expressions readily understood by the general public that accurately portray the existing habitat conditions. Regeneration is used to describe young trees that do not exceed 5.9 inches DBH. Pulpwood is used to describe intermediate sized trees that range in size from 6.0 inches to 13.9 inches DBH. Sawtimber is used to describe larger or mature trees that have diameters larger than 14.0 inches DBH.

Density classes have been depicted in cords and board feet--terms that are generally understood by members of the public that are interested in forest management. It is possible that stand densities could be depicted by the number of stems per acre or the percentage of crown closure. However, it is likely that these expressions would neither present a clear picture to the public nor accurately portray the information needed for habitat management activities.

All refuge lands have been mapped and divided by forest cover types, tree size, and density classes. Copies of compartment/habitat maps showing these types and density and size classes are located at the refuge office for review if needed.

Forest Land Management

Felsenthal NWR's forest management practices focus on providing excellent conditions for the variety of wildlife living in the forest. Prescribed burning, thinning, regeneration and stand improvement are some of the techniques used to enhance and maintain optimum habitat conditions. In the upland areas, the timber is managed primary for the endangered red-cockaded woodpecker where artificial nest inserts are placed in mature pine trees to supplement suitable cavities. Felsenthal NWR has 49,668 acres of forest under active and passive management. This long-term program is designed to provide a diversity of habitat conditions to meet the needs of a full spectrum of indigenous wildlife species with the main emphasis on endangered species and waterfowl. Based on the Timber-Wildlife Management Plan (revised in 1995), the refuge uses biologically sound silvicultural practices to provide a diversity of forest habitat. Through commercial forest thinning and improvements cuts, the forest environment is managed to provide habitat for endangered red-cockaded woodpeckers, resident and wintering waterfowl, other migratory birds and numerous species of resident wildlife. Currently about 15,500 acres of the forested habitat on Felsenthal NWR have had some type of forest management to enhance wildlife habitat and promote forest health.

Green Tree Reservoir (GTR) Management

GTRs are implemented in forest stands with trees desirable as food sources for waterfowl. With the completion of the lock and dam in 1985 and raising the water level to 65'msl, the Felsenthal pool grew to approximately 15,000 acres. In November the GTR was raised annually an additional 5 feet, inundating an additional 21,000 acres. In many cases natural flood events override management attempts to maintain or lower water levels at appropriate times.

In 1987, U.S. Geological Survey and the Refuge initiated a study to evaluate the tree growth and mortality within the GTR to relate changes in the forest structure and composition to strategies of GTR management. Initially it was thought the increased soil moisture was beneficial to tree growth and acorn production (Broadfoot 1958, Minckler and McDermott 1960, Broadfoot 1967). However, more recent studies have shown GTR management had reduced tree vigor and growth (Francis 1983, Schlaegal 1989). In one study, nearly half of those GTRs surveyed showed increased mortality and poor regeneration of desired trees species (Wigley and Filer 1989). Ervin et al. (2006) noted differences in species composition between natural forested wetlands and GTRs.

In the Refuge study, the forest stands were mature trees approximately 50-75 years of age. Five species are considered the primary hardwood species: Nuttall oak, willow oak, overcup oak, sweetgum, and water hickory. From 1990-2006 stem density declined by 29% for all species. The five primary species declined by 34% (Keeland 2010).

Overall mortality rates between 1990-2006 were 2.6% annually and were even greater at the lower elevations (3.1%) (Keeland 2010). Normal mortality rates should reside around 1%. After two decades of GTR management, mortality of mature trees has continued to be 2 to 3 times greater than normally expected rates (Keeland 2010). All oak species suffered major losses at the lower elevations.

In the refuge's GTR, Nuttall oak mortality ranges from 3.5-5%. By 2006, half of the Nuttall oaks died at the lower elevations and 1/3 died at the mid to higher elevations (Keeland 2010). Nuttall oak is an

important waterfowl species and floods, as seen in the GTR, have been shown to decrease acorn production by more than 50% (Francis 1983). Willow oak, another important waterfowl species, had the highest mortality rates, 1/3 died at the higher elevations, ½ died at the mid-range and 2/3 perished in the lower elevations (Keeland 2010).

Regeneration of oak species continuously occurred but failed to mature due to extended flooding. Saplings were a rare find in the refuge study plots, as oak saplings occurred in only 6 of 54 plots in 2006 (Keeland 2010).

The GTR study demonstrates that tree vigor has decreased and subsequent mortality appears to be inevitable. Stem densities have decreased for all five primary species. More than 25% of all trees species have died since 1987. Mortality rates continue at higher than normal levels. Although overcup oak has declined as well it is appears to be the most adapted to these changes. The net result appears to be a shift toward a more water tolerant species composition. The study is ongoing. Results of 2011 re-evaluation should be available in 2016.

Fire Management

Over millennia, natural and human induced fires have had a major impact on the extent, distribution, and composition of southern forest ecosystems. Lightning serves a source of ignition for natural fires. The interval between these fires may be as short as a year or as long as centuries. The intensity of fire and severity of effects would range from benign to catastrophic. Periodically, multiple sources of disturbance have a cumulative effect on the amount of fuel available and the intensity at which naturally ignited fires burned. Areas subjected to wind-throw, flooding, ice damage, insect attack or drought may have a high rate of tree damage or mortality which leads to large accumulations of debris or fuel available for wildland fires. Fires in these areas could have been intense and not only consumed the available fuel source but could consume or damage residual forest or vegetative structure.

The role of fire was dramatically increased with the arrival of aboriginals in America about 14,000 years ago (Stanturf, et al., 2002). Native Americans purposely set fire to clear land for cultivation of food plants, maintain grasslands for the hunting, and maintain open areas for visibility and defense. The frequency at which areas would have been burned would vary depending on the use, ranging from annually to once every 10 years. Knowledge of Native American practices involving fire in found in writing of European explorers and settlers whose journals contain either mention fire directly or indirectly in descriptions of ecological features that are typical to landscapes subjected to repeated burning (Fowler and Konopik, 2007).

Locally, the effect of fire on the landscape was documented in GLO survey records. GLO surveys were conducted in Ashley County Arkansas from 1818 to 1855. These surveys contained records of land disturbances including wind throw, fire and flood. Surveyor notes include statements such as “huge trunks of trees…on the ground blackened by the fire and broken into fragments from their fall…” and “…the hurricane [an area of wind throw near the Ouachita River] so burnt that it makes the appearance of prairie fit for cultivation.” Other notes describe prairies or forests with open grass understories that would have required frequent exposure to fire, otherwise would have been quickly occupied by woody shrubs, vines and tree seedlings (Bragg, 2003).

Commercial harvest of virgin timberlands of the Upper West Gulf Coastal Plain began in the 1880’s and continued for the next half century. Only the largest trees in the virgin forest were initially considered desirable. Fires were common in the logging slash and little effort was taken to protect the remaining forest (Bragg, 2002).

In the late 1920's and 1930's the practice of active forest management began in south Arkansas. A component of this was fire control. The Arkansas Forestry Commission was established with the passage of Act 234 by the 1931 Session of the Arkansas Legislature. These developments led to a decrease in the amount of wildland fire that was allowed to run unchecked across the landscape. Woods burning and prescribed fire were practices still employed by timber companies and private landowners of the area, but the effects of these fires remained localized and more controlled. Timber companies that owned and managed the land in which Felsenthal NWR now lies would have utilized prescribed fire for competition control, site preparation, and to improve access for forest management practices.

Since the establishment of the refuge, prescribed fire has been used to improve wildlife habitat, reduce hazardous fuel loading, and maintain fire adapted ecosystems. Records for the application of prescribed fire were kept starting in 1985. Table 5 shows the total number of prescribed fires implemented, the total acres prescribed burned, and the average annual acreage burned for each 10 year period.

Table 5. Ten year totals of number of prescribed fires and annual average acreage prescribe burned on Felsenthal NWR

Year Range	Total Number of Prescribed Fires	Annual Average of Acres Prescribe Burned for 10 Year Period
1985-1994	78	2,961 avg. acres per year
1995-2004	80	2,542 avg. acres per year
2005-2014	66	2,148 avg. acres per year

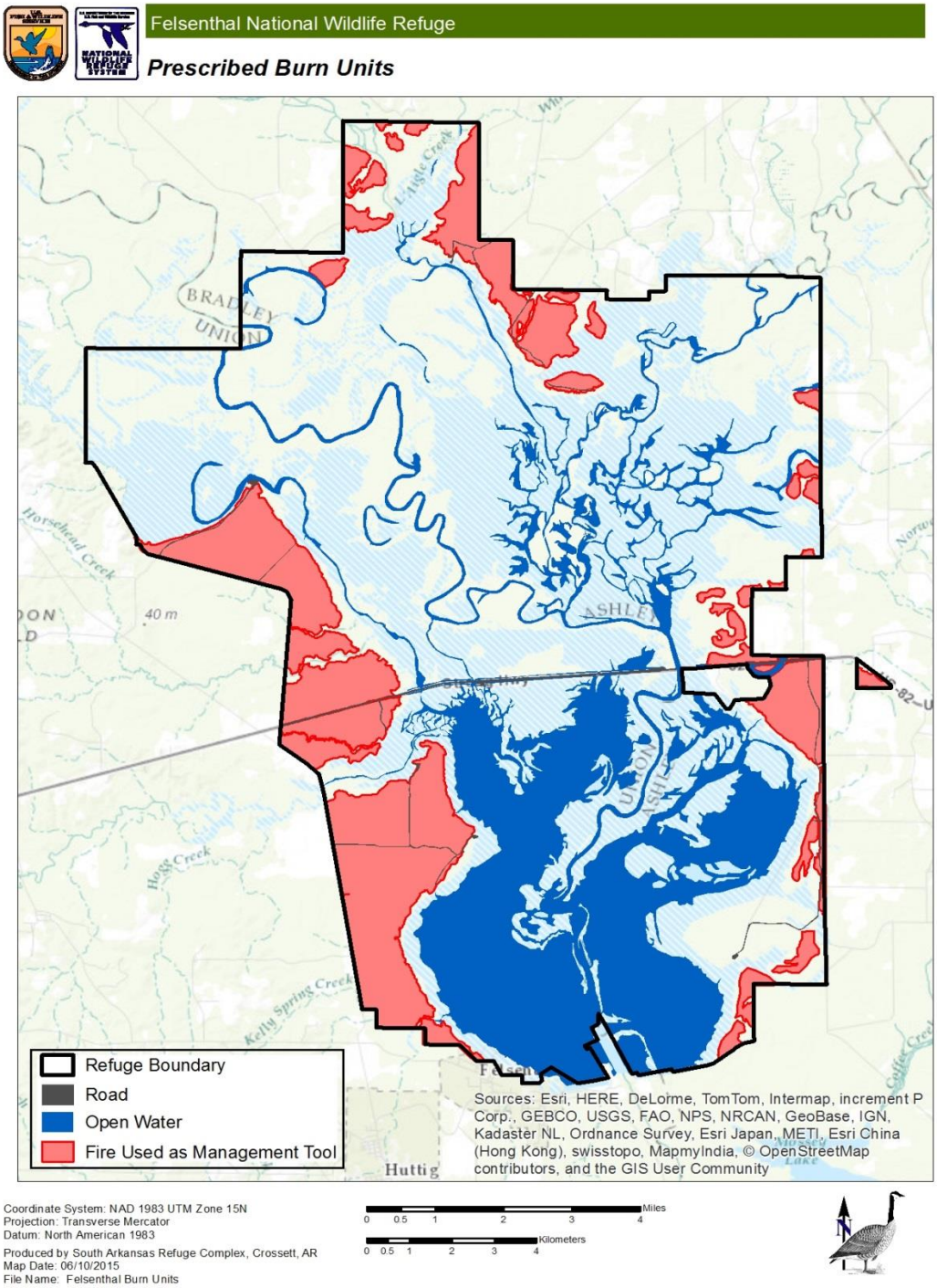
Prescribed fire is a primary habitat management tool on the 9,490 acres of pine forest on Felsenthal NWR. The objectives of the refuge's prescribed burning program are wildlife habitat improvement for the red-cockaded woodpeckers and other species, fuel reduction, site preparation, and understory management. The prescribed burns are managed on a rotational basis. Pine forests on Felsenthal NWR have a targeted return interval of 2 to 5 years. Upland hardwood and mixed hardwood/pine sites have a targeted return interval of 5 to 35 years. Figure 11 depicts the refuge burn units.

Water Level Management

Felsenthal NWR is located at the confluence of the Ouachita and Saline Rivers and is 65,000 acres in size. The refuge was created in part to offset the impacts from the Ouachita-Black Rivers Navigation Project developed by the U.S. Army Corps of Engineers. The first lock and dam was constructed in 1925 about 5.6 km downstream of the refuge's southern boundary. This dam created a permanent pool that inundated 4,942 acres of forest at an elevation of 18.8 m MSL. A second lock and dam ("Felsenthal dam") replaced the first dam in 1985, raised the pool elevation to 19.8 m MSL, and increased the permanent pool to 14,826 acres. The Felsenthal dam is designed to maintain a navigational channel for barges and to seasonally raise water levels to 21.3 m MSL, inundating an additional 21,000 acres currently managed as the GTR at Felsenthal NWR. Annual variation patterns in water levels recorded at the Felsenthal dam have shown similar patterns of fluctuation for pre and post 1985 dam operation but with an apparent shift in base water levels from 61.7' msl to 65' msl of the dam.

The GTR at the Felsenthal NWR differs from others in the southeastern U.S. because it was created by damming the Ouachita River rather than diverting water into an area surrounded by low levees. This has resulted in a system through which water is constantly flowing. In addition, the Saline River flows into the Ouachita River from the east. Since there are no dams on the Saline River, precipitation

Figure 11. Prescribed Fire Burn Units on Felsenthal National Wildlife Refuge.



also plays an important role in influencing immediate short-term fluctuations in water levels at the GTR. While flowing water may lessen the impacts of long-term flooding on the trees (Kozlowski 2002), it also makes control of the water levels in the GTR more difficult. In several cases, the natural river flood conditions have overridden management attempts to maintain or lower water levels at designated times.

The GTR can become flooded annually beginning in each November, with water depth from a few centimeters to more than three meters when the level at the Felsenthal dam is 70' msl. This area increases by another 19,027 acres if water levels reach 75' msl. By March 1, water levels are gradually lowered back to 65' msl. Water levels can vary considerably throughout the refuge and are reflected in the different patterns observed in the growth and survival of the trees. Water levels have been managed on a more variable schedule including extended spring flooding to allow more areas for fish to spawn. In several years, natural precipitation caused extensive flooding. Between 1985 and 2006 over ¼ of all trees in the GTR had died, consisting mostly of the five primary species with little to no regeneration. Since 2001, the refuge has managed for lower water levels during the flooding season and increases started at the end of November. This has allowed for quicker removal of water and thousands of acres flooded for shorter durations and less often.

The Lock and Dams have altered the hydrology of the area for a long time and vegetation communities are changing as a result. Keeland et al. (2010) and other USGS scientists have both studied this area extensively. These studies have concluded that changes in forest composition and vigor are declining due to the water management regime and constant flooding in this GTR.

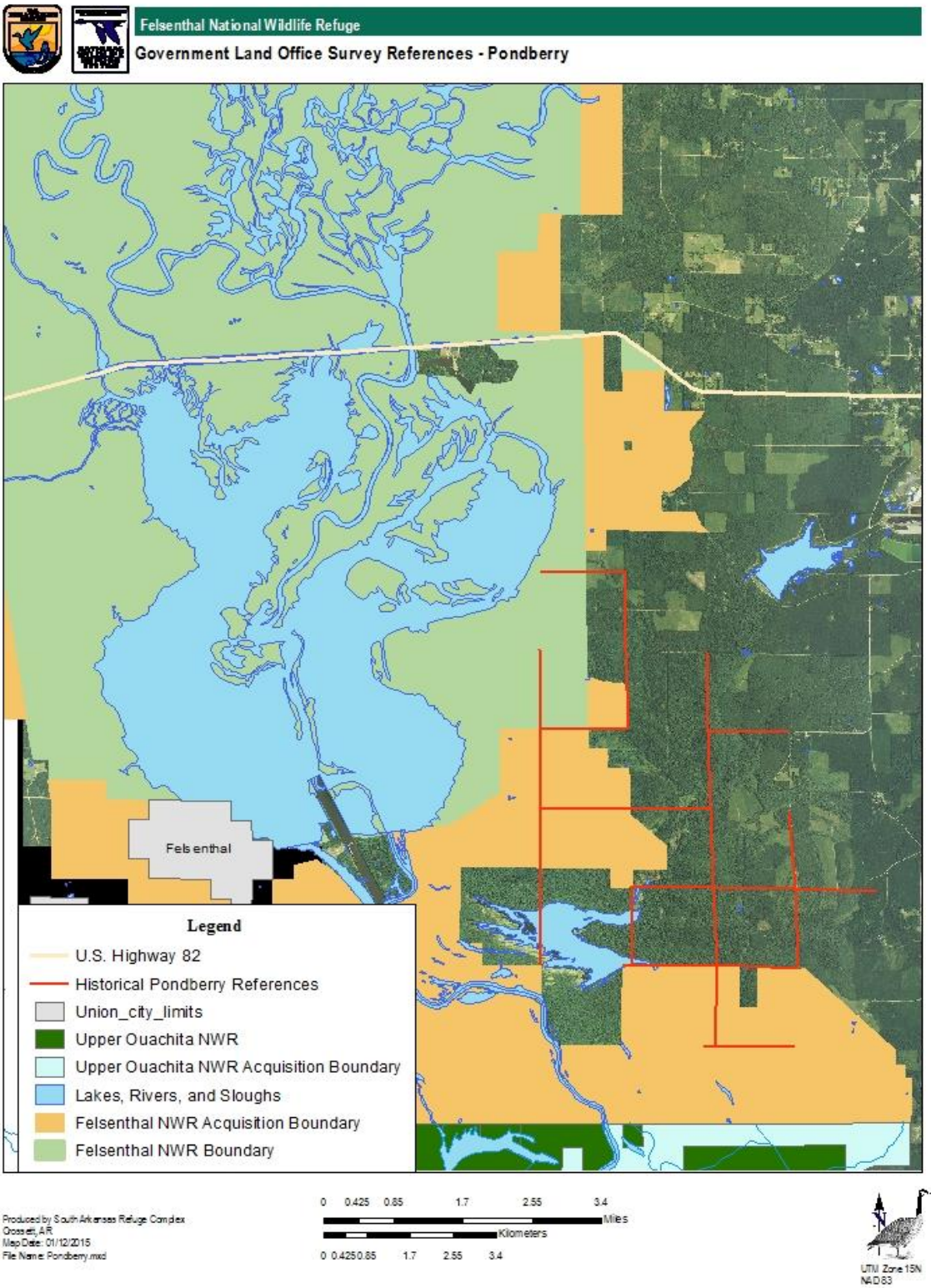
In 1995, the refuge, the US Geological Survey, and Corps of Engineers conducted an experimental one foot (0.3 m) drawn down of the Felsenthal Pool. On July 1, the pool was lowered in one-tenth foot increments each day until the 64.0' msl (19.5 m) pool was reached. The pool was then gradually flooded around November 1 until it reached 65' msl (19.8 m). The drawdown was viewed as a complete success because of abundant and diverse moist-soil vegetation within the drawdown zone and increased waterfowl use. Plant response was excellent, and the staff estimated no less the 310,000 ducks utilizing the refuge in late November of 1995. USGS researchers concluded that it is probable that future drawdowns will result in increased quantity and quality of desirable waterfowl food plants, such as red-root flat sedge (*Cyperus erythorhizos*) and bearded sprangletop (*Leptochloa fascicularis*) (Howard and Wells 2007).

Federal and State Listed Plant Species

Pondberry

Pondberry (*Lindera melissifolia*) is a deciduous shrub that grows in wetland habitats, and is federally listed as endangered. Pondberry grows to approximately 2 meters (6 feet) tall, flowers in late February or March with pale yellow flowers that appear in the spring before the leaves emerge. The oval-shaped fruits are 0.5 inch (12 millimeter) long, and turn from green during the summer to bright red in the fall. Pondberry leaves have a distinct sassafras-like odor when crushed. The most significant threats to this plant are drainage ditching and subsequent conversion of its habitat to other uses. Domestic and feral hogs, cattle grazing, and timber harvesting have also impacted the plants at some sites. GLO surveyors mentioned spicewood, a historic common name for Pondberry. These references correspond to the section lines within two townships. This corresponds to Arkansas Natural Heritage Commission's Coffee Prairie Natural Area. Pondberry is known to occur on this area. Figure 12 shows those historic references in relation to the current refuge boundary and acquisition boundary.

Figure 12. Historic Distribution of Pondberry, Felsenthal National Wildlife Refuge.



Other Rare/Uncommon Plant Communities

Lowland sand prairies are known to occur only in extreme southern Arkansas and northern Louisiana in the bottomlands of the Ouachita River and are unlike any other prairies in Arkansas in species composition, soils, and hydrology. These unique wetland communities are dominated by Switchgrass and other graminoides (Pagan 2001). Felsenthal NWR has eleven sand prairies identified within the acquisition boundary (Figure 13); ten of which are in Ashley County and one in Bradley County. Bragg (2003) noted these bottomland prairies arose from a combination of hydrology, frequent fire, soil texture and mineralogy and lacked the natural mounds common to terrace grasslands. High levels of Al+3 in the deep sandy soils are a major factor keeping these areas in a barren or treeless state. These soils can be extremely droughty or have extreme wetness. Sand prairies can experience long periods of flooding of depths from 5 to 10 feet. The long duration of flooding and the scouring effects of water velocities may contribute to maintaining the community structure. Fire is also a historical disturbance factor that kept these areas open. In the Government Land Office (GLO) survey records descriptions like grassy woods or prairie woods helped distinguish them from the closed canopy forests and grasslands that dominate the landscape. GLO Deputy Surveyor Caleb Langtree also identified small areas in T19S R9W as hickory barrens or hickory and dogwood barrens, presumably hickory-dominated woodland (Bragg 2003). The tract referred to may actually be Arkansas Natural Heritage Commission's Coffee Prairie Natural Area. This 56 acre tract protects an excellent example of this type of lowland sand prairie. ATVs and other vehicles are detrimental to this vegetation to this community.

Invasive Species

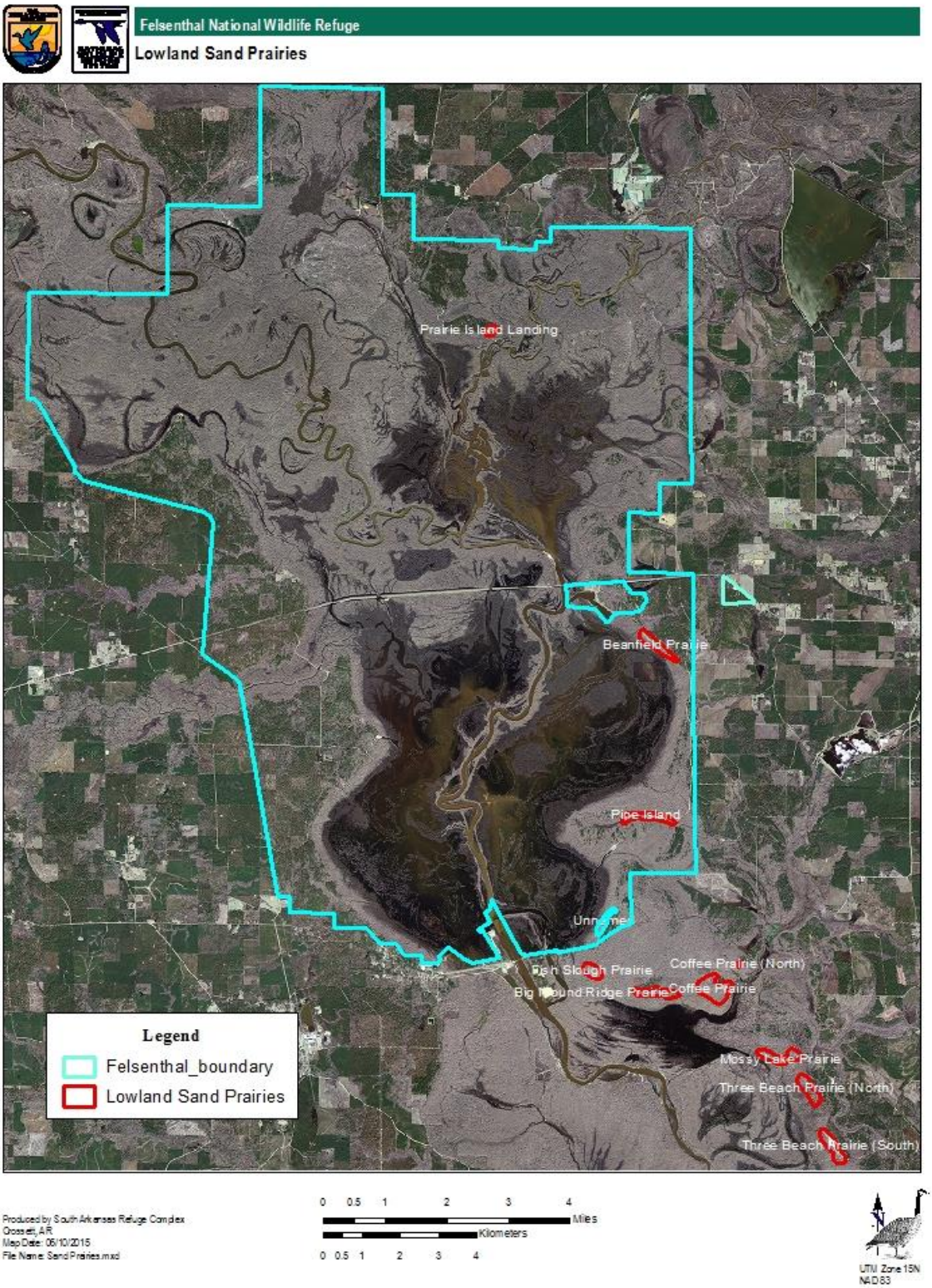
Chinese tallow

Chinese tallow tree is native to southern China, Japan, Indo-China, India, Vietnam, and the Korean Peninsula (McCormmick 2005). It was first introduced into the US in the 1700s where it was cultivated for seed oil and soap production advocated by the Foreign Plant Introduction Division of the USDA in the early 1900s (Flack and Furlow, 1996, McCormmick 2005). Chinese tallow can annually produce over 10,000 pounds of seed per acre (Potts, 1946; Bolley and McCormack, 1950; Conway et al., 2000) and birds, especially edge associated bird species, are important dispersal agents (McCormmick 2005). Chinese tallow grows readily in flooded conditions and seedlings produce thicker roots than native water tupelo (*Nyssa aquatica*) and green ash (*Fraxinus pennnsylvanica*) (Jones and Sharitz, 1990). Chinese tallow tree is increasing exponentially and is an imminent threat to wetland and upland habitats in mostly frost-free latitudes. This species causes large-scale ecosystem disruption by replacing native vegetation, reducing native species diversity, creating 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). An effective management strategy for long-term control Chinese tallow requires an integrated pest management (IPM) plan, which involves the application of biological, chemical, mechanical, and physical control techniques.

Hydrilla

Hydrilla is native to Asia and India and first introduced into the US in the 1950s for use in aquariums. Hydrilla is present throughout the southeast, on the east coast from Florida north to Massachusetts, west into Texas, and in Arizona and California as well (Pieterse 1981, Cook and Luond 1982, Langeland 1996). There are two varieties of hydrilla in the United States. Many of the plants in the southern United States are all one sex (female) and are dioecious. Dioecious plants cannot produce

Figure 13. Location of Sand Prairies on Felsenthal National Wildlife Refuge.



seed. Therefore, this variety of hydrilla multiplies vegetatively by growth from stem fragments and clonal reproduction via runners, rhizomes, and tubers (Pieterse 1981, Hurley 1990). Sutton et al. (1992) indicate that one tuber can give rise to as many as 6,000 new tubers per square meter, and Van and Steward (1990) notes tubers can remain viable longer than 4 years. Hydrilla is an aquatic weed that was first discovered in Lake Ouachita in 2001. Originally, hydrilla was not thought to be able to survive as far north as Arkansas, but the weed is now found in many waters in the state. Found at or just below the water surface, it can grow in mats that can extend up to 10 meters deep. Hydrilla can be spread by boats and through cut pieces of foliage. Arkansas Cooperative Agricultural Pest Survey (CAPS). Hydrilla is known to be an aggressive and competitive plant, out-competing and displacing native species, creating monocultures. Hydrilla is controlled by chemical and biological means; however, complete control is difficult due the ability of hydrilla tubers sprouting after lying dormant for several years.

Cuban bulrush

Cuban bulrush (*Oxycaryum cubense*) is a non-native rush from the West Indies or South America which was brought to the United States likely by migratory birds or in ship ballast. Cuban bulrush can be described as an epiphytic plant, as it requires a raft of other aquatic vegetation to attach to. Once Cuban bulrush gets established on other vegetation, it rapidly outgrows and eventually kills the other plants creating a monotypic self-sustaining population of Cuban bulrush.

Cuban bulrush in Mud Lake, Felsenthal NWR (USFWS, 2014).

Cuban bulrush reproduces sexually through the production of achenes, or more commonly via vegetative means. It was previously described to be a vigorous nuisance and exotic plant with growth rates similar to giant salvinia and water lettuce. However, it does not appear to be a species of concern in much of its range and is a good source of food for ducks, as well as important in cycling detritus.

Emerald ash borer (Agrilus planipennis)

The adult emerald ash borer (EAB) is a metallic green insect about one-half inch long and one-eighth inch wide making it hard to detect in the wild. The female beetles lay eggs on the bark of ash trees. The eggs hatch and the larvae bore into the bark to the fluid-conducting vessels underneath. The larvae feed and develop, cutting off the flow of nutrients and, eventually killing the tree. EAB attacks and kills North American species of true ash, and tree death occurs three to five years following initial infestation. EAB is native to Asia. Signs of EAB include: canopy dieback beginning at the top of the tree and progressing through the year until the tree is bare; sprouts growing from the roots and trunk; split bark with an S-shape gallery; D-shaped exit holes; and more woodpecker activity, creating large holes as they extract the larvae. Firewood is a vehicle for movement of tree-killing forest pests. A recent finding by the Arkansas State Plant Board and the United States Department of Agriculture indicates that the EAB, an invasive beetle that is highly destructive to ash trees, has been found in several Arkansas counties. Precautionary measures are now underway to prevent the spread of the EAB throughout the state including a 25-county quarantine zone in southern and southwestern Arkansas. Three of the ten National Wildlife Refuges in Arkansas are located within the quarantine zone. Precautionary measures are now underway to prevent the spread of the EAB throughout the state. Effective immediately, firewood will no longer be allowed to be imported on any National Wildlife Refuge in Arkansas until further notice. The three refuges within the quarantine zone (Felsenthal, Overflow, and Pond Creek) will also suspend firewood cutting permits for home heating purposes. For the refuges that allow camping, the following conditions apply: 1) individuals may collect downed trees/logs/limbs no more than 100 feet from roads and trails open to motorized vehicles, 2) it is prohibited to damage standing trees and/ or habitat, 3) on public roads all debris must be removed from the road, shoulders, and ditches, 4) all vehicles including ATV/UTVs must remain on designated roads or trails, 5) all refuge regulations apply and will be strictly enforced.

Ambrosia beetle (Xylosandrus crassiusculus)

Ambrosia beetle was first found in the United States on peach trees in 1974 near Charleston, South Carolina. Additional populations were found in 1983 as far south as Florida and as far west as Alabama. In the past, U. S. populations were found mostly from Zone 7 southward from Missouri to Texas and eastward towards Florida and north to Virginia. However, more recently adults have been captured in zone 5 as far north as northern Indiana. This species has also been reported as far west as Oklahoma, Missouri and Kansas.

Adults are small and have a reddish brown appearance with a downward facing head. Trees are often mass attacked and can rapidly decline. However, it is difficult to decipher if the abundant numbers of the beetles infesting the tree causes death or it the symbiotic fungi are clogging the xylem, thus resulting in tree death. Damage usually appears as small toothpick like projections of frass sticking out of the trunks of infested trees. Frass spikes break off easily in the wind and may not always be seen. Abundant gumosis at multiple sites on tree trunks can occur on hosts such as Prunus, which have high levels of resin. However this type of surface damage can be easily confused with damage from shot hole borer (*Scolytus rugulosus*). Damage from granulate ambrosia beetles will differ by going deeper into the wood than shot hole borers, which only cause damage in a tree just beneath the bark. Also, fungal staining from symbiotic fungi is often seen in wood adjacent to ambrosia beetle galleries. Granulate ambrosia beetles usually mass attack trees and numerous exit holes can be observed. Perfectly round, 2 mm entrance holes can be seen when the gumosis and/or frass spikes are removed. Damage usually occurs on the main stem close to the ground, but can be found throughout the tree in heavy infestations. Trees of 3 inch DBH or less are more readily infested than larger trees, but large host can be attacked. Heavy infestations usually lead to wilting,

dieback and eventual tree death.

Japanese climbing fern (Lygodium japonicum)

Japanese climbing fern is an invasive fern that can increase in cover to form mats, smothering shrubs and trees (Miller 2003). It is native to Asia and Australia and was introduced into the US in the early 1900s as an ornamental (Leichty et al. 2011). Japanese climbing fern has climbing, twining fronds of indeterminate growth and can reach lengths of 90 feet. Above-ground growth occurs along wiry main stems, properly called "rachises". Japanese climbing fern is closely related to old world climbing fern, another nonnative species to North America. Japanese climbing fern poses both economic and ecological threats to forests in the Southeast. It is especially problematic in pine plantations managed for pine straw production and spreading of viable Japanese climbing fern plant parts and spores (Zeller and Leslie 2004). The fern is also problematic during prescribed burning because it provides a fuel ladder to canopy trees and it readily re-grows after a burn. Japanese climbing fern can be of particular concern in natural and disturbed areas where restoration of remnant populations of native species is critical because of its ability to engulf and out-compete native vegetation.

Feral Hogs (*Sus scrofa*)

Feral hogs are one of the most invasive, destructive, exotic species in North America. Because they are prolific breeders, hog populations grow at an explosive rate (Seward *et al.* 2004). Much scientific literature exists that documents adverse impacts by feral swine to habitat productivity and reproduction of most native wildlife (Lipscomb 1989; Belden 1972; Belden and Pelton 1976; Yarrow 1987; Jacobi 1980; Baron 1980; Lacki and Lancia 1986; Willy 1987). Being omnivorous, feral swine utilize virtually every component of the habitat resulting in direct competition with native wildlife, reductions in carrying capacities, and adverse impacts to reproduction/recruitment. In addition, existing documentation indicates feral swine serve as a source for many diseases that impact wildlife, domestic livestock and humans. A partial list of these diseases include black plague (Clark et al. 1983), bovine tuberculosis (Nettles et al. 1989), brucellosis (Becker et al. 1978), coccidiosis (Greiner et al. 1982), foot and mouth disease (Pech and Hone 1988), hog cholera (Nettles et al. 1989), Leptospirosis (Clark et al. 1983), parvo (New et al. 1994), pseudorabies (Clark et al. 1983), swine fever (Dahle and Leiss 1992), and Trichinosis (Nettles et al. 1989). In fact, recent results of feral swine disease monitoring on Felsenthal NWR discovered that 22% and 35% of the feral pigs tested were infected with swine brucellocis and pseudorabies, respectively. Methods for feral swine control/eradication include trapping and shooting by Service employees.

Nutria (*Myocastor coypus*)

The nutria is a semiaquatic rodent native to southern South America. Nutria were intentionally released into the U.S. in support of the fur farming trade during the 1930's and nutria were later introduced to many areas to control aquatic vegetation (Sealander and Heidt 1990). Nutria populations are now well established in the U.S. including Felsenthal NWR. Nutria do not represent a valuable fur resource and their value for vegetation control is at best overrated because they more often feed on desirable vegetation, especially waterfowl foods, and avoid nuisance aquatic vegetation (Lowery 1974, Linscombe and Kinler 1997). In fact, at high population densities, foraging by nutria can significantly impact natural plant communities and can negatively impact a host of native wildlife including waterfowl, wading birds, and muskrats. Digging and rooting by nutria in aquatic systems can contribute to severe erosion. Nutria can serve as hosts for several pathogens that can infect people, pets, and livestock such as tuberculosis and septicemia. Also, nutria can carry parasites such as blood flukes, tapeworms, liver flukes, giardia, and harmful nematodes. Nutria have a high reproductive potential and few, if any, natural predators; therefore, population control is challenging

(Lowery 1974, Sealander and Heidt 1990). The most practical control measures include recreational trapping by the public and shooting by refuge staff.

Nuisance Species

Southern pine bark beetles *(Dendroctonus frontalis*)

Southern pine bark beetles are native beetles found extensively in southern pine habitats. The southern pine beetle is the most destructive forest insect in the south. Weakening of trees by flooding, windstorms, and especially drought commonly precedes outbreaks. Trees of all sizes are attacked, but usually trees larger than six inches in diameter are infested first. Adult beetles are usually attracted to weakened trees. The first indication of attack is usually yellowing or browning of needles. The trunk will usually reveal white, yellow, or sometimes red-brown pitch tubes, about as large as a wad of gum. Under drought conditions, pitch tubes may be very small or absent, and only reddish-brown boring dust will be present. Removal of the bark will show a distinctive winding "S" shaped gallery pattern. In active spots, trees in the center have dark reddish-brown foliage. Foliage will change to light greenish or yellowish green on the edges of active spots. In epidemics, they attack trees that appear healthy and vigorous. Initial attacks are in the mid-trunk and then the length of the tree. Adult beetles bore through the bark and excavate long winding "S" shaped galleries. Eggs are laid in niches along the galleries. Larvae feed in the cambium until grown, and then excavate cells near the bark surface in which to pupate. After pupation, adult beetles chew through the bark and emerge. The complete cycle of the attack takes from 25 to 40 days, depending on the temperature.

Most southern pine bark beetle spot infestations should not need to be controlled, are self-limiting, and will not expand to a level that threatens RCW foraging or nesting habitat. However, when bark beetle populations become epidemic or individual infestations have the high potential to expand and jeopardize pine stands or RCW clusters, control measures are warranted. Epidemic levels seem to recur on a 5 to 10 year basis, but do not appear related to pine stand conditions. Rather certain stands may be more likely to become infested during severe outbreaks. Both age of the stand and overall stocking density (stems/acre and BA) tend to be correlated with higher potential for infestation.

When epidemic southern pine beetle levels occur, control measures need to be done aggressively and timely to prevent large-scale stand mortality and possible loss of RCW clusters. Control measures should be based on a risk assessment of existing size and potential to expand, threat to RCW foraging and nesting habitat associated with active and inactive clusters, and high public use areas (e.g., Woodpecker Trail, Visitor Center). Priority for control should be on active clusters. Provided sufficient funding and staffing are available, monitoring and locating infestations is best achieved through aerial surveys. During extreme conditions, recurring aerial flights may be needed on a weekly basis to deal with the epidemic. Once the infestation is located, its threat can be better assessed. Under epidemic situations, control will normally consist of the creation of a 150- 200 foot buffer around the spot and the possible removal of infested trees. The buffer is created through the removal of non-infested trees or those which have yet to show signs of pitch tubes or fading of needle color in the crown. Only dead trees or red needle trees (e.g., beetle vacated) are left at the site. Treatment is typically accomplished through a contract logger that is responsible for felling all marked trees and removing merchantable material. All trees are felled to the center of the designated spot, and loggers need to treat each site as soon as possible to limit spread.

Beavers (*Castor canadensis*)

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 that beavers, on average, damaged $164/acre (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 have not been in demand; therefore, little trapping is conducted, causing beaver numbers to be high (Hill 1982).

Methods to control beavers include trapping and shooting by Service employees, through interagency agreements with USDA-APHIS, and trapping by the public. To minimize habitat loss, removing beaver dams manually, with heavy equipment or by explosives is done by Service employees. Dams that are small enough to remove by hand or are located in a culvert or water control structure will be removed manually. If a dam is so large it cannot be removed manually, it can either be removed by machinery or explosives. Explosives are used only by certified employees of the Service or APHIS and all state and local laws are followed.

HABITAT CHANGES FROM HISTORIC TO CURRENT CONDITION

Between 12,000 BC and 1540 AD Native Americans inhabited southeast Arkansas. The Paleo-Indian people developed regional cultural groups; along the Ouachita River, as the Caddo people were becoming defined. The first European explorers entered the area in the mid-1500s. In 1803 the United States acquired Arkansas in the Louisiana Purchase after which American settlers began establishing farms throughout the first half of the 19th century.

Prior to settlement, these forests were probably in a climax state. One can wonder what they looked like then. We have some insight from the journals of Dr. George Hunter who led the first organized expedition up the Ouachita River from the Red River to Hot Springs, Arkansas during the fall and winter of 1804 and spring of 1805 (McDermott 1966). While in the area now encompassed by the refuge, Dr. Hunter made remarks such as "The timber pretty good," "Little under wood," and "The woods here besides many sorts of unknown names, consist of hickory, oak, cypress, dogwood, persimmon, many sorts of grape vines, but no pines in these drowned lands." In the area that is now the north boundary of the refuge, Dr. Hunter stated, "The lands now bear amongst other trees the long leafed pine." Dr. Hunter would have been referring to the loblolly pine (*Pinus taeda*) in comparison to short leaf pine (*Pinus echinata*) considering that Dr. Hunter identified two different pines in the area with one having a shorter leaf than the other. The expedition compiled a list of trees, plants, and shrubs growing in the county adjacent to the Ouachitas which included: 3 species of white oak, 4 of red oak, 3 sorts of hickory, 3 species of elm, 2 of maple, and 2 of pine. Other species mentioned were: ironwood, sycamore, persimmon, pawpaw, mulberry, locust, hawthorn, and tooth ache tree.

During the time of settlement the forest in southeast Arkansas was harvested heavily by removing the highest quality stems and leaving smaller lower valued stems and as well as large cull trees. It was common practice during this time period to run cattle and hogs in the bottomlands. Eventually most of the land in the area was acquired by large timber companies.

In 1902, Congress authorized a series of six lock and dams to be built from the mouth of the Black River to Camden, AR. This project was completed in 1925 with the sixth lock and dam being located approximately 4 miles south of Felsenthal, AR. The sixth lock controlled the navigation pool through

the refuge and maintained a 5,000 acre pool. The top of this pool was 61.6 feet above mean sea level (msl).

Toward the end of the 19th century commercial lumbering began to spread across the state. Although Bragg (2004) noted GLO Surveyors commented on the quality of the Ashley County baldcypress. Commercial logging of the baldcypress may have begun as early as 1826/27 at the confluence of the Ouachita and Saline Rivers. (See Historical photo of bald cypress) A large portion of the timber in southeast Arkansas was harvested between the late 1890s and early 1930s. During this period a large portion of the refuge was harvested. The Union County area of the refuge was most likely the first to be harvested by the Union Sawmill Company located in Huttig. Harvest operations began in the southern Ashley County portion of the refuge by the Crossett Lumber Company but were halted due to financial issues associated with harvesting low quality hardwoods in wet areas (D. Bragg, U.S. Forest Service, personal communication). The Bradley County portion of the Refuge that lies between the Ouachita and Saline Rivers was harvested during the late 1930s by the Bradley Lumber Company. These commercial timber operations left the majority of the refuge heavily harvested by the end of the 1930s, with the exception of the bottomlands in Ashley County located north of highway 82 which were most likely not harvested until after World War II.

At the time land acquisition was initiated for Felsenthal NWR, most of the land suitable for growing pine forests was managed intensively for the production of pulpwood, veneer bolts, and sawlogs. Most of this land was stocked with large volumes of valuable pine. Past management of the bottomlands consisted of either a clear-cutting operation, at any time economical volumes existed, or a high-grading selective cut. Most of the refuge bottomlands that were formerly owned by the Potlatch Corporation and the Georgia-Pacific Corporation had been clear-cut within ten years of their acquisition date.

Before acquisition was initiated for Felsenthal NWR, it was decided that the five largest landowners with land involved in the project would be allowed to reserve one-half the volumes present on their holdings. These companies were the Georgia-Pacific Corporation; Olinkraft, Incorporated; Potlatch Forest; Calion Lumber Company; and Deltic Farm and Timber. These five forest product companies owned about 92 percent of the refuge. An agreement could not be negotiated with Potlatch; therefore, the Potlatch forest lands were acquired, in their entirety, through condemnation. Olinkraft elected to remove their company's share of the timber volume by harvesting all pine timber, 10 inch DBH or greater, which occurred on each alternating 40-acre tract. All other timber occurring on these lands was sold to the government. Georgia-Pacific reserved all merchantable pine that occurred on each alternating 40-acre tract. All hardwood was sold to the government. The Deltic lands were stocked with high quality pine on their upland sites and adequate volumes of hardwood on their bottomland sites. Most of the hardwood had been removed from the refuge lands adjacent the Deltic properties. In an effort to preserve this needed hardwood habitat, a cutting pattern was negotiated with Deltic personnel that allowed their loggers to harvest most of the pine and reserved the better hardwood stands for the refuge. After the Deltic lands were acquired, refuge personnel negotiated an exchange of pine sawtimber for the hardwood that occurred on Deltic's portion of the cutting pattern. This exchange was limited to the pulpwood that occurred in manageable stands.

Calion Lumber Company is a hardwood lumber producing organization; consequently, nearly all of the Calion lands were on bottomland hardwood sites and were stocked with large trees. Because of this, Calion was allowed to harvest their share of the timber by cutting all trees that were 20 inches DBH and larger. After cutting operations were completed, the Calion lands were stocked with an adequate volume of young trees and a large volume of cull trees that were larger than 20 inches DBH. Approximately 30 percent of the residual volumes on the Calion lands consist of non-merchantable material. Since all trees (except some cypress) inundated by the planned navigation

pool would eventually die, the involved landowners were given the option of harvesting the timber growing in this area. Calion Lumber Company was the only landowner to exercise this option.

After cutting agreements were negotiated with the involved forest products companies, refuge personnel negotiated agreements with them to exchange refuge timber for trees containing RCW cavities. After these cavity trees were located by company loggers, refuge personnel determined their value and traded an appropriate amount of refuge timber with the involved company. The trees with the cavities were then left within the cutting areas.

During acquisition negotiations, the lumber companies were given two options that limited the period of time of their cutting reservations. These options were a 2 year cutting reservation and a 4 year cutting reservation. The 4 year cutting reservation had a growth penalty for the last 2 years based on the annual growth of the forest and the appraised value of the timber. All lumber companies, excluding Calion Lumber Company, opted for the 2 year cutting reservation.

After the government received the title to Potlatch and Georgia Pacific lands, refuge personnel began efforts to salvage the timber located within the navigation pool area of these properties. A salvage sale consisting of 2,157 acres with 2,497,440 board feet was sold on September 16, 1976. This salvage sale was located at the confluence of the Ouachita and Saline Rivers in Ashley and Bradley Counties. On August 16, 1977, a timber sale consisting of 488,096 board feet of sawtimber growing on 240 acres was sold near Wheeler Lake in Ashley County. On April 17, 1978, another sale consisting of 2,944,662 board feet of sawtimber with 14,368 cords of pulpwood, growing on 5,065 acres, was sold near Redeye Lake in Ashley County.

In 1985, the construction of the new lock and dam on the south boundary of the refuge was completed. This lock and dam was part of a series of four, replacing the original six stationary lock and dams. This lock and dam maintained the navigational pool on the refuge and added an additional 10,000 acres to the permanent pool. At 65 feet (msl) the pool now consists of 15,000 acres.

WILDLIFE

Felsenthal NWR supports a diversity of wildlife common to the West Gulf Coastal Plain of Arkansas. Most of the wildlife that live on the refuge is found typically in bottomland hardwood forests. Few species surveys have been conducted on the refuge, however. Although actual numbers are hard to accurately quantify, the current wildlife list for Felsenthal would contain at least 200 species of birds, 40 species of mammals, 70 species of reptiles and amphibians, and 90 fish species. Each of these individual species would have the same general requirements in that they require food, water, and cover to survive. However, the particular food and cover requirements of a given species are often very specialized. The specific habitat needs of each species vary in some degree from those of every other kind of animal, although many different animals may occupy the same general area. A diversity of habitats tends to encourage and support a diversity of wildlife species.

Birds

Felsenthal NWR lies within the Mississippi Flyway—the "highway in the sky" from nesting grounds in the north, to wintering areas in south-central North America used by vast numbers of migrating waterfowl, shorebirds, neotropical songbirds, and birds of prey. Almost 100 species of birds are known to nest in the area, and over 200 species have been sighted on the refuges.

Waterfowl begin arriving at Felsenthal NWR in September, with blue-winged teal (*Anas discors*), mallards (*Anas platyrhynchos*), black ducks (*Anas rubripes*), gadwall (*Anas strepera*), and ring-necked ducks (*Aythya collaris*) among the 20 (or more) species that winter on the refuges. The wood duck (*Aix sponsa*), a year-round resident, nests in tree cavities and in nest boxes placed throughout the hardwood forests. Duck populations (in general order of abundance) include mallards, green-winged teal (*Anas crecca*), northern shovelers (*Anas clypeata*), pintails (*Anas acuta*), gadwalls, blue-winged teal, wood ducks, and hooded mergansers (*Lophodytes cucullatus*). In some years, over 100,000 waterfowl have been found on Felsenthal refuge. However, Felsenthal in recent years continues to experience depressed wintering waterfowl numbers compared to long-term averages.

During the spring, summer and through early fall, Felsenthal NWR is a haven for a variety of other migrant birds. A myriad of songbirds and shorebirds stop briefly in the fall and spring to replenish energy reserves for the long journey to and from wintering areas in Central and South America, while other birds, such as northern parula (*Parula Americana*), prothonotary warbler (*Protonotaria citrea*) and American redstart (*Setophaga ruticilla*) utilize the refuge for nesting. Felsenthal remains a "mecca" for great blue herons (*Ardea herodias*), green herons (*Butorides virescens*), little blue herons (*Egretta caerulea*), black-crowned night herons (*Nycticoraz nycticorax*), great egrets (*Andea alba*), white ibis (*Eudocimus albus*), wood storks (*Mycteria americana*), anhinga (*Anhinga anhinga*), double-crested cormorants (*Phalacrocorax auritus)* and American bitterns (*Botaurus lentiginosus*).

Felsenthal NWR hosts migrant American bald eagles (*Haliaeetus leucocephalus*) during the winter months that follow migrating waterfowl down the flyway, and is home to bald eagles that breed and nest on the refuge. One to two pairs of bald eagles have been nesting on the refuge since the mid-1990s. Other raptors commonly observed on the refuge include red-shouldered (*Buteo lineatus*) and red-tailed hawks (*Buteo jamaicensis*), turkey vulture (*Cathartes aura*), black vulture (*Coragyps atratus*), barred owl (*Strix varia*), great-horned owl (*Budo virginianus*), eastern screech owl (*Otus asio*), American kestrel (*Flaco sparverius*), northern harrier (*Circus cyaneus*), broad-winged hawk (*Buteo platypterus*), Cooper's hawk (*Accipiter cooperii*), osprey (*Pandion haliaetus*), and sharp-shinned hawk (*Accipiter striatus*).

Waterfowl

Migrating waterfowl is selected as a resource of concern based on the refuge's establishing purposes and the trust responsibility stemming from the Migratory Bird Treaty Act. Additionally, this suite of species, including wintering ducks and breeding wood ducks is similarly identified in the refuge's CCP. The refuge contributes to the overall waterfowl goals of the North American Waterfowl Management Plan (USFWS 1986). In 2010, a step-down objective was established for bottomland hardwood forest. Using the standard value of 126 duck energy days (DEDs)/acre of bottomland hardwood forest, Felsenthal NWR's objective was set at 2,646,000 DEDs. This suite of species responds well to habitat management such as moist-soil management and the natural flood cycles of the Ouachita River.

Migratory waterfowl have many specific habitat requirements and energy needs. On reaching the wintering grounds, not only do waterfowl need reliable water but also food resources on which to maintain and restore fat reserves prior to returning to the breeding grounds.

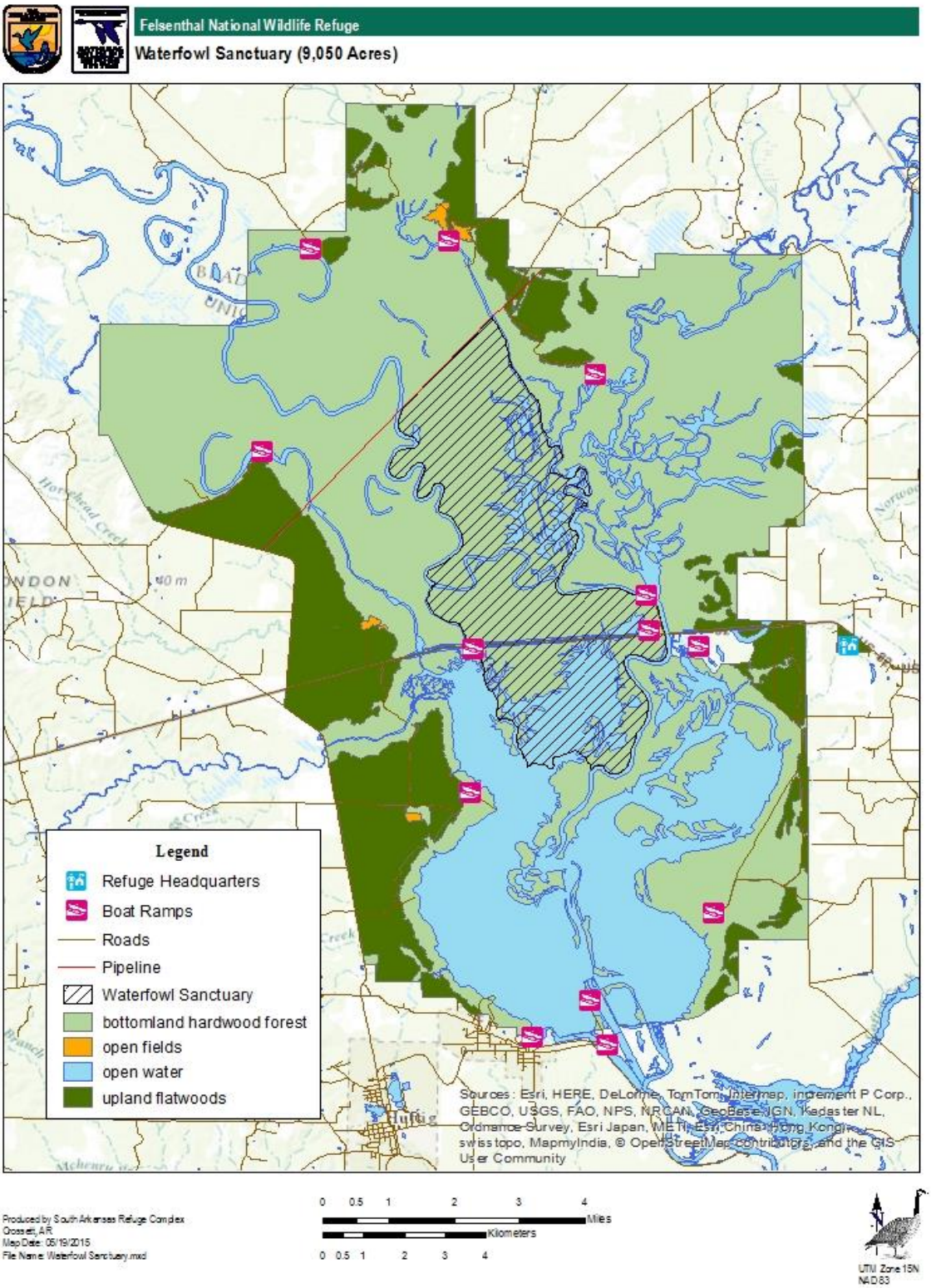
Bottomland hardwood forests are essential to wintering waterfowl. Waterfowl are influenced by four components within forested wetlands: herbaceous vegetation, woody vegetation, leaf litter, and macro invertebrates (Fredrickson and Batema 1992). These natural wetlands are critical foraging and resting 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 (Kaminski et al. 2003, Heitmeyer 1988, 2006). Aside from food resources, forested wetlands are vital to waterfowl for pair bonding, loafing, sanctuary, and thermal cover (Reinecke et al. 1989). Trees also provide roosting and nesting sites for breeding wood ducks. Trees and scrub/shrub vegetation provide cover for brood rearing. 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 widgeon all utilize flooded forested habitat as one of the complex of preferred habitats (Fredrickson and Heitmeyer 1988). Breeding wood ducks preferred habitats include forested wetlands, wooded and shrub swamps, tree-lined rivers, streams, sloughs, and beaver ponds. 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. Adequate brood habitat can seriously affect duckling survival and reproductive success. McGilvrey (1968) described preferred brood habitat as 30 to 50 percent shrubs, 40 to 70 percent herbaceous emergent vegetation, and 25 percent open water. Overhead cover within 1 to 2 feet of the water surface is vital for wood duck broods. Optimum habitat should have 75 percent cover and 25 percent open water, with a minimum of 1/3 cover to 2/3's open water. 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 (Sousa and Farmner 1983).

The primary value of scrub/shrub habitats to waterfowl is by providing thermal roosting cover and protection from avian predators (USFWS 2007) for both wintering waterfowl and breeding wood ducks. Scrub/shrub wetlands are created by beaver, storm damage, and hydrological changes within lakes. These areas are typified by willows, buttonbush, other woody species, and perennial herbaceous vegetation. The decaying leaves provide substrate for invertebrates, which in turn provides food for waterfowl.

An additional essential component of waterfowl wintering habitat complexity is sanctuary from human disturbance. Winter is a biological preparatory period during which many ducks 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 et al. 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. The refuge provides 9,050 acres of waterfowl sanctuary (Figure 14). The sanctuary is closed to all public use during the waterfowl hunting season.

Figure 14. Location of Waterfowl Sanctuary on Felsenthal National Wildlife Refuge.



Forest Breeding Birds

Migratory land birds are declining at alarming rates, and much of the decline has been attributed to habitat fragmentation and loss. Conservation of large contiguous blocks of habitat will be necessary to slow and reverse negative trends in migratory bird populations in the Mississippi Flyway (Rich et al., 2004). Felsenthal NWR plays an important role in providing bottomland hardwood habitat for forest interior songbirds. Forest interior-breeding birds are those which require large blocks of relatively unfragmented forest habitat for breeding. This suite of bird species tends to avoid fragmented habitat, and declines as a result of forest fragmentation, (Andrén & Angelstam, 1988; Rich et al., 2004). Mechanisms for this decline are variously cited as sensitivity to nest predation by corvids and other predators (Wilcove, 1985), to nest parasitism by brown-headed cowbirds (Brittingham & Temple, 1983; Robinson & Wilcove, 1994), to various habitat deficiencies related to smaller patch size such as resource availability or lack of critical microhabitats (Robbins et al., 1989; Wilcove, 1985), or failure of dispersal and colonization mechanisms caused by distance and isolation of small habitat patches ("island biogeography" theory) (Matthysen & Currie, 1996).

Habitat fragmentation occurs when large blocks of continuous habitat are broken up into smaller blocks by the creation of breaks consisting of different kinds of habitat. Habitat fragmentation can obviously be a consequence of habitat conversion, but its effects are distinct, and the difference is important to management and restoration efforts. In bottomland hardwood systems, fragmentation can result from human activities including construction of roads and other rights-of-way, forest management which incorporates clearcutting, conversion to agriculture or other, non-forest uses, and engineered hydrologic management structures such as levees and ditches.

Fragmentation affects ecosystem structure and function in a number of ways, and the effects depend on the pattern and spatial properties of the remaining fragments, as well as their size. For example, blocks of forest which are separated by a road or pipeline right-of-way may retain much of their shared function as habitat for species which are able to cross short distances of inhospitable habitat, while similar-sized blocks that are separated by large distances may effectively isolate those same species (Robbins et al., 1989). However, species composition or other elements of ecosystem structure may change as a result of the presence of a corridor of open habitat, even if the total size of the habitat block does not appreciably change. Species which are adapted to ecotones and open habitat will have access to the interior of a previously inhospitable (to them) area, and the total area of forest interior habitat, i.e. that which is more than some minimum distance from edges, will decrease by much more than the area converted. In some cases, interior-nesting Neotropical migrants may be sensitive to the presence of increased edge habitat created by small, patch clearcuts, despite the absence of increased predation or nest parasitism; the mechanism for this sensitivity is not clear (Germaine et al., 1997). However, patch clearcuts may not have negative impacts on most forest-interior nesting Neotropical migrants in the lower Mississippi River valley (Pashley & Barrow, 1993).

Habitat fragmentation can result in decline or loss of wide-ranging and interior-dependent species (U.S. Fish and Wildlife Service, 1995), increased invasion by exotic plants and animals, decreased (or increased) species diversity (Rudis, 1995), and changes in predator, parasite, and pathogen populations and effects. In bottomland forests of the MAV, documented effects of fragmentation include declines in forest interior breeding bird species such as swallow-tailed kite (*Elanoides forficatus*), prothonotary warbler (*Protonotaria citrea*), and Acadian flycatcher (*Empidonax virescens*)(Rich et al., 2004). Habitat restoration in existing habitat breaks and wildlife-oriented forest management can provide a high quality mix of interior, gap, and edge habitats in bottomland forest which will support a diverse assemblage of birds (Heltzel & Leberg 2006; LMVJV Forest Resource Conservation Working Group 2007).

Although conservation of large, unfragmented blocks of forest is cited as the most important need of forest interior breeding songbirds, there is some diversity of habitat requirements among species within this group. Certain species require very specific habitat conditions or elements that may not be captured by landscape-scale conservation efforts, or which may cause conflicts among habitat needs of different bird species on managed lands. Habitat elements and management practices are presented in Table 6.

Table 6. Habitat characteristics required by or correlated with occurrence of forest interior-breeding birds known or presumed to breed on Felsenthal NWR.

Common Name	Habitat Element, Characteristic, or Management Practice
Worm-eating warbler	Breeds in large tracts of mature deciduous or mixed deciduous-coniferous forest with patches of dense understory, usually on steep slopes.
Brown-headed nuthatch	Prefers high density of recently killed trees (likely a foraging resource), recent prescribed fire, pine dominance, low tree stocking rates, and grassy herbaceous cover. Home ranges vary from 0.3–47.6 ha, and are smaller when the habitat is dominated by pine and high snag density. (Stanton, Jr. et. al 2014)
Cerulean warbler	Prefers mature bottomland hardwoods for breeding (Hamel, 2000); Area sensitive breeder, may require tracts of 8,000 ha (20,000 acres) for sustainable breeding (i.e. source) populations in the MAV (Mueller et al., 1999); Breeding habitat requirements: closed canopy with scattered, very tall super-emergent trees, well-defined canopy, midstory, shrub, and herbaceous understory present (Lynch, 1981).
Prothonotary warbler	"Scour channels" (sloughs) , snags (Pashley & Barrow, 1993); "Selective timber harvest" negative effect compared with closed-canopy "reference" stand (>30 years since harvest) (Heltzel & Leberg, 2006);
Swainson's warbler	Switchcane "brakes", palmetto (Sabal minor) thickets, Individual tree selection cutting (Pashley & Barrow, 1993); Switchcane "brakes", individual tree selection or "small" patch clearcuts, dense understory, heavy leaf litter (Bednarz et al., 2005); Understory density of 30,000-50,000 stems/ha, switchcane not an essential element of habitat, early successional forest or disturbance gaps, moist soil but no flooding during breeding season (Graves, 2002); "Older Selective harvests" (12-18 years) beneficial effect compared with "reference" stand (>30 years since harvest) (Heltzel & Leberg, 2006); Relatively dense understory, no flooding during growing season, canopy gaps (Somershoe et al., 2003). Switchcane "brakes", palmetto (Sabal minor), shaded and fairly dense understory, abundant leaf litter, little herbaceous ground cover (Brown & Dickson, 1994)

Common Name	Habitat Element, Characteristic, or Management Practice
Kentucky warbler	Switchcane “brakes”, lianas, Individual tree selection cutting (Pashley & Barrow, 1993); “Older Selective harvests” (12-18 years) beneficial effect compared with “reference” stand (>30 years since harvest) (Heltzel & Leberg, 2006); increased detections in thinned BLH on Tensas River NWR compared to untreated stands (Twedt & Somershoe, 2009); 50% higher density after group selection than in untreated BLH (Norris et al., 2009).

Northern bobwhite (Colinus virginianus)

In forest habitats, northern bobwhites show a clear preference for early successional vegetation created by disturbances from fire, agriculture, and timber-harvesting. Bobwhite habitats must contain a diversity of invertebrates, seeds, and herbaceous plants. Cover that provides protection from predators, weather, and provides nesting material, which is also essential. Reducing tree density is the first step in developing the grass and forb ground cover bobwhites and other grassland wildlife require. Most pine forests in the southeast do not support bobwhite because they are too heavily stocked with trees that form a closed canopy. Thinning reduces stem density and opens the forest canopy, letting more sunlight reach the ground and stimulating growth of ground-layer vegetation. In Arkansas, most species of pines can be commercially thinned for the first time at 13 to 18 years of age, depending on the site. Basal area, the total cross-sectional area of wood in the stand, is relatively easy to measure and relates well to herbaceous ground cover in forest stands. Thinning stands to a basal area of 50 square feet/acre or less produces good bobwhite habitat. If bobwhite habitat is a greater priority than forest production, a basal area as low as 30-square-feet/acre produces best habitat. In most cases periodic thinnings are necessary to maintain lower basal areas as trees continue to grow after each thin (Dickson, J 2001). Just as thinning stimulates growth of grasses and forbs, it also favors growth of hardwood brush and trees that shade out desirable grasses and forbs if left unmanaged. Prescribed fire on a 2- to 3-year rotation is the most cost-effective tool to control undesirable brush invasion. Soil disturbance, such as prescribed fire or disking, enhances habitat quality for bobwhites and other grassland birds because it inhibits woody brush growth, promotes annual plant communities, reduces plant residue, and increases bare ground in the forest floor. Plant communities that develop after fire or disking also produce quality food and cover for deer, rabbits, turkeys, and other wildlife. If soil is not disturbed, plant community composition changes over several years, and annual plants are replaced by perennial forbs and grasses and, eventually, woody plants.

Bachman's sparrow (Aimophila aestivalis)

Bachman's sparrows are mostly found in open oak and pine forests with abundant grasses. They are most often found in forests with wiregrass or broomsedge (early successional). Populations are highest in areas where forest fires are regular and hardwood understory shrubs are lacking. Bachman's sparrow populations densities are less in areas not burned within the last 4 to 5 years. Habitat requirements include a sparse woody understory with a high density of grasses and forbs (Dunning and Watts, 1990, 1991, Plentovich et al. 1998b). Mature stands of pine can provide optimal habitats for this species. Suitable conditions can also be provided with regeneration cuts such as clearcuts and shelterwoods. Long rotations, regular burning intervals, thinning with the retention of mature or late-successional pines should favor this species. On Felsenthal NWR, areas managed for the red-cockaded woodpecker can benefit this species.

Brown-headed nuthatch (Sitta pusilla)

The brown-headed nuthatch is closely associated with pine: it breeds in mature pine forests and forages almost exclusively in pine trees (>98 percent of observations; Withgott and Smith 1998). Although often associated specifically with the longleaf pine savanna characteristic of red-cockaded woodpecker and Bachman's sparrow habitat, the brown-headed nuthatch has a broader niche than these species (Dornak and others 2004). Brown-headed nuthatch habitat is defined by two habitat elements: mature pines for foraging and cavities for nesting (Wilson and Watts 1999, Dornak and others 2004). Specific pine species composition is not as critical as tree diameter, with an average dbh of 10 inches being optimal (Connor and O'Halloran 19874).

Brown-headed nuthatches primarily nest in large diameter snags and may require approximately 3 snags per acre to ensure adequate nest and roost sites, particularly in the presence of interspecific competition for cavities. In urban areas, brown-headed nuthatches have readily adopted nest boxes and may use other man-made cavities (e.g., streetlights). Brown-headed nuthatches prefer open pine stands with few hardwoods and an open midstory (Wilson and Watts 1999). Optimal canopy closure is highly variable, but stands with closed canopies are not preferred (Connor and O'Halloran 1987, Wilson and Watts 1999). Undergrowth is typically sparse (~35 percent; Dornak and others 2004). Nuthatches regularly breed at low densities in suboptimal habitats and dense understories (Withgott and Smith 1998). Area sensitivity does not appear to be an issue for this species as it is not an acceptable host for the brown-headed cowbird (Withgott and Smith 1998). This species would also benefit from the refuge's management of red-cockaded woodpeckers.

Mammals

Habitat diversity within Felsenthal NWR lends itself to a diversity of wildlife. Temporarily flooded bottomland forests, pine-dominated uplands, upland hardwoods, and various types of riparian and openland areas provide ideal habitat for many species of mammals. More than 40 species of mammals are likely to be found on Felsenthal NWR. In addition to the black bear, which is a consummate generalist that inhabits all refuge habitats, other forest wetland inhabitants are the white-tailed deer, bobcat, coyote, river otter, raccoon, gray fox, red fox, beaver, mink, swamp rabbit, cottontail rabbit, eastern gray squirrel, fox squirrel, nutria, opossum, muskrat, and skunk. No accurate inventories have been conducted on small mammals, such as mice, voles, or moles.

Black Bears

From 2000 to 2007, refuge staff in cooperation with Arkansas Game and Fish Commission (AGFC), released 55 adult female black bears and 116 cubs at Felsenthal NWR. Survival rates of the reintroduced bears were generally high and homing rates were low, but radio tracking ended in 2003 (Wear et al. 2005). Bait-station surveys have been conducted annually; however, the number of bears and the population growth rate remain unknown. Anecdotal evidence such as sightings by the staff and the public suggest a healthy and growing bear population. Various size and age classes of bears are seen in and around the refuge. Sightings of female bears with cubs are common. Refuge managers continue to work with AGFC to secure funding for black bear population surveys that will determine bear population growth rate.

As a larger mammal, American black bears require vast amounts of space with landscape–level needs of food and cover. In the southern United States, preferred black bear habitat is characterized by a mosaic of diverse forest habitats on a landscape scale with limited human intrusion. Sanctuary areas are important for this species and can function to stabilize the population by protecting a nucleus of reproducing females. Black bears need escape cover in the form of thick, impenetrable understory vegetation. Winter denning habitat is also very important to black bears, particularly for

pregnant females. Bears are flexible in their choice of den sites and can den on the ground; however, they often choose the cover provided by root masses, logs, or stumps of large downed trees. The optimal den site of southern black bears is the cavity of a large tree. These elevated den sites are critical in areas with significant winter and spring flooding. Black bears need secure corridors to facilitate dispersal between populations, to make seasonal movements for food, for dispersal of younger animals, and for movements of males during the breeding season. In the South, black bear survival and reproduction are highly influenced by oak mast in the fall. Therefore, forest management that promotes the perpetuation of a diverse and mature oak forest will greatly benefit bears.

Felsenthal NWR provides all necessary habitat requirements for black bears. The refuges bottomland hardwoods, upland hardwoods and pines, riparian areas, and swamplands supply year-round food, escape cover, sanctuary, and a variety of den sites including mature cavity trees. Furthermore, Felsenthal NWR plays an important role in broader regional bear management issues by facilitating genetic interchange and dispersal among the regions separated and isolated bear populations. Felsenthal NWR is situated between Arkansas' native black bear population at White River NWR to the north and the federally-threatened Louisiana black bear to the south. Genetic analyses and radio telemetry have revealed that White River NWR and Felsenthal NWR bears have dispersed to Louisiana and Mississippi. Genetic interchange has likely already occurred between White River and Felsenthal and Louisiana bears, which could possibly reduce the consequences of genetic drift or inbreeding in the small and fragmented populations there (J. Clark, USGS, unpublished data). Thus, bears from southern Arkansas may play a role in the long-term genetic and perhaps demographic health of the threatened Louisiana black bear and bears throughout the Region.

Rafinesque's big-eared bats

Because of concerns over declining bat populations and a lack of knowledge regarding bat use of the refuge, Felsenthal NWR staff in cooperation with the U.S. Fish and Wildlife-Region 4 I&M network has been monitoring bats for over the last 3 years. Bat surveys have been conducted each June and July 2012-2014. The primary survey method involves conducting mobile acoustical bat surveys using an Anabat SD2 bat detector over a 28.8 mile route. Also, passive northern long-eared bats monitoring was conducted during the summer of 2014. Bat surveys resulted in the detection of the following species: big brown bat (*Eptesicus fuscus*); eastern red bat (*Lasiurus borealis*); evening bat (*Nycticeius humeralis*); hoary bat (*Lasiurus cinereus*); tri-colored bat (*Perimyotis subflavus)*; and northern long-eared bat.

The Rafinesque's big-eared bat is one of the least studied bats in the eastern United States and is federally designated as a species of special management concern (Martin et al. 2002). This bat is associated with bottomland hardwoods, and because this habitat has decreased, many biologists are concerned about this bat's status. Many states consider the Rafinesque's big-eared bat to be either threatened or endangered. Rafinesque's big-eared bat has a somewhat sporadic distribution across much of the southeastern United States (Bayless and Clark 2009) . This species has demonstrated preferences for specific features that do not occur evenly across the landscape, and may account for its sporadic distribution (Carver and Ashley 2008; Gooding and Langford 2004; Trousdale 2011). In southern Arkansas, bottomland hardwood systems, like those found at Felsenthal NWR, seem to be important to Rafinesque's big-eared bat as both roosting and foraging habitat (Clark 1990; Clark et al. 1998; Cochran 1999).

Due to the loss of approximately 80% of the bottomland hardwoods in the Lower Mississippi River Alluvial Valley (Tiner 1984), this species has probably been negatively affected. Rafinesque's big-eared bats populations might be declining in Arkansas (Cochran 1999).

An opportunity exists for Felsenthal NWR with its extensive bottomland hardwood forest to provide important habitat for this species of bat. Furthermore, known roost locations have been found on Upper Ouachita NWR for this species (Rice 2009). 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). 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 (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 for this 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 7), and management for mature bottomland hardwood forests (LMVJV 2007). .

Table 7. Old growth attributes for Baldcypress and tupelo that may benefit Rafinesque's big-eared bat (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 ft2/ac	Hall and Penfound 1939
Tupelo	30 ft2/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

Amphibians and Reptiles

Amphibian management and conservation are of great interest due to apparent global amphibian declines. Habitat loss, fragmentation, and degradation appear to be the primary factors in these declines. This group of animals require quality wetland habitat for their survival and they also serve as important indicators of environmental health. Numerous species of frogs, snakes, turtles, lizards, skinks, and salamanders utilize the refuge. Amphibians, particularly frogs, have been intensively studied by refuge staff and staff from the Conway Ecological Services Office as part of a broad-scale effort to document malformed amphibians. Four species of venomous snakes inhabit the refuge and alligators are seen frequently.

Scientists consider amphibians to be indicators of environmental health, and many amphibian populations are declining at rapid rates likely due to changes in their habitat, diseases, and environmental pollution. Abnormalities in amphibians can be attributed to these aforementioned environmental factors. The most common abnormalities involve missing or shortened toes or legs, surficial abnormalities such as cysts, eye abnormalities and extra limbs. The U.S. Fish and Wildlife Service completed a nationwide 10-year study (2000 – 2009) of abnormalities in frogs and toads, and collected a total of 68,359 frogs and toads from 152 National Wildlife Refuges and analyzed a subset of 48,081 individuals to estimate average abnormality frequency (Reeves et al, 2013). This "core dataset" represented 32 amphibian species from 462 wetland sites. On average, only 2 percent of the amphibians were classified as abnormal. One-third of the 675 collection events yielded no abnormal amphibians at all, and one-half of the collections had fewer than 2 percent abnormal individuals. However, there were places where abnormal amphibians were more common, reaching a maximum abnormality prevalence of 40 percent, and referred to as "hot spots" (Reeves et al., 2013; Hemming and Starkel, 2010). Felsenthal NWR is located within one of the identified hot spots where the proportion of amphibians found with developmental abnormalities was significantly higher than the national average (Reeves et al., 2013). Most scientists believe that frog abnormalities result from one or more of the following factors (or interactions between them): contaminants, parasites, predators and ultraviolet-B radiation. It is likely abnormalities are caused by different factors in different places.

Alligator snapping turtles are the largest freshwater turtles in the United States. They are protected from commercial harvest in every state. Commercial harvest of these turtles threatens their population because alligator snapping turtles do not breed until they are approximately 15 years old, and the harvest targets adults. Nest depredation by raccoons, skunks, opossums, and fire ants also harm the population significantly. The refuge has no good estimates of the alligator snapping population, though individual turtles have been seen.

Fish

Felsenthal NWR provides habitat for more than 90 species of freshwater fish. Seasonal flooding of wooded areas provides spawning and feeding habitat for numerous sport, commercial, and forage fishes. Important game species found in refuge waters include bluegill (*(Lepomis macrochirus)*; redear sunfish*(Lepomis microlophus)* ; longear sunfish *(Lepomis megalotis)*; white crappie *(Pomoxis annularis),* black crappie*(Pomoxis nigromaculatus), largemouth bass (Micropterus salmoides), yellow bass (Morone mississippiensis), white bass (Morone chrysops), blue catfish (Ictalurus furcatus), flathead catfish (Pylodictis olivaris), and channel catfish (Ictalurus punctatus).* Other species include smallmouth bass *(Micropterus dolomieui),*bigmouth buffalo *(Ictiobus cyprinellus),* black buffalo *(Ictiobus niger),* freshwater drum *(Aplodinotus grunniens),* longnose gar *(Lepisosteus osseus),* shortnose gar *(Lepisosteus platostomus),* alligator gar *(Atractosteus spatula),* spotted gar

(Lepisosteus oculatus), bowfin *(Amia calva),* grass carp *(Ctenopharyngodon idella),* big head carp *(Hypophthalmichthys nobilis), and* common carp *(Cyprinus carpio)*.

Threatened and Endangered Species

There are 30 federally-listed threatened and endangered animal and plant species in Arkansas, many of which are aquatic species (24 species) and potentially could be found on Felsenthal NWR. The red-cockaded woodpecker is the most recognized and well known endangered species that occurs on Felsenthal NWR.

Red-cockaded woodpecker

Felsenthal NWR harbors one of the highest-known concentrations (per acre of available habitat) of RCWs in Arkansas. During 2014, Felsenthal NWR was home to 13 active colonies of red-cockaded woodpeckers, a number that has remained relatively constant (11 to 14 colonies) over the last few years. The red-cockaded woodpecker was listed in the Federal Register as endangered in 1970 (35 FR 16047), and received federal protection under the Endangered Species Act of 1973, as amended. Once, the RCW was a common bird distributed across the southeastern United States, but by the time of listing, the RCW had declined to fewer than 10,000 individuals. The red-cockaded woodpecker has high priority in refuge management. This woodpecker prefers open, park-like timber stands where it drills nesting cavities in mature pine trees. The RCW prefers mature, older aged, open canopy pine stands with low ground cover of grasses and forbs. Its decline has been traced to the loss of older aged, open pine forests in the South, and a fire-dependent ecosystem to which the RCW has adapted. Because fire is a historic disturbance agent that is critical to the continued existence of the RCW's habitat, forest management practices such as selective cutting and intensive prescribed burning are the primary management tools used to improve and maintain a home for this endangered bird. In addition, in upland areas, trees with cavities are marked with white bands to aid identification and protection, and artificial nest inserts are placed in mature pine trees to supplement natural cavity trees and to encourage establishment of new RCW colonies.

The RCW is a priority Resource of Concern due to several factors. Most significantly, the species is listed as federally endangered and the refuge has specific responsibilities for the management of the species. Further, the RCW Recovery Plan cites the refuge as a support population for the species. Figure 13 shows the current areas that have potential to provide some level of habitat for the species, as the refuge anticipates being able to support 14 clusters (groups) throughout the refuge. Pine dominated habitat can be actively managed to the benefit of the species through actions that provide habitat toward meeting Recovery Plan standards. The best available information, including current use by, and management for, RCWs indicate this is an appropriate priority species for management.

The RCW population on the refuge has been identified in the RCW Recovery Plan (USFWS 2003c) as a support population. This means that the population on the refuge is not necessary for down or delisting of the species. The process of species recovery is not contingent on the refuge's population reaching a particular population goal. The refuge's population is serving to support recovery actions for the species through possible translocation of juvenile birds to primary or secondary core populations or even other support populations; to date no refuge birds have been needed for this use.

It is important to understand where we have been, where were are and where we plan on going to understand the complexity of RCW management and the acquisition of those lands. The refuge RCW goals have long history and have changed many times. Before 1987 the refuge goal was 9,405 acres with 47 clusters. In 1987, Chief Benson sent a memorandum setting the goal for

Felsenthal at 40 clusters on 8,000 acres (200 acres/cluster). Since then several other documents have laid out goals for Felsenthal NWR and are as follows:

Recovery Plan	34	6,800 (200 acres/cluster)
WGCP Plan	34	8,000 (235 acres/cluster)
CCP RCW Acres	22	9,000 (409 acres/cluster)
CCP Fire Acres		9,490 (280/cluster)

The RCW population on the refuge has undergone significant changes since the refuge was first established, when intensive management of the birds began on the refuge. The latest survey in 2015 revealed 15 potential breeding pairs.

RCWs evolved in a fire-maintained ecosystem and consequently prefer open, park-like pine stands with early successional herbaceous groundcover with little or no hardwood midstory (USFWS 2003c). These RCWs prefer to excavate cavities in live pine trees that are of older-aged classes and usually have been infected with heartwood fungus. Habitat loss from development and fire suppression are the primary cause of their endangerment (USFWS 2003c). Where longleaf pine is not available, RCWs utilize loblolly pine and shortleaf pine habitats. RCWs will utilize artificial nest cavities and this has been an effective strategy to increase nesting, particularly in loblolly habitats. Frequent prescribed burning of foraging habitat, especially during the growing season, is strongly recommended. Development and protection of herbaceous groundcovers facilitate prescribed burning and benefit red-cockaded woodpeckers. Habitat condition targets for the species have been explicitly defined in the RCW Recovery Plan, including definitions of Good Quality Foraging Habitat (GQFH) and Managed Stability Standard (MSS). It will be the goal of the refuge to manage all active partitions toward the goal of reaching Good Quality Foraging Habitat (GQFH).

GQFH Criteria

- 18 or more stems per acre of pine that are at least 60 years of age and 14” dbh
- minimal pine BA of 20 square feet per acre
- BA of Pines 10-14” DBH is 0 to 40 square feet per acre
- BA of Pines less than 10” is 10 square feet per acre and less than 20 stems per acre.
- BA of all Pines more than 10” DBH is at least 40 square feet per acre
- groundcover of native bunchgrass or other native, fire-tolerant, fire dependent herbs total 40% or more of ground cover and midstory plants and are dense enough to carry growing season fire at least once every 5 years
- no hardwood midstory exist or it is sparse and less than 7 feet in height
- canopy hardwoods are absent or less than 30% of canopy
- the entire habitat is within 0.5 miles of center of cluster, and 50% is within 0.25 miles of center of cluster
- foraging habitat is not separated by more than 200 feet of non-foraging areas; non-foraging areas include (1) any predominately hardwood forest, (2) pines stands less than 30 years in age, (3) cleared land, (4) paved roads, (5) utility ROW, and (6) water
- total stand BA for loblolly forest should be kept below 80 square feet per acre
- minimum canopy spacing of 25 feet

The habitat needs of RCWs are consistent with a variety of open pine habitat species, including Northern bobwhite, Bachman’s sparrow, brown-headed nuthatch, Eastern wild turkey, butterflies, Eastern hognose, and several salamander species. While providing GQFH for RCWs, management actions will seek to enhance habitat for these other species.

Recently, the Felsenthal/Upper Ouachita NWRs expanded their acquisition boundaries which will ultimately allow for the conservation of more the 177,000 contiguous acres of wildlife habitat (Figure 15). At some point, an additional 50 RCWs clusters will come under federal protection. For Felsenthal, approximately 11,118 acres of upland habitat will be acquired. The Nature Conservancy owns 3,794 acres within Felsenthal NWR's acquisition boundary. 2,962 acres on the west side is under a RCW habitat conservation plan (HCP). An additional 647 acres of 15-20 year old pine plantations/hardwood drainages is not covered by the HCP. These 647 acres are not RCW habitat under the current RCW guidelines. The HCP outlines 100 acres/cluster with the goal of 29 clusters on 2,962 acres. Currently, TNC has 25 active clusters.

The Recovery Plan outlines two standards for managing foraging habitat, the recovery standard and managed stability standard. Federal agencies strive to manage for good quality habitat within ½ mile of cluster center, whereas the managed stability standard, also known as the private lands standard, strive to provide habitat within ¼ mile of cluster center. Figure 16 shows 28 ¼ mile (private lands standard) and ½ mile (federal standard) partitions in relation to the refuge's population. The refuge needs to consider the population of RCWs adjacent to the refuge in our management decisions as those birds may rely on refuge habitat.

Partitions are spatially created using 0.25-mile (160 acres) and 0.5-mile radius (502 acres) circles drawn around the cluster centers (average center point of the cavity trees). The inner ring represents the distance within which 50 percent of foraging habitat should exist; the out ring representing 100 percent of the foraging habitat. Within the full 502-acre partition, the pine forest must be of sufficient quantity to provide habitat for both the current needs of the bird group and regenerating trees to meet the future long-term needs of the group. It is the goal to provide each partition with habitat meeting GQFH criteria.

Within the partitions, a minimum amount of sustainable pine forest needs to exist in order to perpetually manage for GQFH. For loblolly pine habitats, this is calculated based on managing loblolly pine stands under the goal of providing stands of at least 100-years of age; this is not meant as a silvicultural rotation age. Rotation technically refers to the oldest age that commercial forestland managers will let their trees grow; however, it is important to make the distinction that this is not the same meaning as providing pine stands of at least 100 years of age. Pine forest on the refuge will be allowed to naturally exist beyond 100 years of age, but there is not a clear understanding to what maximum age a typical stand of loblolly pine will survive. To manage for long-term GQFH, the minimum acreage calculation for loblolly pine habitat within a 502-acre partition on the refuge is 300 acres. At the current time, less than a third of the existing 38 active partitions meet or exceed this acreage value. A minimum of 75 acres of pine must be present within each partition to meet the minimal yearly needs of the birds; all existing active partitions provide this minimum acreage.

At the time this plan was written, none of the habitat within any of the partitions meets the criteria for GQFH. Total stand basal area is too high, groundcover is limited, hardwood mid-story is moderate to dense, approximately 71 percent of partitions have less than 300 acres of pine habitat, and nest site competition with flying squirrels is impacting the birds' productivity. Factors including avian predation and demographic isolation of some individual clusters are of concern as well.

Figure 15. Current Expanded Acquisition Boundary of Felsenthal National Wildlife Refuge and Adjacent Protected Lands.

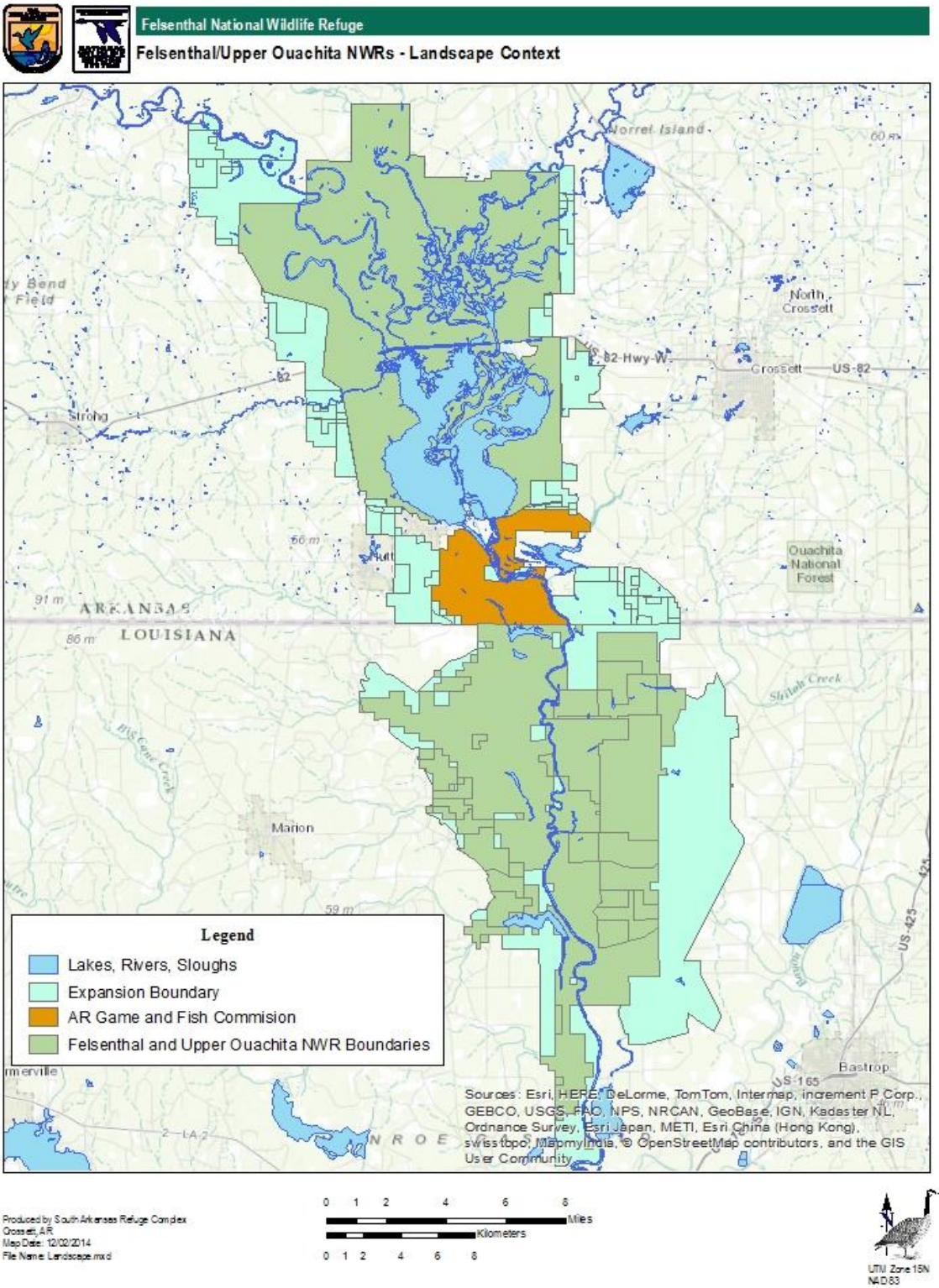
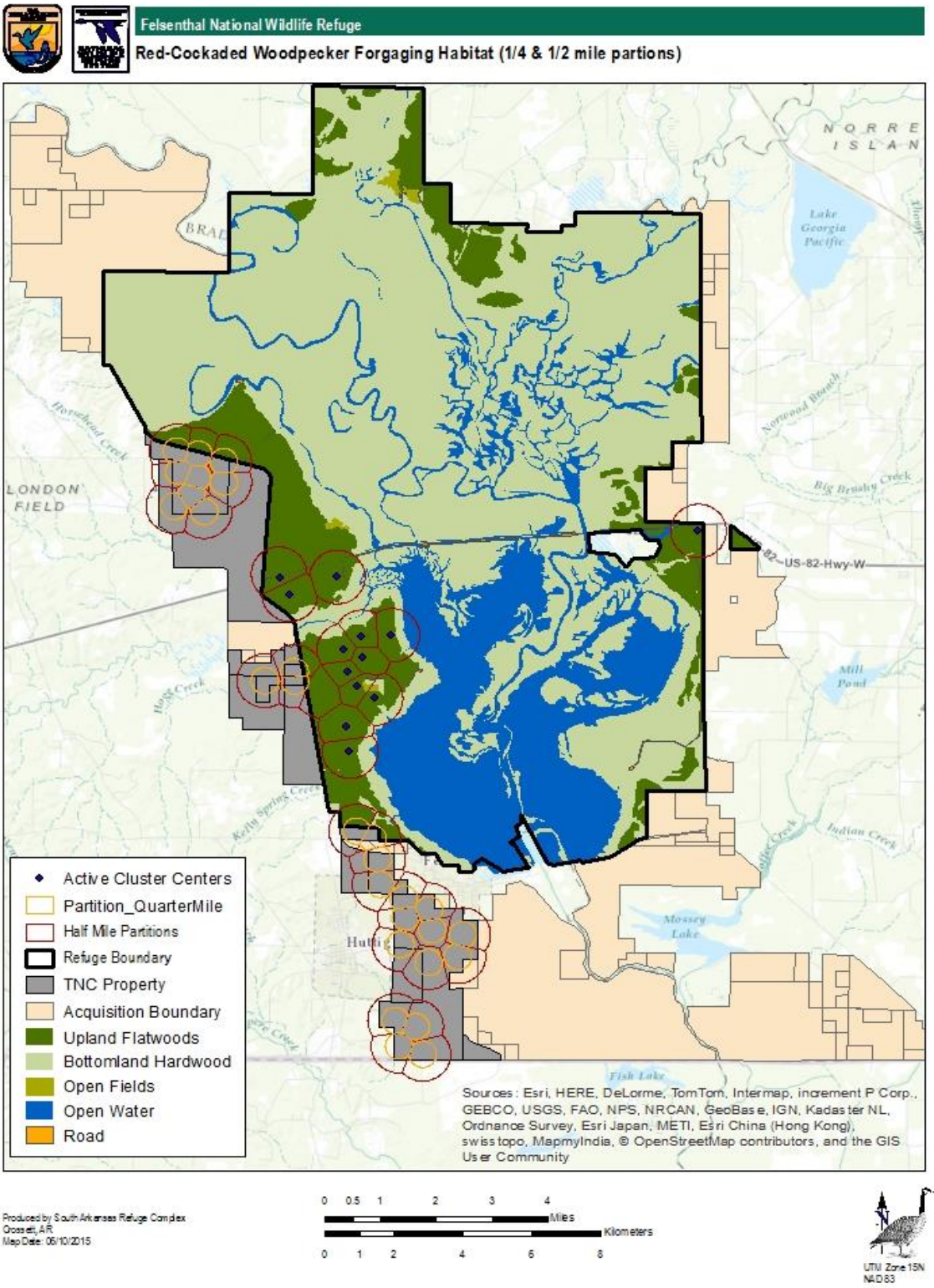


Figure 16. Red-Cockaded Woodpecker ¼ and ½ Mile Foraging Habitat Partitions on Lands in and Around Felsenthal National Wildlife Refuge.



It is the goal of future habitat management to improve habitat conditions within partitions toward meeting GQFH. For those partitions with sufficient amounts of pine habitat to allow for sustained GQFH, it will be important to incorporate forest stand regeneration into the partitions' management. For those partitions severely lacking in available pine habitat, it will be important to manage clusters locations toward larger blocks of pine habitat. It is also going to be important to establish recruitment sites within locations suitable for the long-term management of RCW groups.

Northern Long-eared Bat

The northern long-eared bat has recently been federally listed as "threatened," and is assumed to occur at Felsenthal NWR. Northern long-eared bats spend the winter hibernating in caves and mines. They typically use large caves or mines with large passages and entrances; constant temperatures; and high humidity with no air currents. During summer, northern long-eared bats roost singly or in colonies underneath bark, in cavities, or in crevices of both live and dead trees. Males and non-reproductive females may also roost in cooler places, like caves and mines. This bat seems opportunistic in selecting roosts, using tree species based on suitability to retain bark or provide cavities or crevices. It has also been found, rarely, roosting in structures like barns and sheds. Northern long-eared bats emerge at dusk to forage in upland and lowland woodlots and tree-lined corridors, feeding on insects, which they catch while in flight using echolocation. This species also feeds by gleaning insects from vegetation and water surfaces.

Suitable summer habitat for Northern long-eared bat consists of a wide variety of forested/wooded habitats where they roost, forage, and travel and may also include some adjacent and interspersed non-forested habitats such as emergent wetlands and adjacent edges of agricultural fields, old fields and pastures. This includes forests and woodlots containing potential roosts (i.e., live trees and/or snags 3 inches dbh that have exfoliating bark, cracks, crevices, and/or cavities), as well as linear features such as fencerows, riparian forests, and other wooded corridors. These wooded areas may be dense or loose aggregates of trees with variable amounts of canopy closure. Individual trees may be considered suitable habitat when they exhibit characteristics of suitable roost trees and are within 1,000 feet of other forested/wooded habitat. Northern long-eared bat also has been observed roosting in human-made structures, such as buildings, barns, bridges, and bat houses. Northern long-eared bats typically occupy their summer habitat from mid-May through mid-August each year and the species may arrive or leave some time before or after this period (in the Southeast Region the range of dates are from mid-March to late November to include spring staging and fall swarming).

Northern long-eared bat maternity habitat is defined as suitable summer habitat used by juveniles and reproductive (pregnant, lactating, or post-lactating) females. Northern long-eared bat home ranges, consisting of maternity, foraging, roosting, and commuting habitat, typically occur within three miles of a documented capture record or a positive identification of northern long-eared bat from properly deployed acoustic devices, or within 1.5 miles of a known suitable roost tree.

Suitable northern long-eared bat roosts are trees (live, dying, dead, or snag) with a diameter at breast height (dbh) of three inches or greater that exhibits any of the following characteristics: exfoliating bark, crevices, cavity, or cracks. Isolated trees are considered suitable habitat when they exhibit the characteristics of a suitable roost tree and are less than 1000 feet from the next nearest suitable roost tree within a woodlot, or wooded fencerow.

Invertebrates

Arkansas is home to approximately 85 mussel species. Of these, 14 are federally protected under the Endangered Species Act and 6 are being evaluated for protection. Mussels in Arkansas are

primarily threatened from changes to their habitat including the construction and operation of dams and reservoirs on Arkansas Rivers. Pollution and sedimentation, especially polluted rainwater runoff from roads and fields is an ongoing threat to native mussels. The presence of diverse and reproducing populations of mussels indicates a healthy aquatic system.

Posey (1996) documented mussel beds and species composition within the 33.4-mile portion of the Ouachita River between Felsenthal NWR and the Arkansas-Louisiana line. Posey's findings consisted of 20 major beds, 4 minor beds, and 27 mussel species.

Davidson (2015) documented mussel beds and species composition within the 10.8-mile section of the Saline River that flows through Felsenthal NWR. Davidson recorded 31 mussel species, including the endangered Winged Mapleleaf (*Quadrula fragosa*) and Pink Mucket (*Lampsilis abrupta*). These 31 species were found in 11 major and 2 minor beds. Figure 17 shows the known mussel bed locations on Felsenthal NWR.

CULTURAL RESOURCES

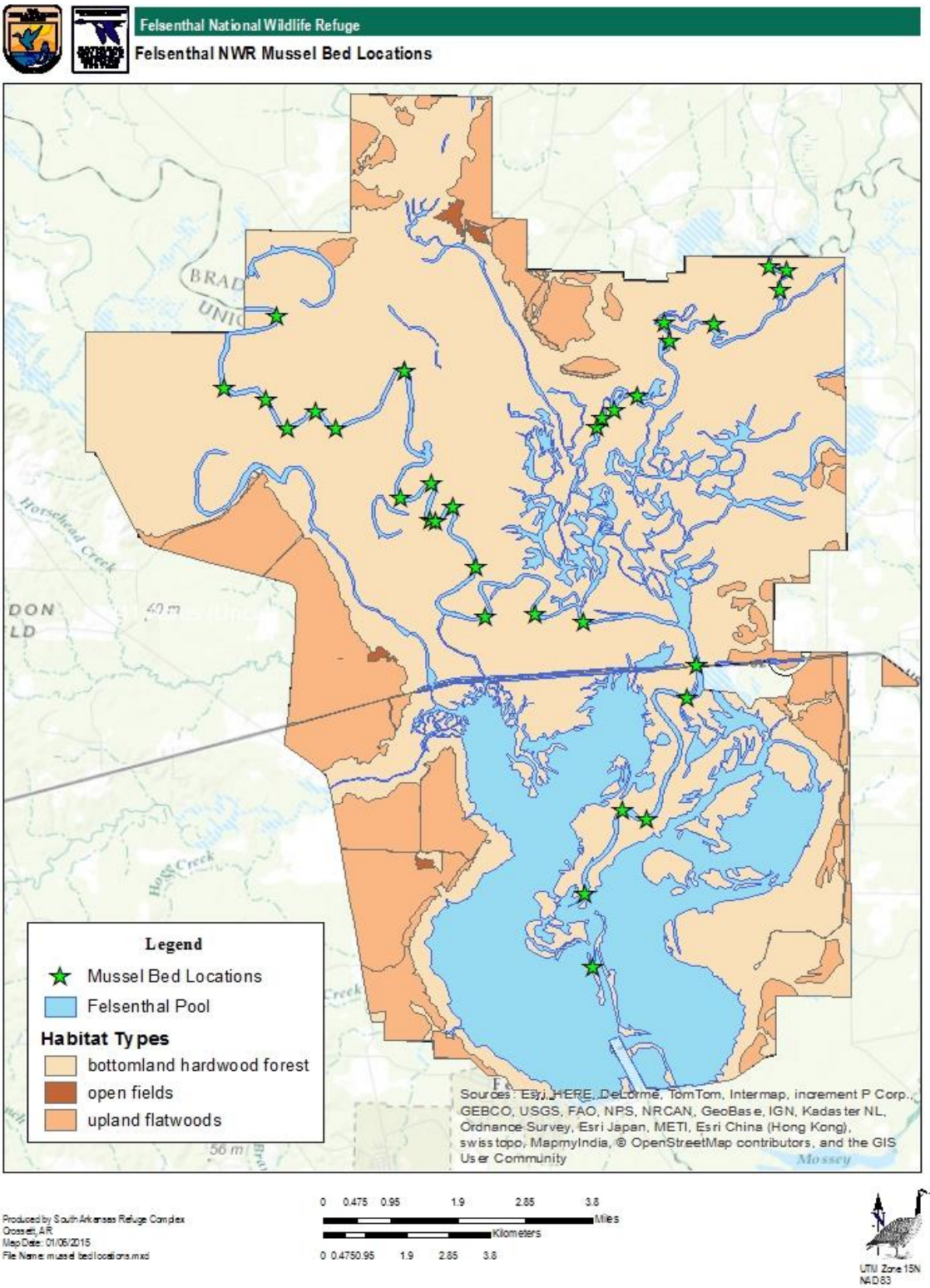
HISTORICAL BACKGROUND

The area in which Felsenthal NWR now occupies is rich in history. Archaeological investigations indicate that the earliest use by man may have occurred about 5,000 years ago when the Caddo Indians occupied the area and hunted, fished and trapped in places that are still popular for these activities today. The area contains farming settlements dating back to the Mississippian Period (AD 900-1600). The archaeological site at Lake Enterprise, near Wilmot, is approximately 3,500 years old. The land was originally settled by the Tunica and Caddo Indians and became part of the Quapaw holdings. Felsenthal NWR is home to some of the most significant and well-preserved archeological resources in the region. Remains of seasonal fishing camps, temple mounds with ceremonial plazas and villages with as many as 200 structures are evidence of once thriving Indian communities. This history is recaptured by displays at the refuge visitor center. Hernando de Soto and his men are thought to be the first Europeans to explore the area. In 1541 they encountered the fierce Caddo Indians and subsequently accepted the hospitality of the Quapaws during the fierce winter of 1541-1542, in which 250 of the de Soto party died.

In 1803, the land that is now known as the Louisiana Purchase was acquired from France, and divided into territories. European visitors to the area in the early 1800s reported Native Americans were engaged in limited farming, as well as hunting and gathering. It is believed that the Caddo Tribe augmented the natural fire process in the area to clear areas, enhance crops, and flush game. The advent of European settlers into this part of Arkansas decimated the Native Americans through diseases brought by the newcomers. The Indians were moved first into other Caddo territory in northwest Louisiana and finally to the Oklahoma Territory in what is now Ottawa County. It is doubtful that any of these tribes were still living in the area when these Indian holdings were ceded to the U.S. in 1818, marking the real beginning of European settlement.

Two hundred years ago, the Lower Mississippi River Valley contained over 24 million acres of bottomland hardwood and swamp forests. Today, only about 4 million acres of wetland forest remain, most as islands in a sea of agriculture. Agriculture was the primary land use in the years before the Civil War. By the mid-1800s, many farms were producing cotton, corn, wheat, potatoes, and livestock on the fertile land. The Civil War curbed the large-scale agricultural development and after the war large plantations were sold off in smaller tracts. Timber abounded, especially hardwood, and as hardwood was cleared for cultivation, pine took over. Timber was rafted down the Saline River and Ouachita River to other settlements. Arkansas's wood products industry saw its beginnings in the

Figure 17. Mussel Bed Locations on Felsenthal National Wildlife Refuge.



1890s concurrent with the first railroads. Cotton farming grew as more lands were cleared for timber harvesting. By 1925, almost all of the virgin pine had been cut over. Many of the smaller farms were abandoned during the Great Depression of the 1920s and 1930s, and later purchased by the timber industry and the federal government, becoming timber plantations, national forests, wildlife refuges, etc.

Following the decrease in timber production, the 1920s saw the advent of a mini "oil boom," but production declined rapidly in later years due to poor recovery practices and widespread industrial pollution from the oil drilling (saltwater and brine discharges to surface streams and wetlands). As of 1997, about 200 oil and 80 gas fields were in production in Arkansas, producing about 23,500 barrels of oil per day and 586,000 MCF of gas per day.

In the 1950s, bromine concentrations were found to be abnormally high (about 70 times the bromine concentration of normal ocean water) in the salt brine oil field wastes (heretofore considered a worthless by-product of drilling). The first commercial recovery of bromine was in Union County in 1957 and has continued ever since. Arkansas is now the largest producer of bromine in the world, averaging about 40% of the world's total production.

CULTURAL RESOURCES PROTECTION

Cultural resources include historic properties as defined in the National Historic Preservation Act (NHPA); cultural items as defined in the Native American Graves Protection and Repatriation Act (NAGPRA); archaeological resources as defined in the Archaeological Resources Protection Act (ARPA); sacred sites as defined in Executive Order 13007, Protection and Accommodation of Access To "Indian Sacred Sites," to which access is provided under the American Indian Religious Freedom Act (AIRFA), and collections. As defined by the NHPA, a historic property or historic resource is any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places (NRHP). These include any artifacts, records, and remains that are related to and located in such properties. The term also includes properties of traditional religious and cultural importance (traditional cultural properties), which are eligible for inclusion in the NRHP as a result of their association with the cultural practices or beliefs of an American Indian tribe. Archaeological resources include any material of human life or activities that is at least 100 years old, and that is of archaeological interest.

Felsenthal NWR abides by these Acts and Executive Orders to protect any cultural or historic legacy that may potentially occur on the refuge. The refuge consults with the U.S. Fish and Wildlife Service's-Regional Historic Preservation Officer prior to any new construction work that is undertaken on the refuge that involves excavation with heavy earth-moving equipment like tractors, graders, and bulldozers. The Regional Historic Preservation Officer investigates the proposed area of impact and consults with the Arkansas Historic Preservation Program (AHPP) and all relevant Native American Tribes. The AHPP and Native American Tribes review the proposals and determine whether cultural or historical resources will be impacted, that is, whether any properties listed in or eligible for listing in the NRHP will be affected.

In the event that cultural resources have been determined to be impacted by an action, the refuge will change the proposed action in order to avoid impacts to cultural and historical resources. If cultural resources are actually encountered during construction activities, the refuge is to notify the Regional Historic Preservation Officer and AHPP immediately. Approximately 212 sites have been identified to be of archaeological significance on Felsenthal NWR. To date, three archaeological surveys have been conducted on the refuge. Given the region's settlement during both the prehistoric and historic periods, the likelihood of cultural resources is considered relatively high.

SOCIOECONOMIC ENVIRONMENT

REGIONAL DEMOGRAPHICS AND ECONOMY

Felsenthal NWR is located in southeastern Arkansas and in close proximity to the Arkansas-Louisiana border. Felsenthal NWR is located in Union, Bradley and Ashley Counties. This three-county area had an estimated population of approximately 73,226 in 2013. The State of Arkansas has only one city with a population greater than 100,000: its capital, Little Rock, with a population of about 197,357. Populations have been declining in the region, with a decrease of about 2.30 percent since 2010. This compares with a 1.5 percent increase for the State of Arkansas, and a 2.4 percent increase for the U.S (Table 8). Per capita income for the three-county area is just below the average for the state, $22,170. Additional information for nearby Morehouse and Union parishes in Louisiana is also included in Table 8.

Union County is the state's largest county geographically. Ninety percent of the county is forested. Forage and hay are raised for livestock, but few row crops are cultivated. Nearly 25% of the workforce is employed in manufacturing, primarily in petro-chemical, poultry processing, and wood products operations. The soils of Ashley County are fertile, allowing the cultivation of the great cash crops of the state: corn, cotton, rice, and soybeans. The western part of the county is largely forested, home to what is billed as "The Forestry Capital of the South." Today, forest products account for 57% of the value of all shipments from Ashley County and are responsible for 26% of the employment. The Great Lakes Chemical Corporation (now Chemture) is the world's largest producer of bromine. With facilities in Union (and Columbia) counties, it contributes significantly to the local economy and employs more than 1,000 people.

Table 8. Demographics and socioeconomics of all counties and parishes bordering Felsenthal NWR.*

Characteristic	Union County	Bradley County	Ashley County	State of Arkansas	M'house Parish	Union Parish	State of Louisiana	United States
Demographic								
Population (2013 estimate)	40,694	11,249	21,283	2,959,373	27,057	22,344	4,625,470	316,128,839
Percent Change 4/1/2010 - 7/1/2013	-2.30%	-2.30%	-2.60%	1.50%	-3.30%	-1.70%	2.00%	2.40%
Total Land Area (sq. miles)	1,039.21	649.23	925.35	52,035.48	794.93	876.99	43,203.90	3,531,905.43
Population Density (pop./sq. mile)	40.1	17.7	23.6	56	35.2	25.9	104.9	87.4
Race/ Ethnicity								
White	64.60%	68.40%	71.90%	79.90%	50.60%	72.20%	63.50%	77.70%
Black/African American	32.60%	27.40%	25.80%	15.60%	47.80%	26.40%	32.40%	13.20%
Hispanic/Latino (of any race)	3.60%	14.40%	5.20%	6.90%	1.30%	4.30%	4.70%	17.10%
Asian	0.80%	0.40%	0.20%	1.50%	0.40%	0.20%	1.70%	5.30%
Education (% of population over 25)								
High School Degree	82.40%	76%	84.20%	83.70%	76.90%	82.00%	82.60%	86.00%
College Degree	16.10%	10.80%	12.20%	20.10%	12.90%	13.10%	21.80%	28.80%
Economic								
Median Household Income,	$37,435	$30,409	$35,683	$40,768	$28,585	$35,828	$44,874	$53,046
Per capita Income,	$20,718	$19,386	$19,761	$22,170	$16,683	$19,412	$24,442	$28,155
Individuals below poverty level	21.50%	31.3	18.90%	19.20%	26.50%	27.90%	19.10%	15.40%

*U.S. Census Bureau. Bureau of Economic Analysis, and Bureau of Labor Statistics (2010 - 2014), http://www.census.gov

LAND PROTECTION AND CONSERVATION

In 2014, the Final Land Protection Plan (LPP) established new acquisition boundaries for the expansion of Felsenthal and Upper Ouachita National Wildlife Refuges (NWRs) (USFWS 2014). This conservation estate will ultimately allow for the conservation of more than 177,000 contiguous acres of wildlife habitat (See Figure 15). More than 120,000 acres of bottomland floodplain habitat and 58 river miles will be protected. Approximately 50-80 red-cockaded woodpecker clusters will come under federal protection. A RCW cluster defines an area of active cavity trees with one or more RCW(s) present. As a result, the bottomland hardwood forests along the Ouachita River will be protected; the lands between the two refuges will increase the core habitat for neotropical migratory songbirds, wintering waterfowl, and black bears; and existing and potential habitat for red-cockaded woodpecker (RCW) and the Louisiana black bear will be protected.

Only 20 percent of the historic bottomland hardwood forests in LCC are left today, most of which are highly fragmented. Black bears have been reintroduced to Felsenthal NWR and these animals disperse to Upper Ouachita NWR regularly. The proposed expansion areas would increase the core area size of forested blocks and provide necessary corridors for migratory birds, bears and other wildlife. These lands are also important to neotropical migratory birds that follow the Ouachita River

during their spring and fall migrations, as well as, to nesting prothonotary, Swainson's and worm-eating warblers, Mississippi kites, and wood ducks. The ultimate goal is as follows:

- To protect contiguous bottomland hardwood forests adjacent to the Ouachita River.
- To protect lands between both national wildlife refuges to increase core habitat for neotropical migratory songbirds, wintering waterfowl, and black bears.
- To protect existing and potential habitat for the federally listed (endangered) red-cockaded woodpecker.

In addition, some of these lands also contain some upland hardwoods that are becoming an endangered ecosystem upon which many wildlife species depend. Hardwood species such as white, southern red and cherry-bark oak, along with various hickories, are disappearing due to intensive pine management by the forest industry. In fact, the mixed species pine-pine hardwood ecosystem of the West Gulf Coastal Plain is perhaps one of the most imperiled systems in the United States due to massive conversion to short-rotation, pine plantation monoculture by the commercial forest industry.

These lands are used by neotropical migratory birds following the Ouachita River during their spring and fall migrations, as well as nesting prothonotary, Swainson's and worm-eating warblers, Mississippi kites, and wood ducks. Hundreds of thousands of wintering waterfowl utilize these bottomland hardwood forests annually (USFWS 2008; USFWS 2010). Rafinesque's big-eared and southeastern myotis bats, both priority species in the Gulf Coastal Plains and Ozarks Landscape Conservation Cooperative (GCPO LCC 2009), utilize the large hollow trees found in these forests.

The expansion areas are 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). Davis et al. (2008) found that female mallards spent the majority of their time in bottomland hardwood forests on Upper Ouachita NWR, underscoring the importance of these forests to wintering waterfowl.

The major value of the upland pine communities will be to contribute to the conservation and management of the endangered RCW. With proper management, these habitats could support additional RCW groups. In addition, large populations of RCWs exist on the Ouachita National Forest in central Arkansas and Kisatchie National Forest in central Louisiana. Habitat restoration in this conservation estate will provide a link between the two larger RCW populations for dispersing birds, thereby increasing their genetic diversity (Will McDearman, RCW Recovery Coordinator, personal comm.).

CHANGES ASSOCIATED WITH CLIMATE CHANGE

Global climate change poses risks to human health and to terrestrial and aquatic ecosystems. Important economic resources such as agriculture, forestry, fisheries, and water resources also may be affected. Warmer temperatures, more severe droughts and floods, and sea level rise could have a wide range of impacts. All these stresses can add to existing stresses on resources caused by other influences such as population growth, land-use changes, and pollution.

Climate change is not a distant threat; it is occurring here and now. As a result of the growing abundance of greenhouse gases, the global average air temperature has risen steadily over several decades, particularly since the 1950s. The first decade of the 21st century has proven to be the hottest decade since scientists began recording global temperatures in the 1880s, with the 1990s following close as the second hottest. Signs of a changing climate include melting glaciers, heat

waves, rising seas, flowers blooming earlier, lakes freezing later, and migratory birds delaying their flights south. No geographic region is immune.

In addition to the rising seas, the effects of climate change will be changes in weather/rainfall patterns, decreases in snow and ice cover, and stressed ecosystems. For the southeastern U.S. and the Felsenthal-Overflow region, this can mean extreme precipitation events; greater likelihood of warmer/drier summers and wetter/reduced winter cold; and alterations of ecosystems and habitats due to these changes in weather patterns—to name but a few possibilities. For example, a recent study of the effects of climate change on eastern U.S. bird species concluded that as many as 78 species of birds could decrease by at least 25%, while as many as 33 species could increase in abundance by at least 25% due to climate and habitat changes.

CHAPTER III. RESOURCES OF CONCERN

Resources of Concern are defined in the Habitat Management Planning Policy as *"all plant and or animal species, species groups, or communities specifically identified in Refuge purpose(s), System mission, or international, national, regional, state, or ecosystem conservation plans or acts"* {620 FW 14 (G)}. Each refuge has one or more purposes for which it was established that guide it's management objectives. For example, based on Felsenthal NWR's purpose legislation, migratory birds and endangered species are priority resources of concern (ROCs) for the refuge.

Other Service "trust resources" that are also considered as resources of concern include inter-jurisdictional fishes, wetlands, marine mammals. Further, refuges support other elements of biodiversity, including invertebrates, rare plants, unique natural communities, and ecological processes that contribute to BIDEH at refuge, ecosystem, and broader scales (USFWS 1999, 2003).

The refuge supports other elements of biological diversity that include unique natural communities for Arkansas and natural ecological processes that contribute and/or sustain biological integrity and environmental health at the refuge, state, ecosystem, and broader scales, and many of these elements are also considered resources of concern.

Given the multitude of purposes, mandates, policies, regional, national, international, and state plans that apply to Felsenthal NWR, there is a need to identify and prioritize all the potential ROCs that the refuge would be best suited to focus its habitat management objectives and associated strategies. We used the process described in the Service's "*Handbook for identifying refuge resources of concern and establishing management priorities for the NWR System"* (USFWS 2007b). The first step in this process yielded a comprehensive list of resources of concern.

From this process, we selected priority habitats and priority resources of concern for Felsenthal NWR. These ROCs served as the foundation for developing management goals and objectives.

Biological Integrity, Diversity and Environmental Health (BIDEH)

The RIA in section 4(a)(4)(B) states that in administering the System the Service shall *"…ensure that the biological integrity, diversity and environmental health of the System are maintained for the benefit of present and future generations of Americans…"* The Service defines these terms in its policy (601 FW 3) for maintaining and restoring the biological integrity, diversity, and environmental health (BIDEH) of the Refuge System.

Wherever and whenever possible, refuge habitat management will mimic and/or restore natural ecosystem processes and functions to maintain and enhance biological integrity, diversity, and environmental health. The policy states that *"We will, first and foremost, maintain existing levels of biological diversity, integrity, and environmental health at the refuge scale."* To help achieve this policy goal we have mapped the existing elements of BIDEH on the refuge as our starting point in determining habitat goals and management objectives, strategies, and prescriptions, to first, maintain existing elements of ecological integrity and second, to restore lost elements of BIDEH when feasible.

In planning habitat management activities we will focus on the establishment of native communities we believe can occur through natural succession and/or maintain native non-climax communities to best achieve refuge purpose(s). We will favor techniques that set back succession such as prescribed fire, mowing and other techniques to maintain early successional communities for migratory birds and other priority resources of concern. But in the case of Red-cockaded woodpeckers, we wish to

accelerate succession toward a more climax seral stage. When restoring habitats we attempt to re-establish native plant species and vegetative communities found under natural conditions and use native seed sources or rely on natural succession and native seed banks in ecological restoration projects.

Process for Determining Resources of Concern and Habitat Priorities

The refuge followed the process outlined in the Service's handbook (USFWS 2007) for prioritizing the key habitats and species upon which to focus habitat management actions in this HMP. First, a comprehensive list of potential resources of concern was developed from Refuge purpose and Service trust species that were found on the refuge, using the following list of regional and state wildlife and habitat data sources:

- BCR 25 Bird Species List
- PIF – Area 42 Bird Species List
- National and Regional Bird Conservation Plans for waterfowl, landbirds, shorebirds, and waterbirds
- USFWS Birds of Conservation Concern
- Federally Threatened and Endangered Species Listings
- State Threatened and Endangered Species Listings
- Refuge Purpose/Service Trust Resources
- Arkansas Natural Heritage Program Data
- Arkansas Wildlife Action Plan

To guide us in prioritizing this list, we considered the following concepts:

- Achieving refuge purposes and managing for trust resources as well as biological diversity, integrity, and environmental health can be addressed through the habitat requirements of "focal species" or species that may represent guilds that are highly associated with important attributes or conditions within habitat types. The use of focal species is particularly valuable when addressing USFWS trust resources such as migratory birds.
- The Bird Conservation Region (BCR) plans are increasing their effectiveness at ranking and prioritizing those migratory birds most in need of management or conservation focus. Although all species that make it to a ranked BCR priority list are in need of conservation attention, we selected focal species that were ranked High or Moderate in Continental concern with a High to Moderate BCR Responsibility. If there were too many or too few birds with these rankings for a given habitat type then species with the highest then high then medium final BCR ranking were chosen. (See www.abcbirds.org/nabci for BCR rules used to rank birds.)
- Habitat conditions on or surrounding the refuge may limit the Refuge's capability to support or manage for a potential species of concern. The following site-specific factors were evaluated:
    - Patch size requirements
    - Habitat connectivity
    - Compatibility of surrounding land uses
    - Environmental conditions: soils, hydrology, disturbance patterns, contaminants, predation, invasive species
    - Specific life history needs
- The likelihood that a potential species of concern would have a positive reaction to management strategies.

FOCAL SPECIES MANAGEMENT

To understand the above process and how it was incorporated into our HMP effort, the idea of focal species management and the definition of focal species must be understood. A focal species is a species or group of species (guild) that is directly targeted for conservation and habitat management actions. The selection of focal species is associated with important habitat elements or ecosystem attributes of identified species with the greatest and most urgent conservation needs. These needs are based on the Service's BCC (USFWS 2008), national, ecoregional, and regional plans, and the State of Arkansas' wildlife action plan.

Focal species for the refuge have been determined to be those specific species requiring immediate conservation action due to declining populations and other factors. Vulnerability to threats has limited the life history requirements needed to ensure their persistence into the future. Once identified, these species were used to define the compositional ecosystem spatial and functional features imbedded in habitat management objectives, strategies, and conservation actions contained in this HMP.
The use of focal species facilitated the complex tasks of writing habitat objectives for refuge purpose species (e.g., migratory birds and endangered species) and other Service trust species (e.g., interjurisdictional fish), while incorporating legal mandates of maintaining and enhancing biological integrity, diversity, and environmental health on refuge lands. Identifying focal species served as a shortcut to simplify dealing with a huge list of wildlife species (birds, native plants, insects, fish, reptiles, amphibians, etc.) that currently reside or seasonally utilize the refuge, and focus habitat management objectives on a shortened list of migratory birds and other wildlife species.

For example, there are over 900 species of migratory birds in North America that are trust species for the Service. The Service's national focal species strategy in its strategic migratory bird management plan (2004 to 2014) has shortened this list to 412 focal bird species. The selection of focal species is a subset of the bird species protected by the Migratory Bird Treaty Act. In 2008, the Service's BCC list narrowed to 139 focal species, targeted for conservation actions based on declining trend data. This list and other ecoregional and State plans reduced our HMP biological planning efforts to two focal bird guilds, 13 refuge focal bird species, two mammals, two Invertebrates, one reptile, one fish and one plant. These focal guilds and species are listed below and are separated by habitat type. Focal species and resources of concern are interchangeable terms. It should be noted some species may be found in one or more habitat types:

Refuge Focus Guilds

- Migrating and wintering dabbling duck
- Migratory landbirds

REFUGE FOCAL SPECIES BY HABITAT TYPE

Upland Pine (Open Pine)

- Red-cockaded Woodpecker (E)
- Bachman's Sparrow
- Brown-headed Nuthatch
- Northern Bobwhite

Upland Hardwoods/Pine Forest

- Kentucky Warbler
- Swainson's Warbler

- Worm-eating Warbler
- Wood Thrush

Bottomland Hardwood Forest

- Cerulean Warbler
- Prothonotary Warbler
- Mallard
- Wood Duck
- Rafinesque's Big-ear Bat
- American Black Bear
- Pondberry (E)

Aquatic/Riverine Habitat

- Rabbitsfoot (T)
- Pink Muckett (T)
- Winged Mapleleaf (E)
- Western Chicken Turtle
- Alligator Gar

*() E - endangered and T - Threatened

The focal species approach was then used to write wildlife and habitat objectives that linked focal species to habitat management strategies and new conservation actions targeting these wildlife species. It is a multi-species management approach in which the life history and habitat structural requirements of focal species and guilds have been used to define the future management direction and desired conservation outcomes for the refuge, based on the best contribution the refuge makes to both State and regional landscape conservation scales. Targeting conservation actions to a few focal species, specifically in habitat management objectives, is made with the assumption that hundreds of other fish, wildlife, and native plant species will benefit.

Monitoring will be an integral component of biological planning using focal species, such as presence/absence as an inexpensive measure to gauge environmental health, relative abundance, and density of focal species as measures of biological integrity and diversity. Our habitat objectives incorporating specific focal species are based on numerous hypotheses and assumptions using the most recent and best available plant and wildlife survey information. These assumptions will be tested in on-going refuge monitoring studies where focal species serve as key targets for monitoring endeavors to test the effectiveness of habitat management strategies and conservation actions, or to adjust strategies and actions when outcomes do not meet expectations.

UPLAND PINE (OPEN PINE)

SIGNIFICANCE

Open Pine forests or savannahs with low canopy cover and basal area with an herbaceous understory were once in the West Gulf Coastal Plain. With the suppression of fire and conversion to pine plantations many of the bird species dependent on this habitat have also declined.

The priority species listed below are representative of open pine habitat (Table 9). We describe the habitat necessary for viable populations. Population and habitat objectives were stepped down for the Open Pine Land Bird Plan (2011).

Table 9. Total area required to support estimated viable populations of four open pine focal species on Felsenthal NWR.

Species	Minimum viable Population Size (pairs)	Area required to support a viable Population Size (acres)	Recovery Plan Population and Habitat Objective	WGCPO Population Objective (pairs)	WGCPO Habitat Objective (acres)	Felsenthal NWR Proposed Population Objective (pairs)	Felsenthal NWR Proposed Habitat Objective (acres)
Red-cockaded Woodpecker	N/A	N /A	34 Clusters (6,800 acres)	34 Clusters	8,100	13 Clusters	6,200
Northern bobwhite	60	1008	N/A	262,156	4,405,051	360	6,200
Brown-headed nuthatch	28	244	N/A	56,029	491,500	700	6,200
Bachman's sparrow	46	341	N/A	75,622	560,598	828	6,200

IDENTIFICATION OF HABITAT REQUIREMENTS

Bachman's sparrow (Aimophila aestivalis)

Bachman's sparrows are mostly found in open oak and pine forests with abundant grasses. They are most often found in forests with wiregrass or broomsedge (early successional). Populations are highest in areas where forest fires are regular and hardwood understory shrubs are lacking. Bachman's sparrow populations densities are less in areas not burned within the last 4 to 5 years. Habitat requirements include a sparse woody understory with a high density of grasses and forbs (Dunning and Watts, 1990, 1991, Plentovich et al. 1998b). Mature stands of pine can provide optimal habitats for this species. Suitable conditions can also be provided with regeneration cuts such as clearcuts and shelterwoods. Long rotations, regular burning intervals, thinning with the retention of mature or late-successional pines should favor this species. On Felsenthal NWR, areas managed for the red-cockaded woodpecker should also benefit this species.

Brown-headed nuthatch (Sitta pusilla)

The brown-headed nuthatch is closely associated with pine: it breeds in mature pine forests and forages almost exclusively in pine trees (>98 percent of observations; Withgott and Smith 1998). Although often associated specifically with the longleaf pine savanna characteristic of red-cockaded woodpecker and Bachman's sparrow habitat, the brown-headed nuthatch has a broader niche than these species (Dornak and others 2004). Brown-headed nuthatch habitat is defined by two habitat elements: mature pines for foraging and cavities for nesting (Wilson and Watts 1999, Dornak and others 2004). Specific pine species composition is not as critical as tree diameter, with an average dbh of 10 inches being optimal (Connor and O'Halloran 19874).

Brown-headed nuthatches primarily nest in large diameter snags and may require approximately 3 snags per acre to ensure adequate nest and roost sites, particularly in the presence of interspecific competition for cavities. In urban areas, brown-headed nuthatches have readily adopted nest boxes and may use other man-made cavities (e.g., streetlights). Brown-headed nuthatches prefer open pine stands with few hardwoods and an open midstory (Wilson and Watts 1999). Optimal canopy closure is highly variable, but stands with closed canopies are not preferred (Connor and O'Halloran 1987, Wilson and Watts 1999). Undergrowth is typically sparse (~35 percent; Dornak and others 2004). Nuthatches regularly breed at low densities in suboptimal habitats and dense understories (Withgott and Smith 1998). Area sensitivity does not appear to be an issue for this species as it is not an acceptable host for the brown-headed cowbird (Withgott and Smith 1998). This species would also benefit from the refuge's management of red-cockaded woodpeckers.

Northern bobwhite (Colinus virginianus)

In forest habitats, northern bobwhites show a clear preference for early successional vegetation created by disturbances from fire, agriculture, and timber-harvesting. Bobwhite habitats must contain a diversity of invertebrates, seeds, and herbaceous plants. Cover that provides protection from predators, weather, and provides nesting material, which is also essential. Reducing tree density is the first step in developing the grass and forb ground cover bobwhites and other grassland wildlife require. Most pine forests in the Southeast do not support bobwhite because they are too heavily stocked with trees that form a closed canopy. Thinning reduces stem density and opens the forest canopy, letting more sunlight reach the ground and stimulating growth of ground-layer vegetation. In Arkansas, most species of pines can be commercially thinned for the first time at 13 to 18 years of age, depending on the site. Basal area, the total cross-sectional area of wood in the stand, is relatively easy to measure and relates well to herbaceous ground cover in forest stands. Thinning stands to a basal area of 50 square feet/acre or less produces good bobwhite habitat. If bobwhite habitat is a greater priority than forest production, a basal area as low as 30-square-feet/acre produces best habitat. In most cases periodic thinnings are necessary to maintain lower basal areas as trees continue to grow after each thin (Dickson, J 2001). Just as thinning stimulates growth of grasses and forbs, it also favors growth of hardwood brush and trees that shade out desirable grasses and forbs if left unmanaged. Prescribed fire on a 2- to 3-year rotation is the most cost-effective tool to control undesirable brush invasion. Soil disturbance, such as prescribed fire or disking, enhances habitat quality for bobwhites and other grassland birds because it inhibits woody brush growth, promotes annual plant communities, reduces plant residue, and increases bare ground in the forest floor. Plant communities that develop after fire or disking also produce quality food and cover for deer, rabbits, turkeys, and other wildlife. If soil is not disturbed, plant community composition changes over several years, and annual plants are replaced by perennial forbs and grasses and, eventually, woody plants.

Red-cockaded Woodpecker (Picoides borealis)

Felsenthal NWR harbors one of the highest-known concentrations (per acre of available habitat) of red-cockaded woodpeckers (RCW) in Arkansas. During 2014, Felsenthal NWR was home to 13 active clusters of red-cockaded woodpeckers, a number that has remained relatively constant (11 to 14 clusters) over the last few years. The red-cockaded woodpecker was listed in the Federal Register as endangered in 1970 (35 FR 16047), and received federal protection under the Endangered Species Act of 1973, as amended. Once, the RCW was a common bird distributed across the southeastern United States, but by the time of listing, the RCW had declined to fewer than 10,000 individuals. The red-cockaded woodpecker has high priority in refuge management. This woodpecker prefers open, park-like timber stands where it drills nesting cavities in mature pine trees. The RCW prefers mature, older aged, open canopy pine stands with low ground cover of grasses and

forbs. Its decline has been traced to the loss of older aged, open pine forests in the South, and a fire-dependent ecosystem to which the RCW has adapted. Because fire is a historic disturbance agent that is critical to the continued existence of the RCW's habitat, forest management practices such as selective cutting and intensive prescribed burning are the primary management tools used to improve and maintain a home for this endangered bird. In addition, in upland areas, trees with cavities are marked with white bands to aid identification and protection, and artificial nest inserts are placed in mature pine trees to supplement natural cavity trees and to encourage establishment of new RCW colonies.

The RCW is a priority Resource of Concern due to several factors. Most significantly, the species is listed as federally endangered and the refuge has specific responsibilities for the management of the species. Further, the RCW Recovery Plan cites the refuge as a support population for the species. Figure 18 shows the current areas that have potential to provide some level of habitat for the species, as the refuge anticipates being able to support 14 clusters throughout the refuge. Pine dominated habitat can be actively managed to the benefit of the species through actions that provide habitat toward meeting Recovery Plan standards. The best available information, including current use by, and management for, RCWs indicate this is an appropriate priority species for management. Historically the RCWs occurred in greater numbers than they do currently. Figure 19 shows the historical and current active clusters in the area. One of the primary purposes for the expansion of the Felsenthal and Upper Ouachita NWRs was to link up to support populations. The landscape may at some point in time support over 75 clusters.

The RCW population on the refuge has been identified in the RCW Recovery Plan (USFWS 2003c) as a support population. This means that the population on the refuge is not necessary for down or delisting of the species. The process of species recovery is not contingent on the refuge's population reaching a particular population goal. The refuge's population is serving to support recovery actions for the species through possible translocation of juvenile birds to primary or secondary core populations or even other support populations; to date no refuge birds have been needed for this use.

RCWs evolved in a fire-maintained ecosystem and consequently prefer open, park-like pine stands with early successional herbaceous groundcover with little or no hardwood midstory (USFWS 2003c). These RCWs prefer to excavate cavities in live pine trees that are of older-aged classes and usually have been infected with heartwood fungus. Habitat loss from development and fire suppression are the primary cause of their endangerment (USFWS 2003c). Where longleaf pine is not available, RCWs utilize loblolly pine and shortleaf pine habitats. RCWs will utilize artificial nest cavities and this has been an effective strategy to increase nesting, particularly in loblolly habitats. Frequent prescribed burning of foraging habitat, especially during the growing season, is strongly recommended. Development and protection of herbaceous groundcovers facilitate prescribed burning and benefit red-cockaded woodpeckers. Habitat condition targets for the species have been explicitly defined in the RCW Recovery Plan, including definitions of Good Quality Foraging Habitat (GQFH) and MSS. It will be the goal of the refuge to manage all active partitions toward the goal of reaching GQFH.

Figure 18. Current Red-Cockaded Woodpecker Usage on Felsenthal National Wildlife Refuge.

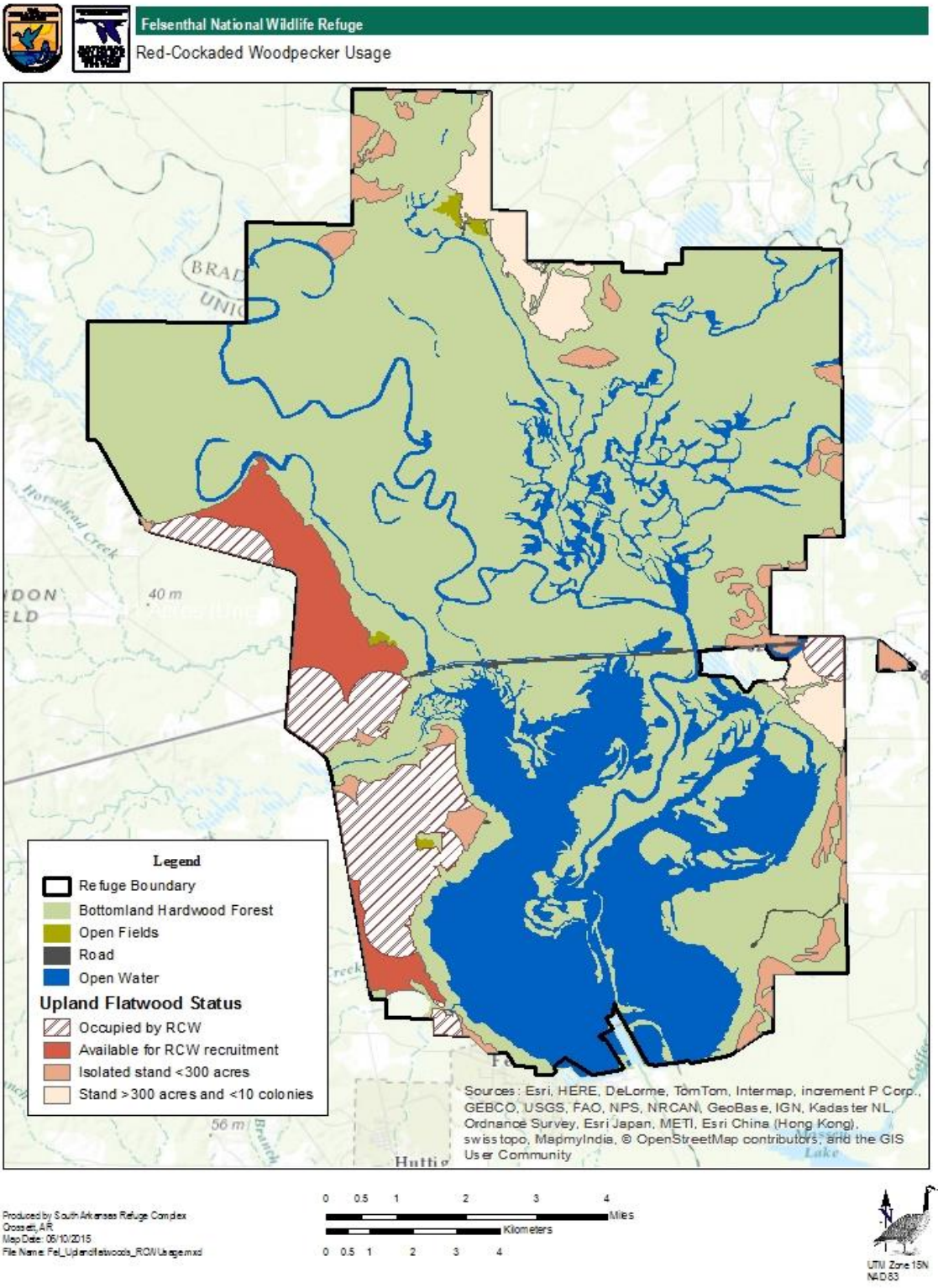
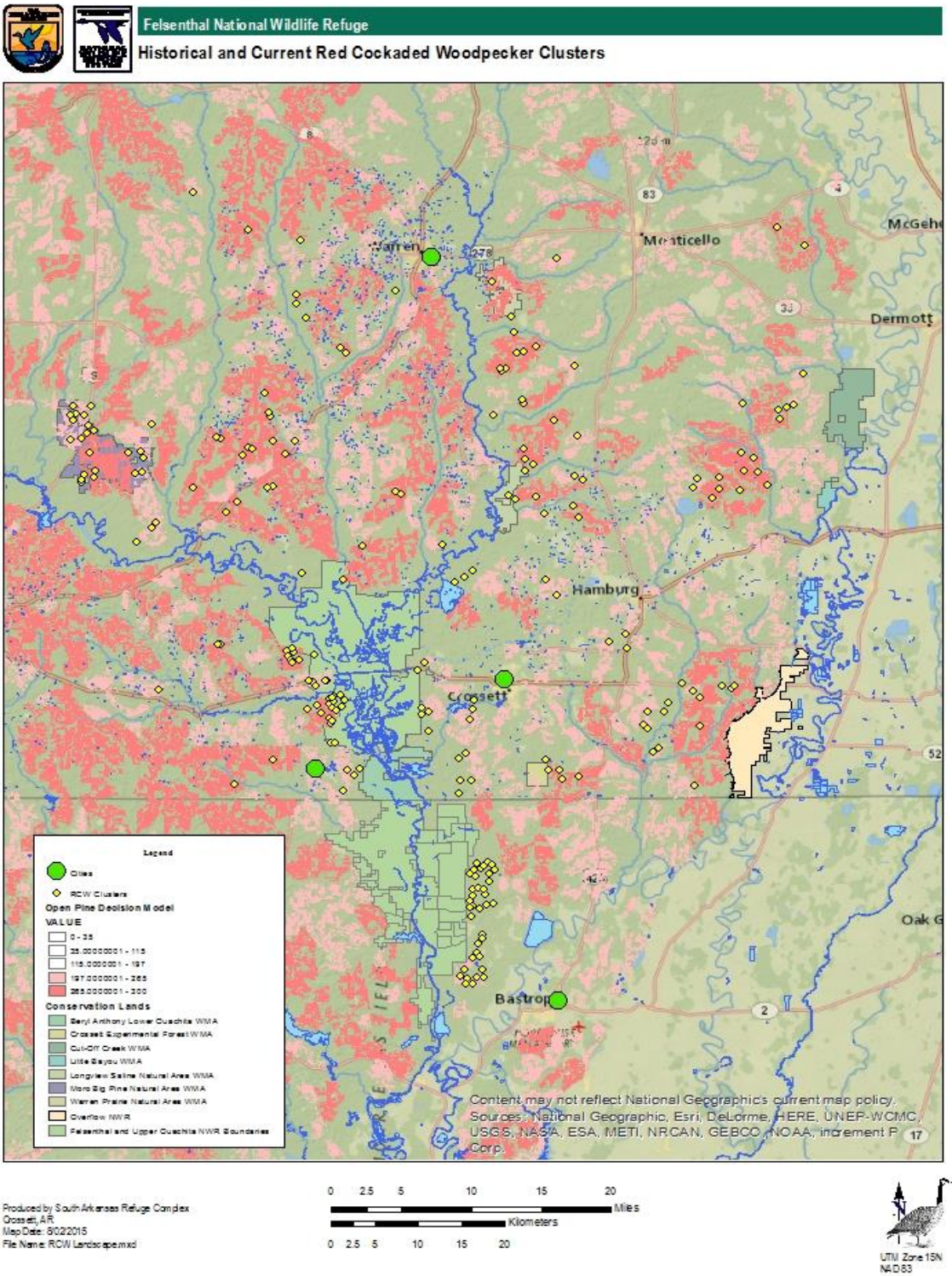


Figure 19. Historical and Current Red-Cockaded Woodpeckers Clusters.



Good Quality Foraging Habitat (GQFH) Criteria

- There are 45 or more stems/ha (18 or more stems/ac) of pines that are ≥ 60 years in age *and* ≥ 35 cm (14 in) dbh. Minimum basal area for these pines is 4.6 m^2/ha (20 ft^2/ac). Recommended minimum rotation ages apply to all land managed as foraging habitat.
- BA of Pines 10-14" DBH is 0 to 40 square feet per acre
- BA of Pines less than 10" is 10 square feet per acre and less than 20 stems per acre.
- BA of all Pines more than 10" DBH is at least 40 square feet per acre
- groundcover of native bunchgrass or other native, fire-tolerant, fire dependent herbs total 40% or more of ground cover and midstory plants and are dense enough to carry growing season fire at least once every 5 years
- no hardwood midstory exist or it is sparse and less than 7 feet in height
- canopy hardwoods are absent or less than 30% of canopy
- the entire habitat is within 0.5 miles of center of cluster, and 50% is within 0.25 miles of center of cluster
- foraging habitat is not separated by more than 200 feet of non-foraging areas; nonforaging areas include (1) any predominately hardwood forest, (2) pines stands less than 30 years in age, (3) cleared land, (4) paved roads, (5) utility ROW, and (6) water
- total stand BA for loblolly forest should be kept below 80 square feet per acre
- minimum canopy spacing of 25 feet

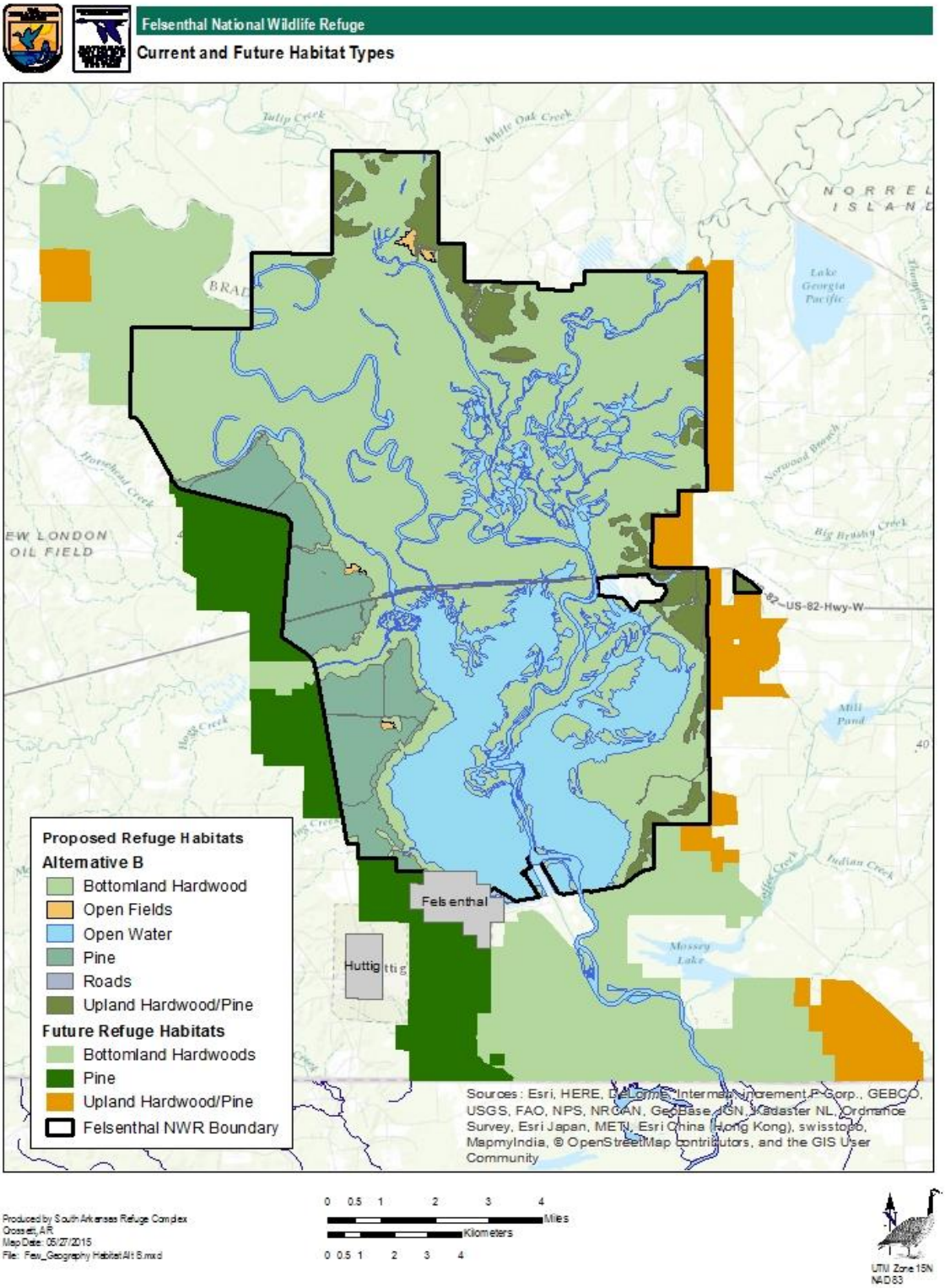
The habitat needs of RCWs are consistent with a variety of open pine habitat species, including Northern bobwhite, Bachman's sparrow, brown-headed nuthatch, Eastern wild turkey, butterflies, Eastern hognose, and several salamander species. While providing GQFH for RCWs, management actions will seek to enhance habitat for these other species.

POTENTIAL REFUGE CONTRIBUTION TO HABITAT NEEDS

The Refuge's current potential for open pine management is 6,200 acres with13-14 active clusters with no active recruitment on the current fee title lands. The refuge will be striving for 300 acres/cluster (120 acres foraging habitat/cluster) for loblolly pine management. The Pine Island cluster is isolated. If this cluster is abandoned or lost, this area will be transitioned to upland/hardwood as well further reducing the RCW pine acreage to 5,553 acres. As shown on Figure 20 the uplands on the north and east of the Ouachita River will be managed for hardwoods with a pine component. The upland south and west of the river will be managed for RCWs. Recently the Felsenthal/Upper Ouachita NWRs expanded their acquisition boundaries which will ultimately allow for the conservation of more the 177,000 contiguous acres of wildlife habitat. In addition a total of 61 RCWs clusters will come under federal protection. For Felsenthal approximately 11,118 acres of upland habitat would be acquired from willing sellers. Of that approximately 6,500 acres would be RCW or open pine habitat. Figure 20 shows what the refuge may look like in the future if all lands were acquired. Essentially the west side of the refuge would be the open pine habitat hence our RCW management focus. The expansion would allow Felsenthal NWR to manage approximately 12,609 acres as open pine habitat. This would bring the RCW clusters up to 39.

In terms of the landscape, the expansion also included 14,159 acres of upland pine on the east side of Upper Ouachita NWR. If the Service is successful in acquiring this property at some point in the future, this would put an additional 36+ RCWs under federal protection and management. Historically over 200 clusters were known to exist in the area. Felsenthal and Upper Ouachita NWRs were at the heart of this landscape. Figure 19 shows the active and historical cluster locations.

Figure 20. Current and Projected Habitat Types that would Potentially Support Red-Cockaded Woodpecker Populations on and adjacent to Felsenthal National Wildlife Refuge.



RECONCILING CONFLICTING NEEDS

The Service recognizes the differences in habitat standards used to manage for RCW. The Nature Conservancy owns 2,962 acres on the west side which is under a RCW habitat conservation plan (HCP). An additional 647 acres of 15-20 year old pine plantations/hardwood drainages is not covered by the HCP. These 647 acres are not RCW habitat under the current RCW guidelines.

This HCP outlines 100 acres/cluster with the goal of 29 clusters on 2,962 acres. Currently, TNC has 25 active clusters. Figure 15 shows 28 ¼ mile (private lands standard) and ½ mile (federal standard) partitions. Table 10 shows the comparison of the various management standards. In addition, Plum Creek owns over 5,000 acres within the acquisition boundary. Of those 5,000 acres approximately 4,000 acres could be RCW habitat. Plum Creek lands are on a 25-30 year rotation. These tracts outside the HCP have been cut or will be cut in the near future. With a 25-30 year rotation none of these lands can be considered RCW habitat under the guidelines.

With the Plum Creek lands not available for the RCWs, TNC's birds are increasingly relying on the refuge's habitat. If and when the Service acquires additional lands, we may have 12,609 acres of RCW habitat with 39 clusters. This provides 323 acres/cluster. With the current land base and looking into the future land acquisition, we are currently maxed out in terms of habitat. This includes no active recruitments of RCWs.

The refuge staff and TNC are concerned about the potential lack of foraging habitat if additional recruitments occur. TNC and refuge have agreed to work closely together regarding RCW management. Everyone recognizes the challenges TNC and the Refuge face in the management of the RCWs. Working together ensures the best possible future outcome for RCWs.

Table 10. A comparison of the Red-cockaded woodpecker Habitat Conservation Plan Guidelines, Private Lands and Federal Standards.

	HCP	MSS* (private)	Recovery(USFWS)
Minimum foraging acres	90	75	120
Partition Acres	100	120	300+
Minimum Basal Area	30 (average not min.)	40	40
Maximum Basal Area	80	80	Not defined
Maximum % Canopy Hardwoods	10	Not defined	30
Minimum Age	25	30	Not defined

*MSS - managed stability standard

UPLAND HARDWOODS/PINE FOREST

SIGNIFICANCE

In southern Arkansas and Felsenthal NWR, upland hardwoods and mixed hardwood/pine forests are becoming an endangered ecosystem upon which many wildlife species depend. Hardwood species such as white oak, southern red oak and cherrybark oak, along with various hickories, are disappearing due to intensive pine management by the forest industry. In fact, the mixed species pine-pine hardwood ecosystem of the West Gulf Coastal Plain is perhaps one of the most imperiled systems in the United States due to massive conversion to short-rotation, pine plantation monoculture by the commercial forest industry. Historically, many upland hardwood and hardwood/pine sites on Felsenthal NWR have been intensively managed for the red-cockaded woodpecker through the use of frequent fire and silvicultural practices that favor pines. These potential upland hardwood/pine areas are unsuitable red-cockaded woodpecker habitat because the sites are relatively small and isolated from existing red-cockaded woodpecker clusters. Therefore, these areas provide an excellent opportunity to restore a declining upland hardwood/pine ecotype. Felsenthal NWR has the potential to provide 3,388 acres of upland hardwood/pine habitat.

These upland hardwood and harwood/pine forests will be used by neotropical migratory birds following the Ouachita River during their spring and fall migrations, as well as nesting prothonotary, Swainson's and worm-eating warblers, Mississippi kites, and wood ducks.

Kentucky Warbler (*Geothlypis formosa*)

The Kentucky warbler is a secretive neotropical migratory songbird that prefers forest habitat with thick, shrubby understory. The Kentucky warbler's breeding range is restricted to the deciduous forests of the eastern United States and the bird migrates to wintering areas in Central America. Breeding bird survey data indicate a serious decrease of 29% (0.9% per year) in Kentucky warbler encounters from 1966 to 2005. The US Fish & Wildlife Service considers this species to be a bird of Conservation Concern because of its declining population trend. Also, the Kentucky warbler is considered a Species of Greatest Conservation Need in the Arkansas State Wildlife Action Plan and a Watch List species by Partners in Flight. It is estimated that nearly 25% of the global Kentucky warbler population breeds in the West Gulf Coastal Plain/Ouachitas Bird Conservation Region and is considered to be a species of Regional Concern and Stewardship. Declining Kentucky warbler population trends are attributed to loss and fragmentation of forest habitat on breeding and wintering grounds. Kentucky warblers nest in mature deciduous forests with dense understory and forest management practices that promote a dense understory and well-developed ground cover will be beneficial.

Swainson's Warbler (*Limnothlypis swainsonii)*

The Swainson's warbler is a neotropical migrant songbird that breeds in dense thickets across the southeastern United States and winters on Caribbean islands and the Yucatan Peninsula. Within its range, the species has a very patchy and discontinuous distribution. Breeding bird survey data for this species are unreliable because of the birds low population densities and because it resides in habitats that are not well sampled by the Breeding Bird Survey. Nevertheless, the species is considered a Bird of Conservation Concern in the West Gulf Coastal Plain by Partners in Flight and the Arkansas State Wildlife Action Plan. Swainsons' warbler population decline has been attributed to loss of hardwood forests on the breeding grounds. Silvicultrual actions on Felsenthal NWR that promote dense understory vegetation and leaf litter will benefit Swainson's warblers.

Worm-eating Warbler (Helmintheros vermivorous)

The worm-eating warbler is a species of concern because if its relatively low breeding density, fragmented breeding distribution, association with mature forests, and its restricted winter distribution in tropical forests. This species breeding range is restricted to the eastern United States where it prefers upland deciduous forests and mixed forests with patches of shrubby understory plants. Worm-eating warblers winter in the Caribbean, Mexico, and Central America. The worm-eating warbler is sensitive to forest fragmentation and is a frequent cowbird host.

Wood Thrush (Hylocichla mustelina)

The wood thrush is neotropical migrant songbird of the eastern deciduous forest. This bird's rapidly declining numbers are attributed to habitat fragmentation on nesting and wintering grounds and cowbird nest parasitism. Wood thrush numbers have declined 55% between 1966 and 2010 (2% per year) based on Breeding Bird survey results. The wood thrush is included on Partners in Flight's Watch List for the United States and Canada and is identified as a Species of Greatest Conservation Need in The Arkansas State Wildlife Action Plan. Wood thrushes breed throughout the deciduous and mixed forests in eastern North America and prefer large block of unfragmented deciduous forest. The wood thrush winters throughout Central America and Mexico.

IDENTIFICATION OF HABITAT REQUIREMENTS

The resources of concern for the upland hardwood/pine ecosystem consist of neotropical migratory songbirds that require large unfragmented areas of forest for migration and nesting. Unfragmented forested habitat is important for adequate breeding success and to avoid nest parasitism by brown-headed cowbirds. Adequate vertical vegetative structure within the canopy, midstory, and understory tend to provide ideal habitat for forest birds nesting and foraging needs.

POTENTIAL REFUGE CONTRIBUTION TO HABITAT NEEDS

Felsenthal NWRs 3,388 acres of upland/pine habitat will provide additional habitat diversity and migration and nesting habitat for many songbirds and other wildlife. Furthermore, these upland hardwood areas are surrounded by or adjacent to bottomland hardwood and upland pine habitats creating a vast area of unfragmented habitat. This habitat type could expand by an additional 4,000 acres if additional lands are acquired from willing sellers with the refuge's approved acquisition boundary.

BOTTOMLAND HARDWOOD FOREST

SIGNIFICANCE

Bottomland hardwood forests occur along rivers and streams throughout the central and southern United States. These forested wetlands provide important habitat for wintering waterfowl, breeding and migrating songbirds, and many other species of wildlife. Bottomland hardwoods often contain a diversity of habitats because of the effect that their undulating topography and variable precipitation cycles have on plant species composition. Unfortunately, much of this once abundant ecosystem has been lost because of land clearing for agriculture and other human uses, a fact that elevates the importance remaining bottomland hardwood forests. Many of the remaining bottomland hardwood systems have been severely altered by man including those within Felsenthal NWR. The

construction of the Felsenthal Lock and Dam increased the water level of the Ouachita River by five feet. The dam causes more frequent backwater flooding and for longer periods of time, often during the growing season. Nevertheless, Felsenthal NWRs bottomland hardwood forest provide excellent habitat for a variety of resident and migratory wildlife.

Forested wetlands are a highly productive environment as a result of water and alluvial deposits. Bottomland hardwoods are described as among the most productive and diverse systems (Klimas et al, 2004). These forested areas are maintained by natural hydrological regimes of alternating wet and dry cycles. The conservation and maintenance of these bottomland hardwood forests are important to maintaining the biological integrity, diversity and environmental health of these systems of which numerous wildlife species depend. Listed below is the priority species representative of these forested wetlands.

Cerulean Warbler (Dendroica cerulea)

The cerulean warbler is a small neotropical migrant songbird that breeds in eastern North American and winters in middle elevations of the Andes Mountains in northern South America. Cerulean warblers have experienced a long-term population decline. Analysis of North American Breeding Bird Survey (BBS) data indicates that over the last 40 years, the decline has been steep and steady at a rate of about -3.0% per year. Primary limiting factors for this species are thought to be habitat loss and degradation on its wintering and breeding grounds. Cerulean warblers are protected under the Migratory Bird Treaty Act. They are also included in the USFWS list of Birds of Conservation Concern for the West Gulf Coastal Plain/Oauchitas and the Mississippi Alluvial Plain. It is also identified as a Species of Greatest Conservation Need within the Arkansas State Wildlife Action Plan. This species has specific habitat preferences on both the breeding and wintering grounds, largely associated with mature deciduous forests having structurally diverse canopies with multiple vegetation layers. Hamel (2000) suggests that cerulean warbler nesting and foraging habitat include canopy gaps intermixed with dominant shade-intolerant trees with expansive, long-limbed crowns that overtop large, individual, shade tolerant trees. Lynch (1981) found that cerulean warbler breeding habitat requirements included closed canopy with scattered, very tall super-emergent trees, a well-defined canopy, and with midstory, shrub, and herbaceous understory present. Mueller et al, (1999) found ceruleans to be sensitive to the amount of area required for suitable breeding habitat and a minimum of 20,000 acres may be required. Felsenthal NWRs 40,000 acres of bottomland hardwoods certainly provides migration habitat for cerulean warblers and may provide breeding and nesting habitat.

Prothonotary Warbler (Protonotaria citrea)

The prothonotary warbler is a neotropical migratory songbird that nests in eastern North America and winters along the coast of Central and South America. The prothonotary warbler is another neotropical migrant songbird whose populations are in significant decline. Breeding Bird Survey analysis shows a significant population decrease of approximately 39% (1.3% per year) from 1966 to 2005. The primary factors responsible for this decline are ongoing loss of mangrove habitats in Central and South America and historic loss of bottomland hardwood forests in North American breeding grounds. The swamps and riparian areas of the southeastern United States are believed to support 96% of the total prothonotary warbler population. Breeding habitat occurs in flooded forests or along water edges of lakes, ponds, and slow-moving rivers and streams. Prothonotary warblers generaly prefer large blocks of mature forsest with little understory and with permanent water. Therefore, the bottomland hardwood forests within Felsenthal NWR that are bisected by miles of rivers, lakes, sloughs, and streams provide critical breeding and nesting habitat for this species.

Prothonotary warblers are one of only two warblers that nest in tree cavities. Nests are typically within 15 feet of standing water and 5-6 feet above ground or water level.

Mallard (Anas platyrhynchos)

The mallard duck is selected as a resource of concern for Felsenthal NWR because of its status as a surrogate for the management of migratory dabbling duck species and because the primary management objective for Felsenthal NWR is to provide high-quality wintering and resident waterfowl habitat. Felsenthal NWR provides important waterfowl foraging and resting habitats within the LMV and serves an integral role in the North American Waterfowl Management Plan (USFWS 1986).

Migrating and wintering mallards have specific habitat requirements and energy needs and habitat conditions on the wintering grounds are connected to successful production on the breeding grounds. During migration and the wintering period, mallards need reliable water, food resources, and sanctuary for a variety of life cycle functions including migration to wintering habitats, fall molt, pair bonding, prebasic molt by females in late winter and spring, and energy deposition prior to spring migration and egg laying.

Bottomland hardwood forests are essential to wintering mallards and are critical foraging and resting habitats that provide high-energy natural seeds and aquatic invertebrates. Forested wetlands are vital to mallards for pair bonding, loafing, sanctuary, thermal cover, and feeding (Reineke et al. 1989).

Because Felsenthal NWR does not have the capability to provide cropland or managed moist-soil habitat, step-down objectives that were established for the refuge in 2010 were entirely comprised of the bottomland forest habitat type which consists of approximately 21,000 acres. Duck-energy days (DEDs) are used to estimate waterfowl foraging habitat and carrying capacity, and are based on the daily energy requirements of mallard ducks. The DED standard value used for the bottomland forest habitat type in the Felsenthal NWR CCP was 156 DEDs/acre, which established a management objective of providing 3,276,000 DEDs annually for the refuge. Mallards and wood ducks make up the largest portion of the DEDs on Felsenthal NWR. It is worth noting that this DED value is thought by many wetland managers to represent a conservative estimate of waterfowl foraging habitat actually available in the bottomland forest type, when resources such as moist-soil vegetation and invertebrates are factored in. Therefore, the refuge's actual DED capability should exceed the stated objective. Besides the value that bottomland forests provide as foraging habitat for waterfowl, they probably play an even more important role by isolating birds during pair bonding, providing thermal protection on cold, windy days, and providing escape cover.

Wood Duck (Aix sponsa)

Wood ducks are year round residents in the forest lands of the United States, including Felsenthal 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 unclear. Population estimates are difficult to obtain because aerial surveys are 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). Wood ducks depend upon forested wetlands for breeding and wintering habitat (Dugger and Fredrickson 2001). Therefore, Felsenthal NWR has the ability to provide excellent breeding, nesting, brood-rearing, and wintering habitat for wood ducks.

Rafinesque's Big-eared Bat (Corynorhinus rafinesquii)

The Rafinesque's big-eared bat is one of the least studied bats in the eastern United States and is federally designated as a species of special management concern. This bat is associated with bottomland hardwoods, and because this habitat has decreased, many biologists are concerned about this bat's status. Many states consider the Rafinesque's big-eared bat to be either threatened or endangered. Rafinesque's big-eared bat has a somewhat sporadic distribution across much of the southeastern United States (Bayless and Clark 2009) and is designated as a federal species of concern (Martin et al. 2002). This species has demonstrated preferences for specific features that do not occur evenly across the landscape, and may account for its sporadic distribution (Carver and Ashley 2008; Gooding and Langford 2004; Trousdale 2011). In southern Arkansas, bottomland hardwood systems, like those found at Felsenthal NWR, seem to be important to Rafinesque's big-eared bat as both roosting and foraging habitat (Clark 1990; Clark et al. 1998; Cochran 1999). Due to the loss of approximately 80% of the bottomland hardwoods in the Lower Mississippi River Alluvial Valley (Tiner 1984), this species has probably been negatively affected. Rafinesque's big-eared bats populations might be declining in Arkansas (Cochran 1999).

An opportunity exists for Felsenthal NWR with its extensive bottomland hardwood forest to provide important habitat for this species of bat. Furthermore, known roost locations have been found on Upper Ouachita NWR for this species (Rice 2009). 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). 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 for this bat species (Gooding and Langford 2004, Rice 2009). Management should be directed towards retention of large snags, promotion and regeneration of baldcypress/tupelo stands (See Table 7), and management for mature bottomland hardwood forests (LMVJV 2007). It should be noted most cypress/tupelo stands are passively managed.

American Black Bear (Ursus americanus)

From 2000 to 2007, refuge staff in cooperation with Arkansas Game and Fish Commission (AGFC), released 55 adult female black bears and 116 cubs at Felsenthal NWR for the purpose of re-establishing a self-sustaining bear population to southern Arkansas. Survival rates of the reintroduced bears were generally high and homing rates were low, but radio tracking ended in 2003 (Wear et al. 2005). Bait-station surveys have been conducted annually; however, the number of bears and the population growth rate remain unknown. Anecdotal evidence such as sightings by the staff and the public suggest a healthy and growing bear population. Various size and age classes of bears are seen in and around the refuge. Sightings of female bears with cubs are common. Refuge managers continue to work with AGFC to secure funding for black bear population surveys that will determine bear population growth rate.

American black bears require space because they are a large mammal with landscape–level needs of food and cover. In the southern United States, preferred black bear habitat is characterized by a mosaic of diverse forest habitats on a landscape scale with limited human intrusion. Sanctuary areas

are important for this species and can function to stabilize the population by protecting a nucleus of reproducing females. Black bears need escape cover in the form of thick, impenetrable understory vegetation. Winter denning habitat is also very important to black bears, particularly for pregnant females. Bears are flexible in their choice of den sites and can den on the ground; however, they often choose the cover provided by root masses, logs, or stumps of large downed trees. The optimal den site of southern black bears is the cavity of a large tree. These elevated den sites are critical in areas with significant winter and spring flooding. Black bears need secure corridors to facilitate dispersal between populations, to make seasonal movements for food, for dispersal of younger animals, and for movements of males during the breeding season. In the South, black bear survival and reproduction are highly influenced by oak mast in the fall. Therefore, forest management that promotes the perpetuation of a diverse and mature oak forest will greatly benefit bears. Felsenthal NWR provides all necessary habitat requirements for black bears. The refuges bottomland hardwoods, upland hardwoods and pines, riparian areas, and swamplands supply year-round food, escape cover, sanctuary, and a variety of den sites including mature cavity trees. Furthermore, Felsenthal NWR plays an important role in broader regional bear management issues by facilitating genetic interchange and dispersal among the regions separated and isolated bear populations. Felsenthal NWR is situated between Arkansas' native black bear population at White River NWR to the north and the federally-threatened Louisiana black bear to the south and east. Genetic analyses and radio telemetry have revealed that White River NWR and Felsenthal NWR bears have dispersed to Louisiana and Mississippi. Genetic interchange has likely already occurred between White River and Felsenthal and Louisiana bears, which could possibly reduce the consequences of genetic drift or inbreeding in the small and fragmented populations there (J. Clark, USGS, unpublished data). Thus, bears from southern Arkansas may play a role in the long-term genetic and perhaps demographic health of the threatened Louisiana black bear and bears throughout the Region. For these reasons, the American black bear has been chosen as a resource of concern.

Pondberry (Lindera melissifolia) (E)

Pondberry is a deciduous shrub that grows in wetland habitats, and is federally listed as endangered. Pondberry grows to approximately 2 meters (6 feet) tall, flowers in late February or March with pale yellow flowers that appear in the spring before the leaves emerge. The oval-shaped fruits are 0.5 inch (12 millimeter) long, and turn from green during the summer to bright red in the fall. Pondberry leaves have a distinct sassafras-like odor when crushed. The most significant threats to this plant are drainage ditching and subsequent conversion of its habitat to other uses. Domestic and feral hogs, cattle grazing, and timber harvesting have also impacted the plants at some sites. Recent surveys failed to find pondberry within Felsenthal NWR, however, the plant does occur within Arkansas Natural Heritage Commission's Coffee Prairie Natural Area. Coffee Prairie is just south of the Felsenthal NWR boundary and is within the refuge's acquisition boundary.

IDENTIFICATION OF HABITAT REQUIREMENTS

The diverse list of resources of concern for the bottomland hardwood ecosystem consists of those species that require or benefit from large unfragmented areas of forest. Adequate vertical vegetative structure within the canopy, midstory, and understory tend to provide ideal habitat for the forest-dependent resources of concern.

POTENTIAL REFUGE CONTRIBUTION TO HABITAT NEEDS

Felsenthal NWR provides nearly 40,000 acres of diverse bottomland hardwood habitat to meet the needs of the chosen resources of concern and many other wildlife species. The diversity among

resources of concern reflects the diversity and importance of bottomland hardwood habitat. Application of the LMJV Forest Working Group forest management recommendations will guide the management of the refuges bottomland hardwood habitat and will conserve prime habitat for the stated resources of concern and many other wildlife species. The refuge expansion would add an additional 20,630 acres of forested wetlands to the refuge (See Figure 10). Taking into consideration the local landscape, this wetland system may exceed 130,000 acres of bottomland hardwood forest.

AQUATIC/RIVERINE HABITAT

SIGNIFICANCE

Aquatic and riverine habitats sustain ecological processes that support a plethora of aquatic and terrestrial organisms including vegetation, wetlands, fish, mussels, amphibians, reptiles, birds, and mammals. Water quality is an important attribute within aquatic habitats. These habitats are utilized for commercial and recreational activities, consumption, irrigation, and industrial uses. Aquatic and riverine habitats are a dominant component of Felsenthal NWR. The most dominant aquatic feature within Felsenthal NWR is the confluence of the Ouachita and Saline rivers; more than 30 miles of the Ouachita River and more than 10 miles of the Saline River flow through Felsenthal NWR. Furthermore, the refuge is bisected by numerous creeks, sloughs, bayous, brakes, swamps, and lakes. We have chosen 3 imperiled freshwater mussel species, the Western Chicken Turtle, and the Alligator Gar as the resources of concern within the refuges aquatic and riverine habitats.

Rabbitsfoot (*Quadrula cylindrica cylindrica*), Pink Mucket (*Lampsilis abrupta*), Winged Mapleleaf (*Quadrula fragosa*)

The presence of diverse and reproducing populations of mussels indicates a healthy aquatic system. Arkansas is home to approximately 85 mussel species. Of these, 14 are federally protected under the Endangered Species Act and 6 are being evaluated for protection. Mussels in Arkansas are primarily threatened from changes to their habitat including the construction and operation of dams and reservoirs on Arkansas rivers. Pollution and sedimentation, especially polluted rainwater runoff from roads and fields is an ongoing threat to native mussels.

Posey (1996) documented mussel beds and species composition within the 33.4-mile portion of the Ouachita River between Felsenthal NWR and the Arkansas-Louisiana line. Posey's findings consisted of 20 major beds and 4 minor beds and 27 mussel species.

Davidson (2015) documented mussel beds and species composition within the 10.8-mile section of the Saline River that flows through Felsenthal NWR. Davidson recorded 31 mussel species, including the endangered Winged Mapleleaf and Pink Mucket. These 31 species were found in 11 major and 2 minor beds.

Recommendations for the management of freshwater mussel species include periodic water quality monitoring, monitoring of sediment loads in known mussel beds, application of best management practices to reduce sediment runoff, and implementation of a mussel monitoring program.

Western Chicken Turtle (*Deirochelys reticularia miaria*)

The western chicken turtle is a semiaquatic species that prefers still to slow-moving aquatic habitats, including swamps, river sloughs, oxbow lakes, and drainage ditches and they are known for making use of temporary aquatic habitats. Western chicken turtles have an historic range that includes

southeastern Missouri, the coastal plain of Arkansas, Louisiana west of the Mississippi River, eastern Texas and southeastern Oklahoma. The Arkansas Game and Fish Commission and Arkansas Natural Heritage Commission consider the chicken turtle to be very rare and at risk of extirpation from the state. The western chicken turtle is identified in the Arkansas State Wildlife Action Plan as a Species of Greatest Conservation Need. Population decline is thought to be caused by habitat loss and degradation. Protection and restoration of wetlands and aquatic habitats is critical for many species, including the western chicken turtle.

Alligator Gar (*Atractosteus spatula)*

The alligator gar is the largest of the 4 species of gar found in Arkansas. Its historic range extended across most large river systems and tributaries from the Gulf of Mexico states upstream into the Ohio River Valley. Historic records suggest that the alligator gar can reach weights and lengths of up to 350 pounds and 10 feet in length; the largest alligator gar collected in Arkansas was over 8 feet long and weighed 240 pounds. They are one of the largest freshwater fishes in North America and are the largest freshwater fish in the Mississippi River Valley and the apex predator in the system. Alligator gar prefer large rivers that have a large overflow floodplain, but these rivers have all but disappeared in North America due to the use of dredging, dams, dikes, and levees.

Recent surveys suggest populations are far below historic levels and could be declining further. In some northern states, they are believed to have been extirpated or reduced in number to non-viable populations requiring reintroductions through stockings. For these reasons they have been identified as an imperiled species by the American Fisheries Society and a focal species of the U.S. Fish & Wildlife Service. Numerous states have already or are in the process of increasing conservation and management through regulations, habitat restoration, and stocking.

In addition to a diminished range, their numbers have also substantially decreased over the past 50 years. Alligator gar were once abundant in many watersheds but are now difficult to find. There are many reasons being considered for their decline including habitat loss resulting from navigation and flood control alteration of streams and flood plains to over-harvesting.

In Arkansas, the US Fish & Wildlife Service, in cooperation with the University of Central Arkansas and the Arkansas Game and Fish Commission, is assessing the status of alligator gar in Arkansas and working cooperatively with the members of the multi-state Alligator Gar Technical Committee under the Southern Division of the American Fisheries Society to determine their status range wide and to promote their conservation, research, and management. The alligator gar is identified in the Arkansas State Wildlife Action Plan as a Species of Greatest Conservation Need.

Recommended conservation actions for the alligator gar include population augmentation, restoration of natural hydrologic regimes, restoration of connectivity of wetland ecosystems, and restrictions on commercial and sport harvest. Furthermore, research and monitoring is needed to determine population status, population distribution, and life history traits.

IDENTIFICATION OF HABITAT REQUIREMENTS

The resources of concern chosen to represent aquatic and riverine habitats on Felsenthal NWR consist of 3 categories (3 aquatic invertebrates, 1 reptile, and 1 fish) of animals with different but overlapping aquatic habitat needs. All resources of concern will benefit from a high-quality, fully-functioning, aquatic/riverine ecosystem. Important habitats for these species include main channel river systems and tributaries, overflow floodplains, and ephemeral wetland sites.

POTENTIAL REFUGE CONTRIBUTION TO HABITAT NEEDS

The diversity of aquatic habitats on Felsenthal NWR and the protection afforded them by the Service increases the likelihood that these resources of concern can persist. The refuge contains every type of habitat necessary to support these animals including over 30 miles of the Ouachita River and more than 10 miles of the Saline River. Also, the refuge is bisected by numerous creeks, sloughs, bayous, brakes, swamps, and lakes. Overflow floodplains and ephemeral wetlands are a common occurrence on Felsenthal NWR. With the potential connection with Upper Ouachita NWR in Louisiana over 58 Ouachita River miles will come under federal protection.

RECONCILING CONFLICTING NEEDS

Mercury contamination and various forms of point and nonpoint pollution sources pose serious threats to water quality, aquatic fauna, and humans who use the refuge. The El Dorado wastewater pipeline remains a potential source of pollution and eutrophication of refuge waters including the permanent pool. Increased eutrophication of the permanent pool could exacerbate the existing problem of nuisance aquatic vegetation to the point that it could become uncontrollable. Aquatic vegetation became established soon after the permanent pool was created and coverage increased rather slowly during the first 10 years of impoundment (1985-1995). During the late 1990's and early 2000's, various aquatic plants spread rapidly throughout the reservoir. By August 2007, over 90% of the off-channel portion of the pool was captured by aquatic vegetation. The extensive coverage of aquatic vegetation has led to a number of negative consequences such as restricted access for boaters and anglers, the creation of an unbalanced fish community due to the effects on predator: prey relationships, and documented fish kills from low dissolved oxygen levels that result from the dense vegetation. Refuge management in cooperation with the AGFC have implemented a 2-part strategy for controlling invasive aquatic vegetation that includes herbicide applications to control submerged aquatic vegetation and the release of triploid grass carp to control submerged vegetation.

Cuban bulrush (*Oxycarym cubense*), a non-native rush from the West Indies and South America, was discovered within the Felsenthal Pool in 2012. Cuban bulrush can be described as a free floating epiphytic plant, as it requires a raft of other aquatic vegetation to attach to. Once Cuban bulrush becomes established on the host vegetation, it rapidly outgrows and eventually kills the other plants creating a monotypic self-sustaining population of Cuban bulrush. Floating mats of Cuban bulrush can occur in freshwater ditches, marshes, ponds, lakes, rivers, and swamps. Mats of Cuban bulrush impede navigation and recreational use by obstructing shorelines and access areas. Beneath the mats, habitat quality for aquatic organisms is degraded by increased organic matter and low dissolved oxygen. Cuban bulrush reproduces sexually through the production of achenes, or more commonly via vegetative means. It was previously described to be a vigorous invasive plant with growth rates similar to giant salvinia and water lettuce. Given its rapid growth rate, ability to out compete native species, and potential means of long distance dispersal; Cuban bulrush will require intensive management and persistent monitoring. Since the discovery of Cuban bulrush on Felsenthal NWR, refuge management has worked closely with Arkansas Game and Fish Commission fisheries biologists who have applied successful experimental herbicide treatments to the plant on portions of the refuge.

CHAPTER IV. HABITAT GOAL AND OBJECTIVES

The habitat goals and objectives are based on the following underlying assumptions that were used to decide the future management direction for the refuge, including the desired habitat conditions (See Figure 20):

- Focal species management would be the best approach for the refuge to contribute to the conservation of continental migratory bird populations, while maintaining, enhancing, and restoring biological integrity, diversity, and environmental health of refuge lands.
- Managing forest habitats is the best approach to meet the habitat requirements of forest interior birds and other resident wildlife, (e.g. black bear).
- Increasing avian diversity and abundance on refuge habitats is best accomplished by conserving, protecting and restoring native plant community cover types.
- Selecting certain focal species as indicator and umbrella species will enable the Refuge to gauge ecosystem function, biological diversity, integrity, and environmental health and adapt management to achieve desired biological responses by these species. In the discussion that follows, we describe the goals, objectives, strategies and associated rationales that we would use to implement these habitat management objectives. The goals are taken directly out of the approved 2010 CCP (USFWS 2010). The objectives are also taken from the CCP (USFWS 2010); however, they are replaced and/or modified based on the proposed Alternative in the environmental assessment.

GOAL 1 (CCP GOAL 2)

Protect, maintain, enhance, and where appropriate, restore suitable habitat for the conservation and management of migratory birds, resident wildlife, fish, and native plants, including all federal and state threatened and endangered species endemic to Felsenthal NWR. (Same as CCP Goal 2).

OBJECTIVE 2.1. UPLAND PINE

Maintain suitable habitat for red-cockaded woodpecker, northern bobwhite, Bachman's sparrow, and brown-headed nuthatch on 75% of all upland pine forest habitat (6,200 acres) that meets the following desired conditions: (USFWS 2003c) (*Replaces CCP Objectives 1.1, 2.2, 2.4, 2.8, 2.9, and 2.10 and Modifies CCP Objective 2.11*):

- There are 45 or more stems/ha (18 or more stems/ac) of pines that are $\geq$ 60 years in age *and* $\geq$ 35 cm (14 in) dbh. Minimum basal area for these pines is 4.6 m^2/ha (20 ft^2/ac). Recommended minimum rotation ages apply to all land managed as foraging habitat.

- Basal area of pines 25.4 – 35 cm (10 – 14 in) dbh is between 0 and 9.2 m^2/ha (0 and 40 ft^2/ac).

- Basal area of pines < 25.4 cm (< 10 in) dbh is below 2.3 m^2/ha (10 ft^2/ac) *and* below 50 stems/ha (20 stems/ac).

- Basal area of all pines $\geq$ 25.4 cm (10 in) dbh is at least 9.2 m^2/ha (40 ft^2/ac). That is, the minimum basal area for pines in categories (a) and (b) above is 9.2 m^2/ha (40 ft^2/ac).

- Groundcovers of native bunchgrass and/or other native, fire-tolerant, fire-dependent herbs total 40 percent or more of ground and midstory plants and are dense enough to carry growing season fire at least once every 5 years.

- No hardwood midstory exists, or if a hardwood midstory is present it is sparse and less than 2.1 m (7 ft) in height.

- Canopy hardwoods are absent or less than 10 percent of the number of canopy trees in longleaf forests and less than 30 percent of the number of canopy trees in loblolly and shortleaf forests. Xeric and sub-xeric oak inclusions that are naturally existing and likely to have been present prior to fire suppression may be retained but are not counted in the total area dedicated to foraging habitat.

- All of this habitat is within 0.8 km (0.5 mi) of the center of the cluster, and preferably, 50 percent or more is within 0.4 km (0.25 mi) of the cluster center.

- Foraging habitat is not separated by more than 61 m (200 ft) of non-foraging areas. Non-foraging areas include (1) any predominantly hardwood forest, (2) pine stands less than 30 years in age, (3) cleared land such as agricultural lands or recently clearcut areas, (4) paved roadways, (5) utility rights of way, and (6) bodies of water.

Resources of Concern: Red-cockaded woodpecker, northern bobwhite, brown-headed nuthatch, and Bachman's sparrow

Table 11. Total area required to support estimated viable populations of the four resources of concern for open pine habitat on Felsenthal NWR.

Species	Minimum viable Population Size (pairs)	Area required to support a viable Population Size (acres)	Recovery Plan Population and Habitat Objectives	WGCPO Population Objectives (pairs)	WGCPO Habitat Objectives (acres)	Felsenthal NWR Proposed Population Objective (pairs)	Felsenthal NWR Proposed Habitat Objective (acres)
Red-cockaded Woodpecker	N/A	N /A	34 Clusters (6,800 acres)	34 Clusters	8,100	13 Clusters	6,200
Northern bobwhite	60	1008	N/A	262,156	4,405,051	360	6,200
Brown-headed nuthatch	28	244	N/A	56,029	491,500	700	6,200
Bachman's sparrow	46	341	N/A	75,622	560,598	828	6,200

Rationale: Open pine management with characteristics described above can generally be described as low canopy cover, low basal area with an herbaceous understory. Open pine habitat provides important habitat for priority bird species and other wildlife. The West Gulf Coastal Plain/Ouachitas Open Pine Landbird Plan (2011) has identified 11 species of conservation concern. Of those 11, four species, red-cockaded woodpecker, Bachman's sparrow, brown-headed nuthatch, and Northern bobwhite, are considered umbrella species. Collectively the habitat requirements of these four species will meet the needs of all priority species within this habitat. Populations and habitat objectives were developed for these species. Table 11 steps those objectives down to refuge level. The management of these areas for open pine habitat is further supported by the open pine decision support model (LMVJV 2011) (Figure 21).

As RCW management is a high priority, the refuge will manage 13-14 RCW clusters on 6,200 acres with no active recruitment on the current fee title lands. The refuge will be striving for 300 acres/cluster (120 acres foraging habitat/cluster) for loblolly pine management. The Pine Island RCW cluster is isolated. Its isolation may inhibit expansion or even contribute to their extirpation (Conner and Rudolph 1991). If this cluster is abandoned or lost, this area will be transitioned to a upland/hardwood forest type as well, further reducing the RCW pine acreage to 5,553 acres. In a nutshell, the uplands on the north and east of the Ouachita River will be managed for hardwoods with a pine component. The upland, south and west of the river will be managed for RCWs (Figure 20).

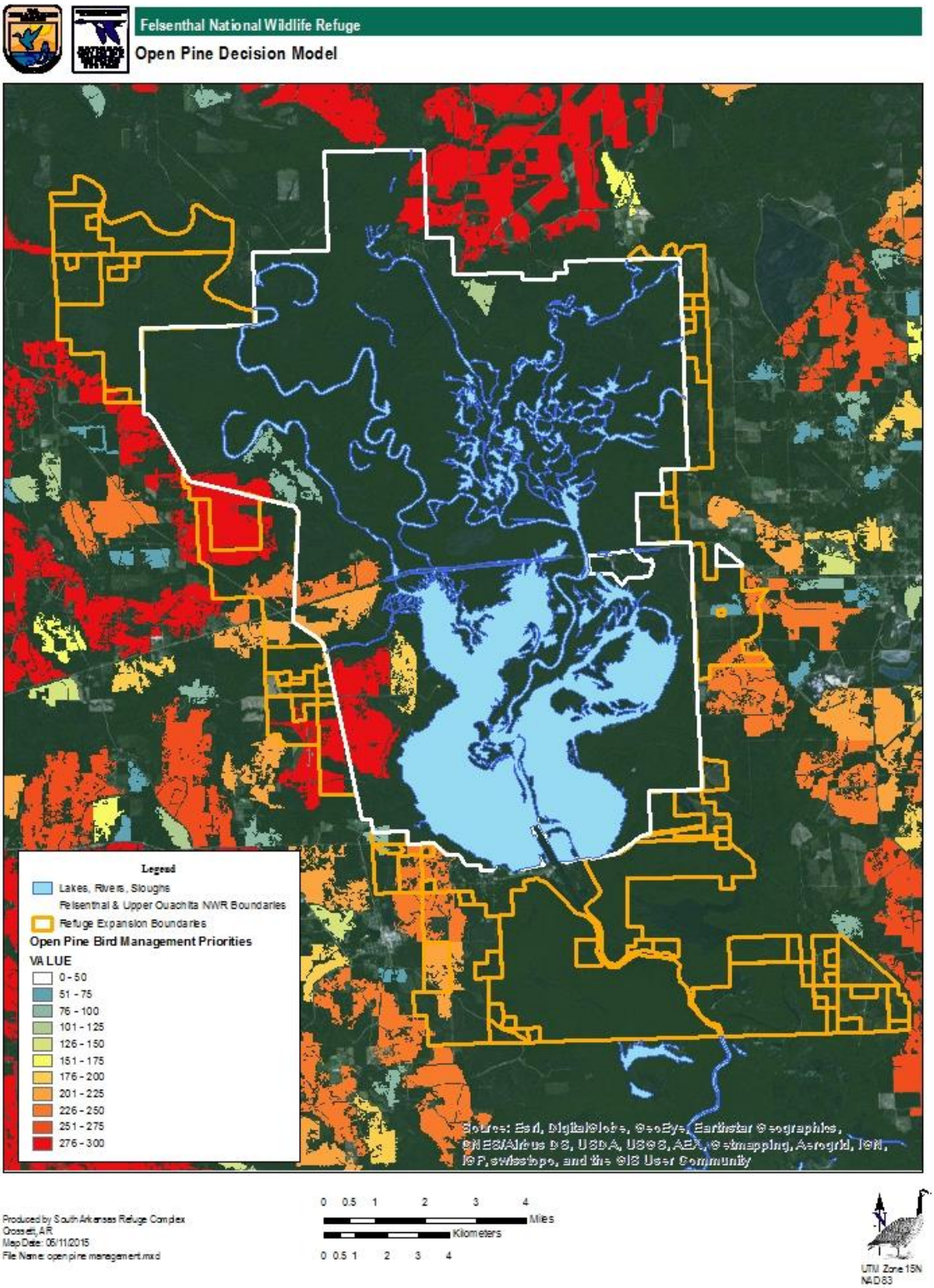
Recently, the Felsenthal/Upper Ouachita NWRs expanded their acquisition boundaries which will ultimately allow for the conservation of more than 177,000 contiguous acres of wildlife habitat. In addition, a total of 75+ RCW clusters will come under federal protection. For Felsenthal NWR, approximately 11,118 acres of upland habitat will be acquired. The refuge's HMP must take into consideration the adjacent population of RCWs.

The Nature Conservancy (TNC) owns 3,609 acres within Felsenthal NWR's acquisition boundary on the west of the Ouachita River. Two thousand nine hundred and sixty-two acres of this land is under a RCW habitat conservation plan (HCP). An additional 647 acres of 15-20 year old pine plantations/hardwood drainages is not covered by the HCP. These 647 acres are not RCW habitat under the current RCW guidelines. The HCP outlines 100 acres/cluster with the goal of 29 clusters on 2,962 acres. Currently, TNC manages 25 active RCW clusters. Figure 16 shows 28-¼ mile (private lands standard) and ½ mile (federal standard) RCW habitat partitions.

In addition, a private landowner owns over 5,000 acres within the acquisition boundary. Of those 5,000 acres approximately 4,000 acres could be RCW habitat. These lands are on a 25-30 year rotation. With a 25-30 year rotation none of these lands can be considered RCW habitat under the recovery plan guidelines.

Taking these factors into consideration, TNC's birds are relying on the refuge's habitat. So the proposed population goal for the refuge will be 14 clusters with a future goal of 39 clusters on 9,162 acres of RCW habitat once the TNC lands are acquired. This includes no active RCW recruitment. If

Figure 21. Potential Habitat for Red-Cockaded Woodpecker on and around Felsenthal National Wildlife Refuge Based on Open Pine Decision Support Model.



the Service is able to acquire all of the lands within the acquisition boundary, we would have 12,609 acres of RCW habitat with 39 clusters; which provides 323 acres/cluster. With the current land base and looking into the future land acquisition, we are currently maxed out in terms of habitat. Careful consideration needs to be given when considering population recruitment actions (artificial cavities, translocations, etc.) to ensure adequate foraging habitat is available.

When taking into consideration the refuge population and adjacent population (Figure 16), one can quickly see the lack of suitable and continuous pine habitat within these partitions. Adding to the issue is the RCWs propensity to be located in close proximity to each other hence competition for the limited pine acres. Throw in loblolly's growth rates and fire sensitivity, plus the lack of adequate regeneration in the RCW partitions, good quality foraging habitat may not be sustainable in the long-term. Management is a spatial and temporal quagmire. For these reasons the population goal has been reduced. It should be noted the population may expand and/or contract due to the juxtaposition of the habitat and clusters. In 2015, two additional clusters may have formed. However several long standing RCW clusters had no known reproduction. The sustainability of the new clusters is yet to be seen.

These four focal species respond well to active forest management. Management, including timber harvest strategies and prescribed fires, are used to produce and sustain suitable open pine habitat. Frequent fires reduce hardwood encroachment and encourage an herbaceous understory. In addition timber harvests can reduce basal area and canopy cover required by these species.

Managing forest landscapes for diversity involves managing patterns of succession. Some successional stages have more species than others. Within the refuge's open pine habitat, the refuge maintains 132 acres of old fields in an early successional habitat. These fields are located near refuge ponds. This habitat provides nesting and brood rearing habitat for turkeys and quail, migrating and wintering habitat for sparrows, and foraging for several bat species.

Adaptive Management Monitoring Elements:

Primary Habitat Response Variables	Probable Assessment Methods
• Forest structure and composition • % hardwood cover in under- and mid-story • Ground cover and landscape position • Landscape analysis	• Forest Inventory Sampling (traditional cruise parameters, e.g. Basal Area (BA), stocking, % cover) • Fire effects monitoring for mid- and understory • Foraging habitat assessments • Vegetation plots
Primary Wildlife Response Variables	**Probable Assessment Methods**
• # of RCW potential breeding groups • Annual RCW nest success • Open Pine Birds (species composition and abundance)	• RCW annual cluster activity checks • Survey for new cavity trees • RCW nest checks • RCW banding activities • Forest landbird Surveys (point counts)

OBJECTIVE 2. 2. UPLAND PINE / HARDWOOD

During the next 15 years, maintain, enhance and restore 3,388 acres upland hardwoods to conserve focal species; e.g. Kentucky warbler, worm-eating warbler, and wood thrush, using sound silvicultural practices to achieve desired forest conditions. Upland hardwood habitat is characterized by the following attributes (*New Objective*):

- Dominated by hard mast species (hickories, southern red oak, post oak, water oak, etc)
- Diversified forest canopy structure
- Dense patches of ground cover
- Patchy midstory

Resources of Concern:

- Kentucky Warbler
- Swainson's Warbler
- Worm-eating Warbler
- Wood Thrush

Rationale:

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 three decades has increased the herbaceous, grassy understory in some areas and has somewhat limited hardwood understory and mid-story.

Upland hardwood forests on and around the refuge are rare today and are greatly diminished from their historic distribution in south Arkansas. Bragg (2003) noted in the review of the GLO surveys that only 17% of the witness trees were pine and much of the area above the overflow was dominated by hardwoods, often interspersed with loblolly and shortleaf pine. He also noted that good hardwood sites, especially those close to bottomlands, often yielded very large witness trees. It is basically impossible to determine the exact forest composition using GLO records for a variety of reasons. However, it is not hard to derive from multiple sources and scientific reasoning that hardwoods were a large part of the upland system in and around Felsenthal NWR. Unfortunately, little attention seems to be given to the decline of upland hardwoods (mostly due to the focus on bottomland hardwood forested wetlands). Animal species associated with this habitat type include wood thrush, worm-eating warbler, eastern spadefoot toad, Louisiana waterthrush (*Seiurus motacilla*), and Chuck-will's-widow. For these reasons upland hardwood forest will be retained and restored as much as possible on Felsenthal NWR outside of the red-cockaded woodpecker foraging habitat.

Felsenthal 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 on 3,388 acres. These 3,388 acres will be transitioned or restored to upland

hardwood/pine and we will reduce or eliminate fire within these converted acres. Upland hardwood/pine is the historic condition of the converted area and is further supported by the open pine management decision model (See Figure 21).

Adaptive Management Monitoring Elements:

Primary Habitat Response Variables	Probable Assessment Methods
• Forest structure and composition • Forest Health and productivity	• Forest Inventory sampling (traditional cruise parameters, e.g. BA, overstory, % cover, midstory cover)
Primary Wildlife Response Variables	**Probable Assessment Methods**
• Forest Breeding Birds (species composition and abundance)	• Breeding landbird surveys (point counts)

OBJECTIVE 2.3. BOTTOMLAND HARDWOODS

Protect, maintain, enhance, and restore forested wetland cover-types with less than 10% invasive species to support species of management concern listed below by providing desired forest conditions as outlined by the LMVJV Forest Resource Working Group (Table 12) (*Modifies CCP Objectives 2.1, 2.5, and 2.11, and Replaces Objectives 2.8, 2.9, and 2.10*).

Table 12. Desired stand conditions for bottomland hardwood forests within the Mississippi Alluvial Valley.

Forest variables [1]	Desired stand structure	Conditions that may warrant management
Primary Management Factors		
Overstory canopy cover	60 – 70 %	>80%
Midstory cover	25 – 40 %	<20% or >50%
Basal area	60 – 70 ft^2 / acre with ≥25% in older age classes[2]	>90ft^2 / acre or ≥60% in older age classes
Tree stocking	60 – 70 %	<50% or >90%
Secondary Management Factors		
Dominant trees[3]	>2 / acre	<1 / acre
Understory cover	25 – 40%	<20%
Regeneration[4]	30 – 40% of area	<20% of area

Forest variables [1]	Desired stand structure	Conditions that may warrant management
Coarse woody debris (>10 inch diameter)	≥200 ft³ / acres	<100ft³ / acre
Small cavities (<10 inch diameter)	>4 visible holes / acre **or** >4 "snag" stems ≥4 inch dbh **or** ≥2 stems >20 inch dbh	<2 visible holes / acre **or** <2 snags ≥4 inch dbh **or** <1 stem ≥20 inch dbh
Den trees/large cavities[5] (>10 inch diameter)	1 visible hole / 10 acres **or** ≥2 stems ≥26 inch dbh (≥8 ft² BA ≥26 inch dbh)	0 visible holes / 10 acres **or** <1 stem ≥26 inch dbh (<4 ft² BA ≥ 26 inch dbh)
Standing dead and/or stressed trees[5]	>6 stems / acre ≥10 inch dbh **or** ≥2 stems ≥20 inch dbh (>4 ft² BA ≥ 10 inch dbh)	<4 stems ≥10 inch dbh / acre **or** <1 stem ≥20 inch dbh (<2 ft² BA ≥ 10 inch dbh)

(LMVJV Forest Resource Conservation Working Group. 2007. Restoration, Management, and Monitoring of Forest Resources in the Mississippi Alluvial Valley: Recommendations for Enhancing Wildlife Habitat. Edited by R. Wilson, K. Ribbeck, S. King, and D. Twedt.)

Resources of Concern:

- Cerulean Warbler
- ProthontaryWarbler
- Mallard
- Wood Duck
- Rafinesque's Big-ear Bat
- American Black Bear
- Pondberry (E)

Rationale:

Since the establishment of refuge, it has provided migratory and wintering bird habitat. Bottomland hardwood forests are very productive as a result of abundant water and alluvial deposits. These riverine systems are maintained by the natural hydrologic cycles of wet and dry periods. These forests contain a diversity of species.

These forests are heavily impacted by anthropogenic changes. Hydrologic regimes have been altered with navigation and flood control projects, levees and roads, and ditches. These changes have altered timing, duration depth, and frequency of flood events. Hydrologic processes underlie the plant communities of the forest system.

Restoration and maintenance of these bottomland hardwood forests are important to maintain biological integrity and to support wildlife populations. Forest structure and species diversity are important to a variety of wildlife. It is well documented that forest interior songbirds benefit from

vertical structure within forested environments. Wintering waterfowl benefit from hard mast produced from certain species within the bottomlands. Bats use foraging habitat within the open areas near water bodies and benefit from diurnal and maternal roosting sites provided by large cavity trees. American black bear benefit from trees that provide large cavities for den locations. This objective will achieve a diverse forest with areas of thick understory, as well as, areas of well-developed midstory and overstory to produce hard and soft mast, and provide snags and cavities.

Adaptive Management Monitoring Elements:

Primary Habitat Response Variables	Probable Assessment Methods
• Forest Composition, structure, and regeneration • Forest habitat components (snags, coarse woody debris, cavities) • Forest stand distribution	• Forest Inventory sampling (traditional cruise parameter and habitat components) • GIS stand mapping and harvest records • Regeneration plots
Primary Wildlife Response Variables	**Probable Assessment Methods**
• Forest breeding birding birds (species composition and abundance) • Bat use of forests and cavities • Wintering waterfowl use	• Breeding landbird surveys (point counts) • Cavity checks, mobile acoustical bat surveys • Waterfowl counts (bi-weekly Nov-Feb)

OBJECTIVE 2.4. FORESTED WETLANDS (WATER MANAGEMENT/SANCTUARIES)

Mimic natural hydrological processes to enhance and restore forested wetlands to meet the needs of wetland dependent migratory birds including wintering waterfowl and forest breeding birds (Replaces CCP Objective 2.3 and modifies CCP Objective 2.5).

Rationale: For approximately 20 years, the bottomland hardwood forest within Felsenthal NWR was intentionally flooded in the fall and winter to provide habitat for migrating and wintering waterfowl. This GTR-type management involved raising the gates of the Felsenthal Lock and Dam an additional 5 feet to increase the permanent pool elevation from 65'msl to 70'msl and inundating 21,000 acres of forest. This strategy was justified at the time because early reports on the effects of GTR management indicated either no impacts or positive impacts of the flooding regime on tree health and mast production (Merz and Brakhage 1964; Broadfoot 1967). However, later studies demonstrated long-term negative impacts of GTR management on forest composition, structure, and health (Malecki et al. 1983; Young et al. 1995; King and Allen 1996; King et al. 1998; Fredrickson 2005; Gray and Kaminski 2005; Ervin et al. 2006), including a shift to more flood-tolerant species and reduced woody species regeneration. In fact, site specific data collected by the US Geological Survey on the effects of long-term flooding of the bottomland hardwood forest within Felsenthal NWR indicate increased tree stress, increased mortality rates, decreased tree vigor, inadequate advanced regeneration, and forest composition that is shifting to the most water-tolerant tree species and a severe decline in red oak species (Allen 1992; King 1995; Allen et al. 1996; King et al. 1998; Keeland et al. 2010). The losses of red oak species (willow oak and Nuttall oak) are particularly alarming because these 2 species provide palatable acorns of high energy, and ideal size for mallard and

wood duck consumption (Barras 1993). The primary objective of the refuge is to provide high-quality wintering and resident waterfowl habitat, therefore these changes are unacceptable.

Traditional GTR management involves impounding a stand of bottomland hardwood forest with a low levee system and water control structures and then artificially or naturally flooding the impounded area to provide waterfowl habitat. Flood water is released from the impounded area after waterfowl migrate to the nesting grounds. Felsenthal NWRs GTR-management strategy involved gradually raising the water level to 70'msl beginning as early as November 1, holding water at this level for a few weeks, and then gradually lowering the water to reach 65'msl by early March. However, as noted by King et al. (1998) this schedule was often altered because heavy rainfall prevented dewatering and floodwaters typically remained until spring or early summer growing seasons. This spring/early summer flooding often increased the pool level to 75'msl and above because artificially maintaining high water levels during winter exacerbated the effects of late winter/early spring flooding and resulted in floods lasting longer into the growing season than would have occurred had the area not been artificially flooded during the winter (King and Allen 1996). Therefore, the nature of managed and natural flooding at Felsenthal NWR does not lend itself to successful GTR management. Continuing attempts at traditional GTR-type management at Felsenthal NWR will negatively affect long-term habitat integrity of the bottomland hardwood forest and conflicts with the BIDEH policy.

If proper GTR management is possible, it must mimic natural hydrologic cycles. Natural flooding is inherently dynamic and characterized by variation in timing, duration, and depth of flood events and includes years without flooding. The years without flooding are critical for ensuring woody plant regeneration and improving overall forest health. Often, successive dry years are necessary to ensure advanced regeneration of red oak species. Since 2010, managers at Felsenthal NWR have chosen to not intentionally flood the refuges bottomland forest in an effort to improve overall forest health and facilitate advanced red oak regeneration. Interestingly, in the 5 years that the bottomland forest was not intentionally flooded, natural flooding occurred for several days each year providing valuable wintering habitat for waterfowl. Furthermore, the staff has documented substantial advanced red oak regeneration as a result of no artificial flooding. Therefore, it is clear that the optimal strategy for restoring forest health, providing high-quality wintering waterfowl habitat, and healthy habitats for many other forest-dependent wildlife species is to discontinue artificial/intentional flooding of the forest and allow natural flooding to occur on the refuge.

As quality wetland habitats become smaller and scarcer, and continental populations of waterfowl decline, the issue of human disturbance becomes increasingly important. These disturbances cause birds to leave quality habitats and negatively affect foraging and behavioral interactions. Therefore, a critical component of waterfowl management on Felsenthal NWR is the provision of waterfowl sanctuary. Wintering waterfowl need access to areas that are free from human disturbance to complete seasonal and annual life cycle events such as feeding, resting, molting, and pair bonding for reproduction. Currently, Felsenthal NWR provides approximately 9,050 acres of waterfowl sanctuary. The current sanctuary was established two decades ago under the water management scheme that involved intentionally flooding 21,000 acres of bottomland hardwood forest annually, a practice that inundated 7,444 acres of refuge waterfowl sanctuary. Since 2010, in an effort to emulate natural flooding and to improve forest health, refuge managers have not intentionally flooded the GTR. As noted above, this decision to not flood the GTR has had a positive effect on forest health and forest regeneration. However, when water levels measured on the Ouachita River at the Felsenthal Lock and Dam remain at the summer pool level (65'msl), then only 3,183 acres of the 9,050-acre waterfowl sanctuary are inundated. Therefore, most of the current waterfowl sanctuary is not suitable waterfowl habitat. Not intentionally flooding the GTR and allowing only natural flooding cycles requires a relocation of the waterfowl sanctuary to a portion of the refuge that will provide consistent waterfowl habitat at the 65'msl water level.

Resources of Concern:

Wintering Waterfowl

Adaptive Management Monitoring Elements:

Primary Habitat Response Variables	Probable Assessment Methods
• Water level by date • Forest Health Assessment (tree growth, mortality, etc.) • Forest structure, composition, and regeneration • Level of disturbance (frequency/degree)	• Corps of Engineer gauges (daily) • Continue GTR Monitoring Study • Forest Cruise/inventory sampling • Regeneration sample plots • Law Enforcement logs • GIS Mapping
Primary Wildlife Response Variables	**Probable Assessment Methods**
• Wintering Waterfowl Use • Forest Breeding Bird (species composition and abundance)	• Waterfowl counts bi-weekly (Nov – Feb) • Breeding Landbird Surveys (point counts)

OBJECTIVE 2.5. MOIST SOIL/FELSENTHAL POOL DRAWDOWN

Create a mosaic of habitat structural diversity across 4,000 acres of wetland habitat to contribute the energy requirements for migrating and resident shorebirds and waterfowl once every three years through the drawdown of the Felsenthal pool *(Modifies CCP Objective 2.5, 2.6, 2.7, and 2.12)*.

Seasonal objectives will include the following habitat condition targets and acreage:

- Fall shorebirds (July 1 to September 30): Provide 500 to 1,000 acres of various wetland habitats consisting of shallow water depths to mudflat (1 to 6 inches) with little to no vegetation (less than 15 percent coverage) as supplemental feeding and roosting areas for fall migrants.

- Migrating and wintering waterfowl: Provide 3,000 acres of feeding and resting habitats by conducting a slow drawdown and re-flooding regimes within moist-soil areas to provide natural foods dominated by wild millet, panic grasses, sprangletop, nutsedge, and smartweeds with various water depths ranging from 4 to 12 inches. These areas will consist of predominately annual emergent moist-soil vegetation with patches of perennials and open water areas, created from gradual drawdown and re-flood schedules.

Rationale:

In 1995, the refuge and Corps of Engineers conducted a one foot drawn down of the Felsenthal Pool. On July 1, the pool was lowered one-tenth foot increments each day until the 64.0’ msl pool was

reached. The pool was then gradually flooded around November 1 until it reached 65' msl. The drawdown was viewed as a complete success. Plant response was excellent, and the staff estimated no less the 310,000 ducks utilizing the refuge in late November, 1995.

Hemi-marsh and native vegetation management provide broad cover and optimal food resources, resulting in the best habitat management outcomes for migrating, staging and wintering waterfowl. Areas managed to create shallow water levels, native emergent patches, and a hemi-marsh condition provide habitat conditions for waterfowl use throughout the fall migrating and wintering periods to sustain the annual life cycle requirements of waterfowl (Bookhout et al. 1989). The emergent plant component is a 50:50 mix of emergent stands and open water, and consists of a wide diversity of native annual moist-soil plants, such as wild millet, panic grasses, sedges, sprangletop, smartweeds, spikerushes, and beggarsticks. Managing native vegetation in the form of moist-soil crops has more benefits for waterfowl than managing agricultural crops.

Howard and Wells (2007) noted future drawdowns of the Felsenthal pool would likely increase food quality and quantity for waterfowl species. Although the encroachment of woody vegetation also increased during the drawdown, fluctuating drawdown cycles (once every three years) should subject these seedlings to flooding stress.

Although managed areas may deviate from the historic natural conditions in a wetland area, they constitute a management option that is consistent with the BIDEH policy. Effectively managed moist soil areas can contribute to diversity on the local scale, and can contribute to the landscape-scale conservation of species, which concentrate during migration and winter. Current estimates of waterfowl carrying capacity within managed moist soil habitats, expressed as duck energy days/ac (DEDs/ac), is 1,868 DEDs/ac (Reinecke and Kaminski 2006). A 1-foot drawdown of Felsenthal NWR's permanent pool will result in 4,000 acres of moist soil vegetation and an additional 7,472,000 DEDs. For comparison, Felsenthal NWRs 21,000 acres of flooded bottomland hardwoods yield 3,276,000 DEDs (156 DEDs/ac). Therefore, the drawdown and subsequent moist soil vegetation response will be a substantial benefit to waterfowl. Water level manipulation is intended to mimic natural hydrological regimes in a controlled and enhanced manner to maximize plant production. Periodic drawdowns may also alleviate stress to the bottomland hardwood forest during the growing season.

Resources of Concern:

Wintering Waterfowl
Migrating Shorebirds

Adaptive Management Monitoring Elements:

Primary Habitat Response Variables	Probable Assessment Methods
% herbaceous cover. (desirable/non-desirable)	• Herbaceous cover plots (X samples/season)
Primary Wildlife Response Variables	**Probable Assessment Methods**
• Fall shorebird use, composition and abundance • Wintering waterfowl use, composition and abundance	• Weekly shorebird surveys • Waterfowl counts (biweekly Nov- Feb)

OBJECTIVE 2.6. WATER QUALITY FOR TRUST FISHERY RESOURCES, MIGRATORY BIRDS, AND RESIDENT WILDLIFE

Maintain the Felsenthal Pool and other aquatic habitats with less than 10% invasive species for interjurisdictional fish species, threatened and endangered species, and improve water quality to perpetuate fish and migratory bird resources. *(Modifies CCP Objective 2.12)*

Rationale:

A portion of the 15,000 acre Felsenthal Pool, a reservoir impounded by the creation of the Ouachita-Black River Navigation Project, is less than 1 meter in depth, making it ideal for the growth of aquatic vegetation. Due to the shallow nature of the reservoir, native aquatic vegetation became established soon after impoundment. However, coverage increased relatively slowly during the first 10 years following impoundment (1985-1995). Then, during the late 1990s and early 2000s, macrophyte species such as fanwort, American lotus, fragrant water-lily, duckweeds, and various marginal plant species began to spread rapidly throughout the reservoir. By 2004, almost all of the 10,000 acres impounded in 1985 were completely captured by aquatic vegetation. Then, in 2004, hydrilla was discovered at Felsenthal NWR, which began to colonize deeper water than the native species previously noted. Hydrilla became established in backwater areas, as well as, along the Ouachita River channel. Its spread over the last 4-years has been rapid, and the consequences have been severe. Although no quantitative estimates have been made, it is estimated that as of August 2007, more than 90 percent of the off-channel portions of the Felsenthal Pool are captured by aquatic vegetation seasonally.

The majority of the Felsenthal Pool is inaccessible to anglers and other boaters during the summer and fall months, due to nuisance aquatic vegetation. Consequently, accessible areas are highly congested. This has caused visitation by anglers to decrease by almost 50 percent since 2004, from around 400,000 trips/year to 200,000 trips/year (USFWS unpublished data). The social and economic consequences of this decline in visitation to the three counties surrounding the refuge are likely quite significant.

Aquatic plants may be controlled by chemical, biological, and/or mechanical means. The U.S. Army Corps of Engineers (USACE) is charged with maintaining a 9 foot navigation channel. Drawdowns can be effective in controlling undesirable vegetation as long as the navigation channel is maintained. Biological control methods are preferred because they are relatively inexpensive and long-lasting (Beyers and Carlson 1993). Grass carp are the most commonly used fish species for aquatic vegetation control in the United States (Chilton and Muoneke 1992). These fish are herbivorous, and when stocked at appropriate rates, have proven to be extremely effective at controlling or eliminating unwanted aquatic vegetation. Stott et al. (1971) and Shireman (1982) reported that the use of herbicides to control nuisance submerged aquatic vegetation was 6 and 14 times more expensive, respectively, than using grass carp. Chilton and Muoneke (1992) suggest that an integrated approach, where herbicide treatments are combined with grass carp stocking, may be the most effective means of aquatic vegetation control.

An experimental herbicide treatment was conducted by the Service and the AGFC during 2000-2002. Numerous plots throughout the reservoir, ranging in size from 2 to 20 acres, were treated with herbicides to assess their effectiveness at clearing small areas for fishing as well as boat lanes to access these areas. Some areas were covered with emergent species such as American lotus and water-lilies, while most areas were choked with fanwort. Herbicide treatment of the emergent species

was highly successful, and some areas remained free of vegetation for almost 3 years. However, treatment of the submerged vegetation was unsuccessful in almost all areas. The continuous flow of water through the reservoir prevented the systemic herbicides from being effective at treating the submerged species. In some areas where emergent species were eliminated, submerged species such as fanwort became established in their place. Managers concluded that small-scale herbicide treatments were not effective for submerged aquatic vegetation control on the Felsenthal Pool.
The AGFC has recommended reducing the aerial coverage of aquatic vegetation to 50 percent of the off- channel portions of the Felsenthal Pool, using an integrated, adaptive approach that includes triploid grass carp stocking and herbicide applications. In 2006-2007, the AGFC conducted a telemetry study to determine if triploid grass carp would stay within the confines of the refuge. Forty-eight fish were implanted with radio transmitters and radio tracked for a 1year period. During this time, the fish were tracked between 1 and 4 times each month. The results showed that no fish moved south of the refuge through the lock and dam system, even though the gates on the lock and dam were open for an extended time period. All radio-marked fish remained in the boundaries of the refuge except for two fish, which moved north of the refuge. Based on the results of this study, it was decided that most fish would remain within the refuge boundary and stocking should be conducted.

To control the submergent macrophytes (hydrilla, fanwort, etc.), triploid grass carp should be stocked at a rate of 10 triploid, yearling grass carp per acre, with additional stockings in subsequent years to maintain this density. As noted in numerous AGFC sampling reports, diploid grass carp have been stocked throughout the Felsenthal Pool watershed, and are known to currently inhabit the reservoir in low densities. However, because Felsenthal NWR is controlled by the Service, and due to its close proximity to the Louisiana state line, it is recommended that triploid grass carp be stocked in this system. Emergent macrophytes (American lotus, fragrant water-lily, etc.) should be controlled with periodic applications of species-appropriate herbicides, applied in historically open water areas of the refuge.

Mercury contamination and various forms of point and nonpoint pollution sources pose serious threats to water quality, aquatic fauna, and humans who use the refuge. The El Dorado wastewater pipeline remains a potential source of pollution and eutrophication of refuge waters including the permanent pool. Increased eutrophication of the permanent pool could exacerbate the existing problem of nuisance aquatic vegetation to the point that it could become uncontrollable. Aquatic vegetation became established soon after the permanent pool was created and coverage increased rather slowly during the first 10 years of impoundment (1985-1995). During the late 1990's and early 2000's, various aquatic plants spread rapidly throughout the reservoir. By August 2007, over 90% of the off-channel portion of the pool was captured by aquatic vegetation. The extensive coverage of aquatic vegetation has led to a number of negative consequences such as restricted access for boaters and anglers, the creation of an unbalanced fish community due to the effects on predator : prey relationships, and documented fish kills from low dissolved oxygen levels that result from the dense vegetation. Refuge management in cooperation with the AGFC have implemented a 2-part strategy for controlling invasive aquatic vegetation that includes herbicide applications to control submerged aquatic vegetation and the release of triploid grass carp to control submerged vegetation.
Cuban bulrush (*Oxycarym cubense*), a non-native rush from the West Indies and South America, was discovered within the Felsenthal Pool in 2012. Cuban bulrush can be described as a free floating epiphytic plant, as it requires a raft of other aquatic vegetation to attach to. Once Cuban bulrush becomes established on the host vegetation, it rapidly outgrows and eventually kills the other plants creating a monotypic self-sustaining population of Cuban bulrush. Floating mats of Cuban bulrush can occur in freshwater ditches, marshes, ponds, lakes, rivers, and swamps. Mats of Cuban bulrush impede navigation and recreational use by obstructing shorelines and access areas. Beneath the mats, habitat quality for aquatic organisms is degraded by increased organic matter and low dissolved oxygen. Cuban bulrush reproduces sexually through the production of achenes, or more

commonly via vegetative means. It was previously described to be a vigorous invasive plant with growth rates similar to giant salvinia and water lettuce. Given its rapid growth rate, ability to out compete native species, and potential means of long distance dispersal; Cuban bulrush will require intensive management and persistent monitoring. Since the discovery of Cuban bulrush on Felsenthal NWR, refuge management has worked closely with Arkansas Game and Fish Commission fisheries biologists who have applied successful experimental herbicide treatments to the plant on portions of the refuge.

The presence of diverse and reproducing populations of mussels indicates a healthy aquatic system. Felsenthal NWR contains approximately 37 river miles of mussel habitat, supports 36 mussel beds, and is home to 2 endangered mussels and 1 proposed threatened mussel species. Implementation of best management practices to reduce sediment runoff from trail maintenance and forest management activities will further improve water quality within the refuge. Execution of these management strategies decreases siltation, pollution, and subsequently improves habitat quality for mussels and other aquatic life.

Resources of Concern:

- Rabbitsfoot (T)
- Pink Muckett (E)
- Winged Mapleleaf (E)
- Western Chicken Turtle
- Alligator Gar

*() E - endangered and T – Threatened

Adaptive Management Monitoring Elements:

Primary Habitat Response Variables	Probable Assessment Methods
• Presence and Abundance of invasive and exotic species • Water Quality	• Invasive and noxious species mapping • Every five years conduct water quality assessments
Primary Wildlife Response Variables	**Probable Assessment Methods**
• Mussel bed abundance, size and composition • Fisheries composition, abundance, and size distribution	• Every 10 years conduct mussel surveys • Support the State's fisheries inventories

CHAPTER V. HABITAT MANAGEMENT STRATEGIES

INTRODUCTION

The refuge is divided into 47 habitat management units (See Figure 6) delineated into manageable blocks of habitat. These units or compartments may have several different distinct habitat types (sand prairie, open field, bottomland hardwood, upland pine, etc.) within each compartment. Because most compartments have multiple habitat types, we have listed all of the potential management strategies that may occur in each compartment.

ADAPTIVE MANAGEMENT

USFWS advocates improving habitat management through adaptive management (http://www.fws.gov/policy/620fw1.html). The Service defines adaptive management as "the rigorous application of management, research, and monitoring to gain information and experience necessary to assess and modify management activities. A process that uses feedback from refuge research and monitoring and evaluation of management actions to support or modify objectives and strategies at all planning levels." As such, it is imperative that the impact of forest and openland management decisions be evaluated with regard to habitat conditions and wildlife response.

POTENTIAL FOREST HABITAT MANAGEMENT STRATEGIES

Silvicultural methods will vary across the landscape to produce the desired forest condition best suited to the site. Determining the treatment methods needed to produce the desired habitat will depend upon the site conditions. Enhancement, maintenance, and/or restoration of these communities will require multiple treatments over time and include commercial harvest operation, non-commercial operations, and fire to create and maintain the desired forest conditions for each forest type**.**

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, when feasible, to meet desired 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 may be used on a small scale when commercial operations cannot meet refuge objectives and sufficient funding is available.

The objectives of Felsenthal NWR dictate the necessity of active forest management. The current conditions represent an altered state from the natural system, and if left to passive management would perpetuate an undesirable forest in terms of the refuge objectives. Disturbance factors such as fire, ice storms, and flooding were common place on the landscape historically. Benefits to active management include increased mast production, release of dominant trees that will be more prone to cavity development, production of understory cover and forage, development of midstory canopy, and development of forest diversity in terms of species composition and structure.

Commercial Timber Harvest Strategies

Commercial timber harvest is the most economical method to manage forest to meet habitat objectives of the refuge. The cost to the refuge associated with non-commercial treatments is much

higher than commercial treatments in terms of manpower and funding. However, there are conditions where commercial operations are not feasible and/or cannot meet refuge objectives.

Depending on the existing stand condition and desired outcome there are harvest strategies that can be utilized to meet the forest management objectives described in the refuge CCP/HMP for bottomland hardwood forest. The silvicultural methods are:

Free-thinning – The removal of trees to control stand spacing and favor desired trees, using a combination of thinning criteria without regard to crown position. Free-thinning, is a removal method aimed primarily at controlling the growth, structure, and composition of stands by manipulating stand density. Free-thinning targets trees in both the overstory and midstory. The intended effect of thinning on the refuge is to create habitat by opening the forest canopy, reducing basal area (e.g., for RCW foraging habitat), releasing trees from competition to improve growth, promoting regeneration, and modifying species composition within a stand. Free-thinning is generally implemented by individual tree selection by refuge staff with tree removal by commercial timber operation. Hack-and-squirt herbicide applications, girdling of tree, and other staff level efforts serve as alternatives for sites having low commercial potential. Due to the specific tree selection, free-thinning is particularly well suited to providing the positive effects of overstory removal, while allowing retention of specific trees with wildlife values. This method is expected to be beneficial to RCW, with both short-term (reduction of hardwood midstory) and long-term (improved basal area, decreased overstory, and tree species composition) benefits. This method does not strongly promote regeneration of the forest.

*Variable Retention Harvest***-** Forest management that removes forest canopy through thinning and/or group selection harvests with the intensity of canopy removal differing spatially within a stand. Trees are retained to meet specific ecological objectives such as maintaining structural heterogeneity or protecting biological legacies (Mitchell and Beese 2002) and not solely to maximize their growth potential.

Crown Thinning **–** The removal of trees from the dominant and co-dominant crown classes in order to favor the best trees of those same crown classes.

Low Thinning – The removal of trees from the lower crown classes to favor those in the upper crown classes.

Group Selection – In an uneven-aged forest management system, a regeneration method that involves the clearing of forest in group cuts or corridors throughout the stand with a focus on providing sufficient light to stimulate development of understory vegetation and regeneration of shade-intolerant species. Although there is not an acreage or dimension specification on opening size, width of cuts generally do not exceed more than two times the height of the dominant forest.

Selection Thinning – The removal of trees in the dominant crown class in order to favor the lower crown classes.

Seed Tree Harvests - The classic seed tree harvest method of regeneration leaves a small number of widely dispersed trees to provide a seed source for regeneration. Though there is not an official number of trees per acre (TPA) associated with this type harvest, an estimate of TPA to target would be between 4 and 10 TPA. This method can be used to promote regeneration of light seeded species (i.e., ash, loblolly pine), but it is not suitable for the heavy seeded hardwood mast trees (Johnson and Krinard 1976). The biological legacies of the leave trees provide structural heterogeneity, creation of microhabitats, and species diversity. Impacts of seed tree harvest on wildlife can be similar to that of clearcuts.

Seed Tree with Reserves – Some or all of the seed trees from a seed tree harvest are retained after regeneration has become established to attain goals other than regeneration.

Shelterwood Harvests – The cutting of most trees, leaving those needed to produce sufficient shade to produce a new age class in a moderated micro-environment. Shelterwood harvests are normally defined as a three stage harvest with the first harvest being an optional prepatory cut to enhance conditions for seed production. The second harvest is an establishment cut to prepare the seed bed and to create a new age class. The third and final harvest is a removal cut to release established regeneration from competition with the residual trees. This third harvest can be done uniformly across the stand (uniform shelterwood), in groups or patches (group shelterwood) or in strips (strip shelterwood). During the initial years following the first harvest, residual trees may serve as habitat for RCW until regenerating trees become established.

Shelterwood with Reserves **–** A method that retains some or all of the shelterwood trees after regeneration has become established to attain goals other than regeneration. As regeneration advances, thinnings can be used to maintain the stand in desired conditions.

Pre-commercial Thinning - Is the thinning of young even-aged groups of trees to encourage tree growth and forest structure development. This method can be quite expensive because all costs of implementation are incurred by the refuge, rather than by a commercial operation. Several ways exist to pre-commercial thin:

- Manual techniques employ crews using a wide range of cutting tools including long handle shears, chainsaws, and brush saws to lower stand density and is general efficient only in small areas.
- Mechanized techniques employ a variety of heavy machinery for severity and/or mulching thinned trees. This thinning technique can include mowing, mulching, disking, or chopping.
- Chemical techniques employ a variety of herbicide formulations applied to thinned trees by injections, cuts, or sprays.
- Aerial or ground based spraying of herbicides could be used to control unwanted woody and herbaceous plants.
- Prescribed burns could be used for a thermal thinning in pine stands, reducing the amount of regeneration.

Clear-Cuts - This even-aged regeneration method removes all overstory trees on seven or more acres to allow for the release of existing regeneration, establishment of light seeded plants, or the manual planting of desired trees species. When used in historically pine habitat, the use of pre- and post-treatments including the use of herbicides and prescribed fire can be used to ensure the desired tree species become established. This technique would not be suitable near RCW clusters or eagle nest sites. This method removes all the overstory within an area and therefore provides site benefits to early successional dependent wildlife species and detriments for late-successional dependent, and likely impacts habitat immediately adjacent to the harvested location. This method would not be used as part of RCW management actions.

Biomass Commercial Thinning - This method is the thinning of young stands before the trees are of size of commercial use for pulp or saw-timber but, are viable for biomass production (i.e., pellets, fuel wood). The objective of biomass commercial thinning on the refuge will be to open the forest canopy, release trees from competition, and increase forest health and vigor.

Non-commercial Forest Stand Improvement Strategies

When commercial harvest is not feasible or will not meet a specific habitat objective, other forest stand improvements work can be on option. However, the costs to the refuge in funds and staff time are much greater. These treatments will likely only be done on a relatively small scale and/or when commercial timber harvest is not a feasible option. FSI is typically used to remove undesirable tree species, allow the canopy spread of existing desirable trees, prepare a site for natural seeding, and releasing underplanted seedlings. The development of snags and course dead wood are a few of the positive wildlife benefits of non-commercial FSI practices.

Mulching - A timber mulcher can perform single tree removal within the midstory to remove specific trees up to 6 inches in diameter. Mulching can be used to open a low forest canopy or midstory, release trees from competition, improve regeneration, improve species composition within a stand, remove invasive species from a stand, remove hardwood encroachment from RCW clusters, and create wildlife habitat openings. Mulching maintains soil integrity, returns nutrients to the soil, and leaves stems on site to increase coarse woody debris.

Reforestation - Reforestation is the act of artificially planting or allowing natural regeneration of forest tree species on site that were previously forested habitats with species which are appropriate to the site and environment, or planting young trees under the canopy of an existing stand. For loblolly pine in areas subjected to prescribed fire, these areas would require protection from fire for 7 to 15 years; young loblolly pines are readily killed by fire.

Underplanting Existing Forest Stands **-** Many bottomland hardwood stands are dominated by pioneer species with little to no oak component. Sufficient advanced oak regeneration needed to replace the pioneer species is also absence in these stands. Artificial regeneration of oak by underplanting is done to supplement natural populations of oak seedlings or to introduce oak in stands where it is missing. Prior to underplanting 100 percent of midstory and 50 percent of the overstory basal area will need to be removed by commercial harvest or by FSI methods identified above. Following this thinning treatment additional treatments will likely be needed for the underplanted oaks to become well established. When the oak seedlings have become vigorous competitors the canopy can then be fully removed (Dey et al. 2012).

Wildlife Stand Improvement - Wildlife Stand Improvement (WSI) is the targeted control or removal of invasive, nonnative (exotic), or undesirable species in order to improve the health or species composition of a forest stand. Control methods can consist of both chemical and mechanical treatments. All forestry chemical applications follow the Service's Pesticide Use Proposal approval process before use. Common application techniques for herbicides include: Hack and Squirt, Stem Injection, Cut Stump, Basal Spray, and Foliar Spray. Negative effects to desired species will be minimized by using proper application techniques.

Insects, Diseases, Lightning and Wind - Each of these are natural forces that affect and alter forest composition and help increase wildlife habitat diversity; however, in some cases these natural forces of change may destroy critical wildlife habitat or endanger the safety of the visiting public. In the case of insect damaged trees, salvage can be used to remove damaged or dead trees, or these trees may be allowed to remain. Trees with active beetle infestations and a limited number of unaffected trees around the infection may be removed to control insect spread; single tree and small multi-tree (2-5 trees) spots which pose no threat of spreading will be retained and monitored; dead and dying trees which have been abandoned by the beetles will be retained to provide snags for the benefit of wildlife;

and commercial loggers may be used to implement salvage emergency actions. Large groups of damaged trees due to non-insect related causes (i.e., wind thrown, ice/storm damaged and other physically damaged trees) will normally not be salvaged unless it is determined that these trees present a potential safety hazard. Salvage harvests primarily serve as a mechanism to stop the spread of an active disease or insect outbreak, but removes snags that are beneficial to many species of wildlife (e.g., insects, cavity nesters).

Prescribed Fire – These staff-set fires are used to enhance and maintain wildlife habitat in fire adapted ecosystems, reduce hazardous fuels, and protect property and natural resources. Prescribed fire is also a tool used to reduce the risk of high intensity wildfires due to accumulated fuel loads. Repeated prescribed burning establishes a unique habitat condition essential to the survival of many plant and animal species. Prescribed fire alters the density and composition of vegetative communities by aiding in seed germination, flowering, and re-sprouting of fire-adapted native plants. Fire lines are often required to constrain prescribed fire and prevent unwanted damage to specific sites (e.g., regenerating trees, private property, refuge assets, or historical sites). Dormant season burns are generally used to maintain herbaceous growth in areas that have high fuel loads. Growing season burns are used to control hardwoods and promote the growth of herbaceous plants in areas that are burned frequently or possess low fuel loads. Although the primary benefits of fire are to decrease midstory and increase understory habitat benefitting RCWs and other species, use of fire decreases litter and litter dependent species such as small mammals and salamanders. Resources, such as RCW or bat cavity trees, that are sensitive to fire or could be damaged by fire are protected by hand raking debris around the trees and creating un-burned areas immediately around these features. Fire staff will often make repeated visits to these sensitive sites during the management of the prescribed fire and provide additional protection as needed. Although fire is a preferred strategy for upland pine management, fire can also be used to manage the sand prairies in the forested wetlands.

Mowing/Disking: Mowing or disking has long been used to manage early successional habitats as a means to suppress invading hardwoods. Timing is critical. Treatments should generally be scheduled outside the bird-nesting season of target species (April 15 to July 15).

Herbicides: There are many chemicals available to control invasive plants. They may work in different ways and be very target-specific, or affect a wide range of species. Herbicides may be pre-emergent, i.e., applied prior to germination to prevent germination or kill the seedling, or post-emergent and have various modes of action (auxin mimic, amino acid inhibitor, mitosis inhibitor, photosynthesis inhibitor, lipid biosynthesis inhibitor). Products may come in granular, pelleted, dust or liquid forms. Common application methods include foliar spray, basal bark, hack and squirt, injection, and cut stump. The timing of applications is critical to achieve good control, as the growth stage at which an invasive plant will be most effectively controlled varies with different species. The advantages are that the right chemicals, applied correctly, can produce desired results over a large area for a reasonable cost. The disadvantages are that the chemicals may affect non-target species at the site or contaminate surface or groundwater. Proper planning includes using the most target-specific, least hazardous (for humans and the environment), and most effective chemical for the job. Additionally, one should research minimum effective dosage, as the chemical labels often give higher than necessary concentrations. Herbicides often are most effective when used in combination with mechanical methods.

Within refuge lands, all chemicals, including adjuvants designed to enhance effectiveness are covered by Service and Departmental regulations, and a pesticide use proposal (PUP) is required for all pesticide applications. Attention to protective gear, licensing requirements and other regulations is essential.

Moist-Soil Management (MSM) Strategies

MSM Is a native wetland plant management system using water level manipulations to create wet/dry cycles in impounded marsh areas that support early successional herbaceous vegetation which produces large quantities of moist-soil annual seeds, tubers, and other plant parts as highly nutritious food sources for waterfowl and other wildlife. MSM uses the drawdown of water levels to promote the germination of native plants on exposed mudflats from late winter, early spring and/or late summer months and subsequent re-flooding of the same areas during early fall waterfowl migration periods. Water level management and the timing of drawdowns and reflooding cycles in moist-soil management, when used, would have specific impacts on the composition and production of freshwater vegetation and moist-soil plants. For example, an early drawdown has been shown to produce more red-root flat sedge in highly organic soils, whereas later drawdowns produce more millet. In mineral soils, early drawdowns would result in more smartweed species, whereas later drawdowns would result in more barnyard millet. The preferred method of a slow drawdown regime would create conditions favorable for moist-soil plant germination and establishment. Other factors besides management technique, such as seed banks, soil types, soil temperatures, soil moisture levels, day length, and residual herbicides would also influence the composition and abundance of developing vegetation.

The Felsenthal pool is not a typical moist soil impoundment. U.S. Corps of Engineers has reserved all rights on flood control and navigation for Felsenthal Pool as part of the Ouachita River water is always moving through the system. The refuge in conjunction with the U.S. Corps of Engineers, will periodically (every three years) conduct a one foot drawdown of the pool. This drawdown would expose 4,000 acres of mudflats and scrub/shrub habitat.

Drawdown and flood-up schedules play a significant role in determining the plant community, seed production, and wildlife use of a specific moist-soil unit. The specific water management techniques are: 1) season of drawdown; 2) speed of the drawdown; 3) variation of drawdowns for plant diversity; and 4) timing of flood-up.

Season of Drawdown

The time of year that a drawdown occurs has a great impact on the species of plants that germinate and eventually dominate the plant community. The growing season has been divided into three periods that typically result in somewhat differing plant communities. These periods are early season, mid-season, and late season. These periods are generally defined by changes in weather variables, such as temperature and rainfall. However, it should be understood that unusual weather patterns, such as drought, flooding, and abnormal temperatures, can greatly alter the expected plant community.

Late season drawdowns (July and August) will be used on the refuge due other seasonal limitations. They can be used to meet objectives (i.e., fall shorebirds) other than moist-soil habitat. Late season drawdowns are a good management tool that will be used under specific conditions. The desirable plants that respond to late drawdowns are yellow-nut sedge, teal grass, and tooth-cup.

Speed of the Drawdown

Fast drawdowns are completed within a matter of days to a few weeks, depending on the size of the impoundment. These are typically done in the early spring or following uncontrolled flood events with a primary purpose of drying agriculture fields. For moist-soil management purposes fast drawdowns

should only occur during the early season period when rainfall and lower temperatures will maintain soil moisture high enough to promote the germination of desirable plants. A disadvantage of utilizing this type of drawdown is that mudflat habitat availability for shorebirds is completely lost in this short time frame.

Slow drawdowns are staggered over a longer period of up to a month, according to the size of the impoundment. This is the technique of choice for moist-soil management in southern latitudes. The advantages of slow drawdowns include; extended habitat availability and foraging times for migrant waterbirds, elevated soil moisture which promotes desirable annual seed producers, decreased probability of germination of undesirable species, gradually decreasing water depths that benefit many species of wildlife, and potentially higher yields of annual moist-soil plants. One disadvantage of using a slow drawdown is the potential to have exposed mud flats during the period when black willow is scattering seeds, which can result in a large acreage of young willows.

Timing of Flood-up

Once the plants have matured the fall flood-up should occur as the moist-soil food resources are depleted and will be in increments that do not exceed six inches. Efforts should be made to provide newly flooded moist-soil habitat throughout the fall migration and wintering period. However, the flooding of moist-soil may vary depending on water availability, waterfowl usage, and weather patterns.

Mechanical

Although the techniques below are common place in moist soil management, the Felsenthal pool is anything but common. Wet conditions, stumps, logs and short season make these strategies difficult to apply. In fact the 1995 drawdown results noted that disked areas had less than desirable results.

Disking

Maintenance of good seed production in moist-soil requires a periodic soil disturbance. Disking is one of the most viable options available to managers as physical manipulation of the soil is necessary to set back succession, control undesirable plant communities, and rejuvenate moist-soil units that are producing low yields. Manipulations are required as seed producing annuals are replaced by perennial plants, which could occur every three to ten years.

Disking can occur during the period of spring to early fall. Disking in the months of April, May, and June are typically aimed at producing annual grasses in that calendar year. Disking in July, August, and September targets invertebrate production and late germinating species for that season, and annual grasses the following growing season. Caution should be taken when disking during the late season without the planting of millets, buckwheat or winter wheat, as it is very conducive to the germination of undesirable plants.

Caution should also be used in deciding what areas are suitable to be disk. There are many areas on the refuge that will never dry sufficiently to support equipment. Other means to set back succession will be required on these sites. Options for inaccessible locations include deep flooding through the growing season.

Mowing

Moist-soil units are typically comprised of desirable and undesirable plant species. Undesirable plants are defined as those species which have either an established mono-culture or have begun to interfere with the production of seed or tuber producers at a specified level (greater than 50% of the moist-soil area). These species often include broadleaves such as cocklebur, which are particularly susceptible to mowing with a rotary mower, and can be successfully controlled when clipped below the meristem after reaching a height of 12 inches or more. Removal of the overstory allows sunlight to reach the ground, which promotes and releases the grass species that are growing underneath the broadleaf canopy.

The greatest benefit derived from mowing occurs after the dominant overstory plants have become well developed, and are effectively stopping sunlight from reaching the ground. This technique should be applied during the months of June through September. Mowing applied in June or July will result in an improved annual grass and broadleaf community, while mowing in August and September will provide a coarse substrate for invertebrate production after flooding.

Waterfowl Sanctuary Management Strategies

The use of sanctuaries as a management tool is an old concept. Bellrose (1954) wrote of the early 1900s when owners of duck lands found that providing non-hunted areas on their properties was of value in building and holding concentrations of waterfowl. The principal factor governing duck use of areas that were all hunted, half hunted/half unhunted, or not hunted was a sense of security. Waterfowl numbers averaged 16 times more abundant per acre on half hunted/ half unhunted areas than on areas that were completely hunted. As wildlife professionals, we recognize that public use and access is important, but this use must be managed so that disturbance to wildlife is minimized and habitat utilization is not compromised. With these objectives in mind, it becomes necessary to recognize that disturbance to waterfowl early and late in the day can negatively impact biological processes such as feeding, flight, metabolic processes, molting, preening, and resting. If measures to minimize or eliminate the cause of disturbance are not considered, the impacts from these activities can negatively affect the potential for wildlife to acquire the necessary resources needed to meet nutritional life history requirements throughout their annual life cycle (Raasch 1996, Fredrickson and Reid 1988). Providing waterfowl sanctuaries will minimize some of these impacts and allow waterfowl to have undisturbed access to these areas during biologically critical periods of the day. Havera et al. (1992) and Dahlgren (1988) in comprehensive literature reviews of human disturbances to migrating and wintering waterfowl have noted that the use of sanctuaries (non-hunted areas) was the most common and effective solution to mitigating adverse disturbance impacts.

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 any habitat type used by waterfowl. Sanctuary should be available in all habitat types, including moist-soil and bottomland hardwood forest (USFWS 2004b). Felsenthal NWR's sanctuary is proposed to be 6,910 acres and closed to all public use including fishing from November 15 to February 15.

Invasive/Nuisance Animal Control Strategies

Many exotic animals and at times native animals can interfere with management objectives. The Refuge Manual (7 RM 14.4A) defines an animal pest as "any terrestrial or aquatic animal which interferes, or threatens to interfere, at an unacceptable level, with the attainment of refuge objectives or which poses a threat to human health." In order to meet management objectives under all alternatives, pest animals will be controlled on the refuge to maintain acceptable population sizes. Acceptable population sizes vary with species and management situation. The impacts of specific pest animal species or groups are described further below.

In controlling animal pests, whether alien or native species, we use an integrated approach. Integrated pest management is defined as "a dynamic approach to pest management which utilizes a full knowledge of a pest problem through understanding of the ecology of the pest and ecologically related organisms and through continuous monitoring of their populations. Once an acceptable level of pest damage is determined, control programs are carefully designed using a combination of compatible techniques to limit damage to that level." We will use integrated pest management to control pests, which is a sustainable ecosystem-based decision making process for managing invasive species, pests, and diseases through a combination of biological, physical, cultural, chemical, and other practices. The goal of integrated pest management is to remove or reduce only the target organism(s) with the least possible risk to other organisms. Pest animals that present problems to refuge management include feral hogs, beaver, nutria, and southern pine beetle.

We will use the following strategies in animal pest management:

- Determine the need for site-specific control, based on the potential to negatively affect wildlife and habitat management objectives on the refuge.
- Employ integrated pest management techniques when a species is having a significant impact on an area resulting in major habitat replacement or damaging rare species.
- Monitor results to ensure that pests do not exceed acceptable levels.

Although we will employ an adaptive management approach to pest animal problems, we also expect that lethal control or removal of individual animals will be required. Unfortunately, establishing general thresholds for lethal action is difficult. Instead, a case-by-case analysis and specific site characteristics will be used to determine the best solutions as needed to fulfill habitat and wildlife management objectives. Trapping or lethal control of mammals will be relied on as a management practice to control and/or manage pest animals that negatively impact refuge habitats. Trapping to control feral hogs, beaver, or nutria can help to protect desirable vegetation, achieve desirable interspersion of wetland vegetation, and protect rarer species. Trapping is also useful for surveys and monitoring of some species, facilities protection, research, feral animal control, disease control, and public health and safety.

Methods to control beavers include trapping and shooting by Service employees and through interagency agreements with USDA-APHIS. To minimize habitat loss removing beaver dams manually, with heavy equipment or by explosives is done by Service employees. Dams that are small enough to remove by hand or are located in a culvert or water control structure will be removed manually. Explosives are used only by certified employees. Annual beaver control efforts typically remove approximately 100+ beaver. Each year many hours are spent by staff removing dams reopening canals or waterways.

Invasive Plant Species Control Strategies

The establishment and spread of invasive species, especially invasive plants, is a major problem that reaches across all refuge habitat cover-types. We use the definition of invasive species found in the Service Manual (620 FW 1.4E):

"Invasive species are alien species whose introduction does or is likely to cause economic or environmental harm, or harm to human health. Alien species, or non-indigenous species, are species that are not native to a particular ecosystem. We are prohibited by Executive Order, law and policy from authorizing, funding, or carrying out actions that are likely to cause or promote the introduction of invasive species in the United States or elsewhere."

The unchecked spread of invasive plants and animals threatens the biological integrity, diversity, and environmental health of all refuge habitats. In many cases, invasive species have a competitive advantage over native plants and animals and out-compete them, reducing the availability of desirable native food and cover plants for wildlife. Invasive plants reproduce rapidly over large areas of the landscape and have few or no natural controls to keep them in check. Invasive vegetation usually spreads aggressively by runners or rhizomes, produces large numbers of seeds and disperses seeds through various means such as wind, water, wildlife, or people. Invasive wildlife is best held in check through alert monitoring; if found, appropriate techniques need to be matched to the particular species of concern.

Controlling and managing invasive species is a strategy for maintaining the biological integrity and diversity of all habitats. The national strategy recommends the following priority order of action for invasive species management:

- Control or contain large established infestations
- Prevent invasion of potential invaders
- Eradicate new or small infestations

Potential management strategies for preventing invasive species, prioritizing control efforts for established invasive species, and controlling invasive species are described in detail below. Prior to the initiation of invasive species control efforts, refuge staff must understand the biology of the species to be controlled. A number of resources are available on the internet to assist with this. Some sources are included below (all accessed February 2012):

- National Invasive Species Information Center *http://invasivespeciesinfo.gov/index.shtml*
- USGS Invasive Species Program *http://biology.usgs.gov/invasive/*
- Weeds Gone Wild *http://www.nps.gov/plants/alien/index.htm*

Refuge staff should conduct appropriate and applicable pest detection, environmental surveillance, and monitoring before, during, and after any management activity to determine whether pest management goals are achieved and whether activity caused any significant unanticipated effects. The lowest risk, most targeted approach for managing invasive species should always be utilized.

Early Detection and Rapid Response

Where prevention is not possible, early detection and rapid response are the next best strategies. Success will depend in part on participation by all refuge staff, contractors, volunteers, and visitors in efforts to report and respond to invasions. The refuge manager must have access to up-to-date reliable scientific and management information on species that are likely to invade. The University of

Arkansas Cooperative Extension Service is an important source of information *http://www.arinvasives.org*.

Prioritizing Invasive Plant Species Control Efforts

The first step in prioritizing invasive species control efforts is to determine the abundance and distribution of invasive species on the refuge or management unit. However, control efforts should not be delayed to collect statistically rigorous survey data. Baseline data regarding the location of many invasives on the refuge already may be available from observations of staff, volunteers, contractors, and refuge visitors. These observations should be documented and mapped on refuge GIS. If a more formalized mapping procedure is desired, the North American Weed Management Association (*http://www.naisma.org*; accessed November 2013) has information on mapping procedures.

There are a number of ranking tools to assist land managers with the daunting task of prioritizing their invasive plant control efforts (Morse et al. 2004, Hierbert and Stubbendieck 1993, APRS Implementation Team 2000). The Fulfilling the Promise Team recommends using the following order of priority to determine appropriate actions: smallest scale of infestation, poses greatest threat to land management objectives, and greatest ease of control.

When limited resources prevent the treatment of entire populations, the following order of priority is recommended: treat the smallest infestations (satellite populations), treat infestations on pathways of spread, and treat the perimeter and advancing front of large infestations.

To prevent the spread of invasives along transportation corridors, maintain invasive species-free zones along trails, around parking lots and boat launches, and at other related facilities. These areas will be inspected often, and new infestations will be controlled immediately. Minimize the number and size of roads on the refuge. Remove all mud, dirt, and plant parts from all equipment between projects or when equipment is moved from one location to another.

Mechanical

Mechanical removal of invasive organisms can be effective against some herbaceous plants, shrubs and saplings, and aquatic organisms. This is particularly effective for plants that are annuals or have a taproot. Care should be taken to minimize soil disturbance to prevent creating conditions ideal for weed seed germination. Repeated cutting over a growing period is needed for effective control of many invasive plant species. Care should be taken to properly remove and dispose of any plant parts that can resprout. Treatments should be timed to prevent seed set and resprouting. The following methods are available: hand-pulling, pulling with hand tools (weed wrench, etc.), mowing, brush-hogging, weed-eating, stabbing (cutting roots while leaving in place), girdling (removing cambium layer), mulching, tilling, smothering, and flooding.

The advantages of mechanical treatment are low cost for equipment and supplies and minimal damage to neighboring plants and the environment. The disadvantages are higher costs for labor and inability to control large areas. For many invasive species, mechanical treatments alone are not effective, especially for mature or well-established plants. For some invasive plants, mechanical treatment alone exacerbates the problem. Mechanical treatments are most effective when combined with herbicide treatments.

Herbicides

There are many chemicals available to control invasive and undesirable plants. They may work in different ways and be very target-specific, or affect a wide range of species. Herbicides may be pre-emergent, i.e., applied prior to germination to prevent germination or kill the seedling, or post-emergent and have various modes of action (auxin mimic, amino acid inhibitor, mitosis inhibitor, photosynthesis inhibitor, lipid biosynthesis inhibitor). Products may come in granular, pelleted, dust or liquid forms. Common application methods include foliar spray, basal bark, hack and squirt, injection, and cut stump. The timing of applications is critical to achieve good control, as the growth stage at which an invasive plant will be most effectively controlled varies with different species. All pesticides must be mixed, loaded and applied in accordance with label specifications and all applicators of restricted use chemicals must be certified with the Arkansas Department of Agriculture or working under the supervision of a certified applicator.

The advantages are that the right chemicals, applied correctly, can produce desired results over a large area for a reasonable cost. The disadvantages are that the chemicals may affect non-target species at the site or contaminate surface or groundwater. Proper planning includes using the most target-specific, least hazardous (for humans and the environment), and most effective chemical for the job. Additionally, one should research minimum effective dosage, as the chemical labels often give higher than necessary concentrations. Herbicides often are most effective when used in combination with mechanical methods.

Within refuge lands, all chemicals, including adjuvants designed to enhance effectiveness are covered by Service and Departmental regulations and a pesticide use proposal (PUP) (7 RM 14) is required for all pesticide applications. Attention to protective gear, licensing requirements and other regulations is essential.

Biological Control

Biological control is the use of animals or disease organisms that feed upon or parasitize the invasive species target. Usually, the control agent is imported from the invasive species' home country, and artificially high numbers of the control agent are fostered and maintained. There are also conservation or augmentation biological control methods in which populations of biological agents already in the environment (native) are maintained or enhanced to target an invasive species. The advantages of this method are that it avoids the use of chemicals and can provide relatively inexpensive and permanent control over large areas. Appropriate control agents do not exist for all invasive species. Petitions are submitted and approved by the USDA Technical Advisory Group on weed biological control before any proposed biological control agent can be released in the United States.

MANAGEMENT STRATEGY DOCUMENTS

NECESSARY RESOURCES

Currently, a staff of seven permanent employees provides habitat management and support for the refuge. These employees also assist the other refuges within the South Arkansas Wildlife Refuge Complex. To complete the extensive habitat management and restoration projects, conduct the necessary inventorying, monitoring, and research additional staff are required. These proposed staffing increases would enable the refuge to achieve its planned objectives and strategies. The rate at which the refuge realizes it full potential to contribute locally, regionally, and nationally to wildlife

conservation is contingent upon receiving adequate resources. The staff and projects listed below would be in addition to current staff and budget.

Staff/Project	Recurring Base Cost
Fire Technician (GS 5/7)	$65K
Forester (GS 5/7/9)	$65K
Biological Technician (GS 5/6/7)	$65K
RCW Work (Mulching/hardwood control)	$25K
Invasives Species Eradication	$50K
Inventory/Monitoring/Research -Continuation of GTR study	$25K (an additional $20K every 5 years)
Student/Intern Support	$30 K

DOCUMENTATION OF SPECIAL USES

Appendix A contains two compatibility determinations associated with this plan, commercial forest management and use of ATV/UTVs.

Appendix B contains the special conditions and procedures for timber sales.

DOCUMENTATION OF COMPLIANCE

For compliance with section 106 of the National Historic Preservation Act, the refuge staff will provide the regional historic preservation officer a description and location of all projects, activities, routine maintenance and operations that affect ground and structures, details on requests for compatible uses, and the range of alternatives considered. That office will analyze those undertakings for their potential to affect historic and prehistoric sites, and consult with the State Historic Preservation Officer and other parties as appropriate. The State and local government officials will be notified to identify concerns about the impacts of those undertakings.

All pesticide usage would comply with the applicable federal (FIFRA) and state regulations pertaining to pesticide use, safety, storage, disposal and reporting. Before pesticides can be used to eradicate, control or contain pests on refuge lands and waters, pesticide use proposals (PUPs) would be prepared and approved in accordance with 7 RM 14. On Refuge lands, all chemicals including adjuvants designed to enhance effectiveness are covered by Service and Departmental regulations. Attention to protective gear, licensing requirements and other regulations is essential. The geographic distribution of treatments and quantities of pesticides used during invasive plant removal varies from year to year. This requires that the refuge identify potential impacts to federally endangered species in a section 7 interagency endangered species consultation as an integral part of the Service's annual pesticide use proposal program.

Section 7 of the Endangered Species Act of 1973, as amended, outlines procedures for interagency cooperation to conserve federally listed species and designated critical habitats. Section 7(a)(1) requires Federal agencies to use their authorities to further the conservation of listed species. Section 7(a)(2) requires Federal agencies to consult with the Services to ensure that they are not undertaking, funding, permitting, or authorizing actions likely to jeopardize the continued existence of listed species or destroy or adversely modify designated critical habitat. Other paragraphs of this section establish the requirement to conduct conferences on proposed species; allow applicants to

initiate early consultation; require FWS and NMFS to prepare biological opinions and issue incidental take statements. Section 7 also establishes procedures for seeking exemptions from the requirements of section 7(a)(2) from the Endangered Species Committee. [ESA §7]

Department of Interior (DOI) and FWS policy requires that every DOI area with burnable vegetation must have an approved Fire Management Plan (FMP) (621 FW 2.3C-4). The South Arkansas Refuge Complex FMP was approved in 2010 and is considered a step down plan from the Comprehensive Conservation Plan and Habitat Management Plan. This FMP specifies options available for the use of prescribed fire and management of wildfire. Any prescribed fire ignited under the authorization of this FMP must have a written, prescribed burn plan. The written plan as well as execution of prescribed fire follows National Wildfire Coordinating Group and Arkansas Forestry Commission requirements and guidelines. The written plan must be approved locally by the Refuge Manager or Project Leader. Additionally, any application of prescribed fire must be approved immediately prior to ignition by the Refuge Manager or Project Leader. If a prescribed burn is anticipated to impact a threatened or endangered species it must comply with the above mentioned Section 7 of the Endangered Species Act. Any ground disturbing activity associated with prescribed burning such as construction of new, permanent fire breaks must comply with the above mentioned Section 106 of the National Historic Preservation Act and Arkansas Best Management Practices for Water Quality. The Arkansas Forestry Commission administers the Arkansas Smoke Management Program to ensure the State of Arkansas adheres to air quality regulations set by the National Environmental Protection Agency (EPA). Any prescribed burning conducted at Felsenthal NWR complies with Arkansas Smoke Management Program.

The policy of the U.S. Fish and Wildlife Service (FWS) is to manage forests in a manner that best meets the overall objectives of a particular refuge. (6 RM 3.2) The first step in forest management involves the development of a general Habitat Management Plan (HMP) for the entire refuge that is submitted to the regional office for approval. The second step is to prepare a management prescription that details specific treatments designed to achieve the management objectives contained in the HMP. (6 RM 3.4) Both of the above mentioned plans are considered step down plans from the refuge Comprehensive Conservation Plan (CCP). If forest management practices are anticipated to impact a threatened or endangered species it must comply with the above mentioned Section 7 of the Endangered Species Act. Any ground disturbing activity associated with forest management practices such as the construction of new roads must comply with the above mentioned section 106 of the National Historic Preservation Act and Arkansas Best Management Practices for Water Quality.

SECTION B. ENVIRONMENTAL ASSESSMENT

CHAPTER I. THE PURPOSE AND NEED FOR ACTION

INTRODUCTION

This draft habitat management plan (HMP) and environmental assessment (EA) for Felsenthal National Wildlife Refuge (hereafter referred to as Felsenthal NWR, or the refuge) combines two documents, one required by Federal law: An EA required by the National Environmental Policy Act of 1969 (NEPA) and HMP as required by U.S. Fish and Wildlife Service (Service) policies (620 FW 1, 602 FW 4, and 603 FW 2). The HMP will serve as a guide for the refuge's habitat management for the next 15 years.

Chapter I- The Purpose of and Need for Action: Explains why and how we must prepare a HMP and EA for Felsenthal NWR. It states the purpose and need for Federal action, i.e., what needs the U.S. Fish and Wildlife Service want to meet by preparing a HMP and what goals we wish to accomplish. It explains the legislated purposes of the refuge; explains the regulations, policies, and laws covering units of the National Wildlife Refuge System (NWRS or Refuge System); states our vision and long-range management goals for managing and protecting the land, waters, and Federal trust resources of Felsenthal NWR in the future; and identifies issues of public concern.

Chapter II - The Planning Policies and Process: Explains the planning steps in developing the HMP; describes the influences of other national, regional, ecosystem, and State plans.

Chapter III - Affected Environment: Describes the physical, biological, and human environment of the refuge, and explains some of the ecological processes that influence the affected environment in a manner that impacts management outcomes.

Chapter IV - Alternatives; Including the Service-Preferred Alternative: Presents and analyzes three management alternatives that offer different strategies in fulfilling the refuge's goals and objectives, and responds to key issues.

Chapter V - Environmental Consequences: Evaluates the foreseeable consequences of implementing each of the three management alternatives.

Chapter VI - Consultation and Coordination with Others: Describes the public and partner involvement used throughout the planning process, and identifies those individuals involved in preparing this document.

PURPOSE AND NEED FOR ACTION

This HMP has been developed in the context of a changing world. Our natural environment, human uses, and management direction have all changed over the past 40 years. This HMP is designed to address management and protection of valuable natural resources into the future; a future where continued change is even more likely to occur. Over the nearly 40 years of Service management, the national directives from Congress and the Service for managing uses, and planning for units of the Refuge System have become more comprehensive and attuned to the essential features of natural systems. Current Refuge System policies direct refuge managers to assess the historic (pre-human condition) or natural conditions of refuge ecosystems in order to make better informed management decisions. These policies direct the Service to avoid additional degradation of environmental

conditions and natural processes and to restore degraded environmental components.

Thus, the purpose of this HMP is to provide strategic management direction to ensure that our management of the refuge will best mesh four key areas of concern. Strategic here means approaches that are ecologically sound and sustainable in light of physical and biological change, practical, viable, or economically realistic, and responsive to the following four key areas of concern: 1) abide by and contribute to the mission, mandates and policies of the U.S. Fish and Wildlife Service and the National Wildlife Refuge System; 2) meets the refuge's goals; 3) addresses key issues; and 4) responds to public concerns. While explained in more depth beginning on page XX, briefly, this HMP will address the mission of the National Wildlife Refuge System; identify important refuge system laws and policies concerning habitat management and wildlife conservation including a key Service policy addressing biological integrity, diversity, and environmental health, known as "BIDEH"; and address other policies and laws that direct how long-term refuge planning is conducted.

The refuge's goals (CCP pages 73-136) describe the desired future condition of the refuge and provide a framework for developing alternatives to achieve that desired future condition (USFWS 2010). Along with a vision statement, these fundamental goals were developed for Felsenthal NWR on how the *desired conditions* can be best achieved in the future. These goals direct management attention to protection and restoration of the ecological integrity, diversity, and sustainability of four key habitat types (bottomland hardwood forest, upland pine forests, upland hardwood/pine forests, and aquatic habitats).

The development of a HMP addresses two administrative needs and six resource management needs. First, there is currently a comprehensive conservation plan (CCP) that was developed to ensure strategic management for the refuge (USFWS 2010). A vision statement, goals, objectives and management strategies were developed, and were necessary to successful refuge management. The public and partners were also involved throughout the planning process. However, since the development of those CCP objectives in 2008, new information has become available. This information will result in modifying and replacing refuge objectives and strategies through this HMP. Secondly, management practices should be consistent with current policies; the new HMP will bring the refuge into conformity with all current law and policies.

Through the NEPA process and the refuge's understanding of its particular challenges, and incorporating the best available scientific and technical information, several key issues or needs have been identified which this HMP will address. They are:

- Water management as it pertains to overall forest health, moist soil management (pool drawdown), and waterfowl disturbance.
- Red-cockaded woodpecker (RCW) management as it pertains to the RCW Recovery Plan, and in conjunction with neighboring landowners with RCWs.
- Conversion of upland pine to hardwood/pine forests in upland areas that do not meet the criteria for red-cockaded woodpecker management.
- Water quality.
- Invasive and noxious plant and animal species management.
- ATV/UTV use and its impacts on water quality, spread of invasive species, and wildlife disturbance.

Public interest in the future management of Felsenthal NWR is widespread. The concerns and situations of the interested members of the public are diverse. We have heard from neighboring landowners; hunters and fishermen; and State agencies and other programs and organizations concerned about the role and contributions the refuge can play in a larger network of natural areas across the State, the Gulf Coastal Plain and Ozark Land Conservation Cooperative (GCPOLCC), and the migratory bird flyway of the Mississippi Alluvial Valley.

NEPA requires a thorough analysis be made of a range of alternatives, including the proposed action and no action. Ultimately, we will select among these alternatives based on their greater or lesser ability to meet the purposes and needs described above. We analyze the socioeconomic, biological, physical, and cultural consequences of implementing each alternative. This draft HMP/EA evaluates three alternatives that represent different ways to achieve the six areas of concern outlined above. For most alternatives, the refuge's goals will be achieved through different objectives, although there are some objectives and actions that are common to more than one alternative. Alternative A fulfills the NEPA requirement for a no action alternative, one that proposes no change in the current management of the refuge. Alternative A is to continue to manage the refuge as we do at the present time. Alternative B will focus on focal species with proactive habitat management. Alternative B is our proposed alternative and the action that we recommend for final selection. Alternative C proposes to a water management program which raises the pool to 68' msl from December 15 to January 15, conduct uneven-aged management on 500 acres of upland pine habitat, propose an annual drawdown of the pool, and place just over 8,000 acres under a fire management regime. A HMP will provide management direction for the next 15 years by:

- Stating clearly the desired future conditions of refuge habitat and wildlife resources.
- Providing state agencies, refuge neighbors, visitors and partners with a clear understanding of the reasons for refuge management actions.
- Ensuring that refuge management reflects the policies, legal mandates and the mission of the National Wildlife Refuge System and the refuge purpose.
- Providing long-term continuity in refuge management.

After its completion, the HMP will be reviewed, evaluated, and subsequently updated approximately every 15 years. However, if and when significant new information becomes available, ecological conditions change, or when we identify the need to do so, the plan can be reviewed sooner. Plan revisions may require NEPA compliance.

PLANNING STUDY AREA

Felsenthal NWR is located in Ashley, Bradley, and Union Counties, Arkansas, about eight miles west of Crossett, Arkansas on U.S. Highway 82 (See Figure 1, Draft HMP, Section A). The 64,902 acre refuge is one of four refuges forming an administrative complex, which also includes Pond Creek National Wildlife Refuge to the west, Overflow National Wildlife Refuge to the east and Oakwood National Wildlife Refuge to the northeast.

Felsenthal NWR occupies a low-lying area dissected by an intricate system of rivers, creeks, sloughs, buttonbush swamps and lakes throughout a vast bottomland hardwood forest that gradually rises to an upland forest community. Historically, periodic flooding of the "bottoms" (bottomland hardwoods) during winter and spring provided excellent wintering waterfowl habitat. These wetlands, in combination with the pine and upland hardwood forest on the higher ridges, support a wide diversity

of native plants and animals, providing habitat for migrant and resident waterfowl, marsh and water birds, Neotropical migratory birds and the endangered red-cockaded woodpecker.

AUTHORITY, LEGAL COMPLIANCE, AND COMPATIBILITY

This section highlights the Service, the National Wildlife Refuge System, and Service policy, laws, regulations, and mandates that directly influenced the development of the Felsenthal NWR Draft HMP/EA document.

THE SERVICE AND ITS MISSION

The U.S. Fish and Wildlife Service administers the National Wildlife Refuge System. The Service is an agency under the Department of the Interior and its purpose is to conserve the nature of America.

The Service's commitment to safeguard the nation's fish, wildlife and their habitats is reflected in its vision statement and mission: "We will continue to be a leader and trusted partner in fish and wildlife conservation, known for our scientific excellence, stewardship of lands and natural resources, dedicated professionals, and commitment to public service."
Its mission is: "Working with others, to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people."

The Service is the primary Federal agency responsible for conserving, protecting and enhancing America's fish and wildlife populations and their habitats. These include migratory birds, federally listed endangered or threatened species, interjurisdictional fish, wetlands, certain marine mammals, and national wildlife refuges. The Service oversees the enforcement of Federal wildlife laws and international treaties on importing and exporting wildlife, management and protection of migratory bird populations, restoration of national fisheries, administration of the Endangered Species Act, and restoration of native plant habitats. The Service also assists states with their fish and wildlife programs and helps other countries develop conservation programs.

The Service Manual, http://www.fws.gov/policy/manuals/, contains the standing and continuing directives to implement its authorities, responsibilities, and activities. Special Service directives that affect the rights of citizens or the authorities of other agencies are published separately in the Code of Federal Regulations (CFR); the Service Manual does not duplicate them (see 50 CFR 1-99 at http://www.gpoaccess.gov/cfr/index.html).

THE NATIONAL WILDLIFE REFUGE SYSTEM: MISSION AND POLICIES

The Refuge System is the world's largest collection of lands set aside specifically for the conservation of wildlife and ecosystem protection. The Refuge System began in 1903, when President Theodore Roosevelt designated Pelican Island, a pelican and heron rookery in Florida, as a bird sanctuary. Today, this unique wildlife conservation system consists of 550 national wildlife refuges. These refuges encompass more than 150 million acres of lands and waters in all 50 states and several island territories, and represent the world's largest collection of lands specifically managed for fish, plants, and wildlife. More than 40 million visitors hunt, fish, observe and photograph wildlife, or participate in environmental education and interpretive activities on refuges across the nation each year.

The Refuge System is home to more than 700 species of birds, 220 species of mammals, 260 reptile and amphibian species, and more than 200 species of fish. This unique network of conserved lands also provides critical habitat for more than 250 threatened and/or endangered plants and animals. As

a result of international treaties for migratory bird conservation, such as the Migratory Bird Conservation Act, many refuges have been established to protect migratory birds. Refuges are also places where people can enjoy wildlife-dependent recreational and educational opportunities about the great outdoors, and the Refuge System provides some of the best places across the country where people can hunt, fish, observe, and enjoy wildlife throughout the year.

In 1997, the Refuge Improvement Act was passed. This law established a unifying mission for the Refuge System, a new process for determining compatible public use activities on the refuges, and the requirement to prepare a CCP for each refuge. The Refuge Improvement Act states first and foremost that the Refuge System must focus on wildlife conservation. This law established several new mandates to make the management of the Refuge System more cohesive and standardized to ensure that wildlife is considered first when managing refuges.

The Refuge Improvement Act directs the Secretary of the Interior to ensure that the mission of the Refuge System and purposes of the individual refuges are carried out. It states that the national mission, coupled with the purpose(s) for which each refuge was established, will provide the principal management direction for each refuge. It also requires the Secretary to maintain the biological integrity, diversity, and environmental health of the Refuge System. The mission of the Refuge System is:
"To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans."

REFUGE IMPROVEMENT ACT, PUBLIC LAW 105-57

The desired conservation end point of the Refuge System mission is articulated through Service goals describing the results the Service expects to achieve by managing the Refuge System. These Refuge System goals have been designed to help guide the development of CCPs and HMPs and improve the administration, management, and growth of the Refuge System in a unified and consistent manner. These goals are:

Conserve a diversity of fish, wildlife and plants and their habitats, including species that are endangered or threatened with becoming endangered.

Develop and maintain a network of habitats for migratory birds, anadromous and interjurisdictional fish, and marine mammal populations that are strategically distributed and carefully managed to meet important life history needs of these species across their ranges.
Conserve those ecosystems, plant communities, wetlands of national or international significance, and landscapes and seascapes that are unique, rare, declining, or underrepresented in existing protection efforts.

Provide and enhance opportunities to participate in compatible wildlife-dependent recreation (hunting, fishing, wildlife observation, photography, environmental education and interpretation).
Foster understanding and instill appreciation of the diversity and interconnectedness of fish, wildlife, plants, and their habitats.

MAINTAINING BIOLOGICAL INTEGRITY, DIVERSITY AND ENVIRONMENTAL HEALTH POLICY (BIDEH POLICY)

This policy provides guidance on maintaining or restoring the biological integrity, diversity and environmental health of the Refuge System, including the protection of a broad spectrum of fish,

wildlife and habitat resources found in refuge ecosystems. Refuge managers are provided with a process for evaluating the best management direction to prevent the additional degradation of environmental conditions and restoring lost or severely degraded environmental components. They accomplish this by assessing the current status of biological integrity, diversity, and environmental health on each refuge through baseline vegetation surveys and studies and by understanding historic conditions, i.e., those conditions which were, and would be present and self-sustaining without human changes to the landscape. Historic conditions serve as a frame of reference to understand the functional processes that naturally shaped the refuge's ecosystem and the scale and frequency of such processes (e.g., fire, flooding, and plant succession) to ascertain the refuge's natural ecosystem. First and foremost, refuges are directed to preserve habitats that maintain a high degree of biological integrity and environmental health. Lost or severely degraded habitats shall be restored, via natural processes or by using management measures which mimic natural ecosystem processes or functions. Guidelines are also provided for dealing with external threats to the biological integrity, diversity, and environmental health of a refuge and its ecosystem. The BIDEH policy (601 FW 3) can be viewed online at http://www.fws.gov/policy/601fw3.html.

COMPATIBILITY

This policy (603 FW 2) and its regulations, including a description of the process and requirements for conducting compatibility reviews, can be viewed on-line at http://www.fws.gov/policy/603fw2.html. The refuge manager must first determine that a use is appropriate before undertaking a compatibility review of that use. If the proposed use is not appropriate, the refuge manager will not allow the use and will not prepare a compatibility determination. A compatible use is one "that will not materially interfere with or detract from the fulfillment of the mission of the Refuge System or the purposes of the refuge." The refuge manager may allow or deny any use, even one that is compatible, based on other considerations such as public safety, policy, or available funding. Refuge management economic activities such as commercial timber harvest are subject to compatibility. Two compatibility determinations (CD) will be updated as a result of this process, commercial forest management and ATV/UTV use. The CDs can be located in Appendix A.

REFUGE ESTABLISHMENT/HISTORY AND PURPOSE

Established in 1975 as mitigation for the creation of the U.S. Corps of Engineers' (USACE) Ouachita and Black Rivers Navigation Project and Felsenthal Lock and Dam, Felsenthal NWR is located in southeast Arkansas, approximately eight miles west of the town of Crossett. This 64,902 acre refuge is named for the small Felsenthal community located at its southwest corner, and contains an abundance of water resources dominated by the Ouachita and Saline Rivers and the Felsenthal Pool.

Geographically, the refuge is located in what is known as the Felsenthal Basin, an extensive natural depression that is laced with a vast complex of sloughs, bayous and lakes (See Figure 4, Draft HMP, Section A). The region's two major rivers, the Saline and Ouachita, flow through the refuge. These wetland areas in combination with the refuge's diverse forest ecosystem of bottomland hardwoods and upland forests support a wide variety of wildlife and provide excellent fishing, hunting, boating, wildlife observation and environmental education opportunities. This low lying refuge area is dissected by an intricate system of rivers, creeks, sloughs, buttonbush swamps and lakes spread throughout a vast bottomland hardwood forest that gradually rises to an upland forest community. Historically, periodic flooding of the "bottoms" during winter and spring provided excellent wintering waterfowl habitat. These wetlands, in combination with the pine and upland hardwood forest on the higher ridges, support a wide diversity of native plants and animals.

About 60% of the refuge (~40,000 acres) is bottomland hardwood, 25% open water (~15,000 acres), and 15% uplands (~10,000 acres).

The Purpose and Establishing Authorities of Felsenthal NWR are:

16 U.S.C. § 664 (Fish and Wildlife Coordination Act)"... shall be administered by him [Secretary of the Interior] directly or in accordance with cooperative agreements ... and in accordance with such rules and regulations for the conservation, maintenance, and management of wildlife, resources thereof, and its habitat thereon ..."
16 U.S.C. § 460k-1"... suitable for incidental fish and wildlife-oriented recreational development; the protection of natural resources; and the conservation of endangered species or threatened species ..."
16 U.S.C. § 460k-2 (Refuge Recreation Act (16 U.S.C. § 460k-460k-4), as amended)"... the Secretary ... may accept and use ... real ... property. Such acceptance may be accomplished under the terms and conditions of restrictive covenants imposed by donors ..."

Refuge Vision Statement

The vision statement below qualitatively describes our desired future character of Felsenthal NWR. It was developed during the 2010 CCP planning process with input from our partners and the public, and it guides priorities at the refuge (USFWS 2010):

The South Arkansas National Wildlife Refuge Complex provides a diversity of habitats for wintering waterfowl, migratory birds, threatened and endangered species, and resident wildlife, and provides enhanced wildlife-dependent public use opportunities. The Complex protects, manages, and restores an intricate system of rivers, creeks, sloughs, buttonbush swamps, and lakes throughout a vast bottomland hardwood forest that gradually rises to an upland forest community.

The Complex will continue to serve the American people by continuing opportunities for compatible, wildlife-dependent recreation such as hunting, fishing, wildlife photography and observation, as well as environmental education and interpretation. In addition, the Complex will seek partnerships that promote environmental stewardship, foster research opportunities to enhance resource management and restoration efforts, and protect historical and cultural resources of the Complex.

Refuge Goals

Goals describe the desired future condition of the refuge and provide a framework for what the refuge is trying to accomplish in adopting a HMP. The habitat goals were developed earlier in the comprehensive conservation planning process which helped focus our thinking about management actions. The goals outlined in the CCP are described below in three categories (USFWS 2010).

We will preserve, restore, and enhance the biological diversity and ecological integrity of Felsenthal NWR's native plants and wildlife in wetland and upland habitats within the Gulf Coastal Plain and Ozark Land Conservation Cooperative with the following goals:

Fish and Wildlife Population Management

Protect, maintain, enhance, and restore healthy and viable populations of migratory birds, resident wildlife, fish, and native plants, including all federal and state threatened and endangered species found within southern Arkansas in a manner that supports national and international treaties, plans, and initiatives.

Habitat Management

Protect, maintain, enhance, and where appropriate, restore suitable habitat for the conservation and management of migratory birds, resident wildlife, fish, and native plants, including all federal and state threatened and endangered species endemic to the Complex.

Resource Protection

Protect the natural and cultural resources of the refuge and ensure visitor safety and facility integrity to fulfill the mission of the National Wildlife Refuge System. Provide for sufficient staffing, facilities and infrastructure to fulfill the Complex's purposes and the goals and objectives of its refuge comprehensive conservation plans.

ISSUES, CONCERNS, AND OPPORTUNITIES

We developed a list of key issues and opportunities, whereby these key issues formed the basis for developing and comparing the proposed alternatives.

KEY ISSUES AND CONCERNS

Since a key purpose of this HMP is to refine/revise management goals, objectives, and strategies, the HMP will focus on several key habitat issues that have been identified by Service staff. Successful conservation strategies will recognize the dynamic nature of bottomland and upland forested systems as a continuing, on-going condition, so we need to understand how natural systems have evolved in this context and predict how those changes will affect fish and wildlife at multiple scales. We need to develop, test, and implement conservation strategies to cope with the physical changes in the wetland environment resulting from these natural and man-made changes. Some of the current and predicted impacts of these changes in these aquatic and forested areas include:

- Displacement of wildlife (as critical habitats decline).
- Conversion of upland habitats to wetter habitats and conversion of forested areas to emergent wetlands.
- Conversion of forested wetlands to water tolerant cover types (ie. nuttall/willow oak to overcup oak/water hickory) or to mudflat or scrub/shrub.
- Conversion of some upland habitats to historic conditions (upland hardwood/pine).
- Continuing to provide adequate red cockaded-woodpecker foraging habitat.
- Spread and control of invasive plant and animal species.

Refuge staff will need to increase cooperative efforts with science partners, such as Arkansas Game and Fish Commission (AGFC), Ducks Unlimited, U.S. Geological Survey (USGS), and others to research and monitor the current and likely physical and biological impacts of environmental change, and to assess species and habitat vulnerabilities. This information will be used to formulate guidelines or thresholds to mitigate habitat losses and assist ecosystem adaptation to the refuge's changing environment.

Water Management: Forest Health/Moist Soil Management/Waterfowl Sanctuary

When Felsenthal NWR was established in 1975 the wetlands, uplands, and waters now encompassed by the refuge were about to experience a drastic alteration of the natural hydrology

with the construction of the Felsenthal lock and dam. While many Service management actions over the ensuing years improved the condition of the natural ecosystems, water level management within the Felsenthal Pool had an overall negative impact on refuge resources. Environmental changes, managed water-level manipulations and natural processes have altered and will continue to alter this wetland environment apart from human actions.

The overall health of the forest within the Felsenthal GTR is deteriorating because of the former water level management regime (Allen 1992; King 1995; Allen et al. 1996; King et al. 1998; Keeland et al. 2010). Specifically, the two most desired species of oaks, willow oak and nuttall oak, have been decreasing in numbers, and more water-tolerant species such as overcup oak and water hickory are increasing. Additionally, recruitment of new trees into the forest system was not occurring due to high water levels drowning out the seedlings. This constitutes the loss of the most important mast-producing tree species within the GTR. The forest composition has been shifting to more water-tolerant species such as overcup oak and water hickory, which have little value for waterfowl. Unless flooding is curtailed during some years, the mast-producing overstory trees will eventually be lost, waterfowl habitat will decrease, and waterfowl hunting opportunities will be lessened. Chapter III of this HMP provides further details about the various factors that influence Felsenthal Pool and GTR in the face of the natural hydrological processes. The status of the physical environment and the condition of the management infrastructure are described to set the stage for considering the management options presented in the alternatives, as outlined in Chapter III. Ultimately, the options that the refuge can reasonably consider in managing the Felsenthal pool and associated forested wetlands will be guided by the challenging dynamic wetland conditions.

Moist-soil management/Sanctuary

A primary purpose of Felsenthal NWR is to provide high-quality habitat for wintering and migrating waterfowl. Moist-soil impoundments provide plant and animal foods that are a critical part of the diet of wintering and migrating waterfowl and have become a significant part of management efforts on many refuges. Moist-soil wetlands can also provide excellent habitat for wading birds and shorebirds. Preferred moist-soil plants provide seeds and other plant parts (e.g., leaves, roots, and tubers) that generally have low deterioration rates after flooding and provide substantial energy and essential nutrients to wintering waterfowl. Moist-soil impoundments also support diverse populations of invertebrates, an important protein source for waterfowl. The plants and invertebrates available in moist-soil impoundments provide food resources necessary for wintering and migrating waterfowl to complete critical aspects of the annual cycle such as molt and reproduction. Moist-soil wetlands can also provide important resting habitats.

In general, moist-soil management practices involve manipulating water depth within impoundments to stimulate growth of herbaceous plants from seeds or tubers that exist in the soil. In 1995, an experimental 1-foot drawdown of the Felsenthal permanent pool was implemented and then evaluated to determine the efficacy of implementing moist soil management on Felsenthal NWR (Howard 2007, Howard 2009). The drawdown resulted in exposing nearly 4,000 acres of moist soil and the production of large quantities of high-quality food resources for waterfowl within the drawdown zone. Refuge staff documented a significant increase in waterfowl use of the refuge as a result of this moist soil management practice. Therefore, a periodic (once every 3-5 years) 1-foot drawdown of the permanent pool will increase the quantity and quality of waterfowl habitat on the refuge.

Another important aspect of waterfowl management on Felsenthal NWR is the provision of waterfowl sanctuary. Wintering waterfowl need access to areas that are free from human disturbance to complete seasonal and annual life cycle events such as feeding, resting, molting, and pair bonding

for reproduction. Currently, Felsenthal NWR provides approximately 9,050 acres of waterfowl sanctuary. The current sanctuary was established two decades ago under a water management scheme that involved intentionally flooding 21,000 acres of bottomland hardwood forest annually, a practice that inundated 7,444 acres of refuge waterfowl sanctuary. Since 2010, in an effort to emulate natural flooding and to improve forest health, refuge managers have not intentionally flooded the GTR. The decision to not flood the GTR has had a positive effect on forest health and forest regeneration. However, when water levels measured on the Ouachita River at the Felsenthal Lock and Dam remain at the summer pool level (65'msl), only 3,183 acres of the 9,050 acre waterfowl sanctuary are inundated. Therefore, most of the current waterfowl sanctuary is not suitable waterfowl habitat. If future management involves an effort to emulate natural flooding cycles, then it will become necessary to move the waterfowl sanctuary to a portion of the refuge that will provide consistent waterfowl habitat at the 65'msl water level.

Red-cockaded Woodpecker Habitat and Population Objectives

Historically, the Felsenthal NWR upland habitats were dominated by hardwoods mixed with loblolly and shortleaf pines. The conversion of these areas to loblolly pine plantations resulted in a loss of biological diversity but favored the endangered red-cockaded woodpecker. The refuge's CCP states the refuge has 9,000 acres for RCWs (Objective 2.2) and 9,490 fire managed acres of RCWs (objective 2.4) with a goal of 22 active clusters on these acres (Objective 1.1) (USFWS 2010). The 2003 RCW Recovery Plan states Felsenthal NWR's goal as 34 clusters on 6,800 fire managed acres. The difference between 9,490 acres and 6,800 acres is the amount allocated to each cluster (300 acres vs. 200 acres) (USFWS 2003c). In addition, the Open Pine Landbird Plan for the West Gulf Coastal Plain/Ouachitas outlines of goal of 34 active clusters on 8,107 acres (LMVJV, 2011).

In addition, the recovery plan relies heavily on the biology of longleaf pine in relation to red-cockaded woodpecker management. Historically, Felsenthal NWR has never supported stands of longleaf pine. Loblolly pine growth rates and fire sensitivity are very different and make it very difficult to provide adequate foraging habitat on 200 acres. A final difference is that loblolly pine is considered an early to intermediate successional species whereas longleaf pine is considered late successional or a climax species. With this mind, the refuge needs to provide a minimum of 300 acres for each cluster to provide adequate foraging habitat for red-cockaded woodpeckers.

Finally, a private landowner owns 3,609 acres of RCW habitat with 25 clusters adjacent to our western boundary in Union County. The challenge is managing this population and the refuge's population as one population. It is important to consider the habitat needs of both populations to avoid the lack of vital habitat particularly, foraging habitat, for the red-cockaded woodpeckers on and off the refuge.

The current land base of Felsenthal NWR cannot support 34 active clusters under any of the acreage scenarios mentioned above. This HMP and EA will use the best available data to set realistic habitat and population objective taking into consideration the private lands adjacent to the refuge.

Upland Hardwood/Pine Conversion

Of the 9,958 acres of upland habitat, 3,263 acres of loblolly pine resides in small isolated patches, less than 200 acres in size or in long, narrow linear tracts with no red-cockaded woodpecker use surrounded by bottomland hardwoods and private land. In the past, these upland pine areas were managed for RCWs; however, these areas cannot support viable populations of RCWs. The BIDEH policy provides a process for evaluating the best management direction to prevent the loss, or to restore environmental components. Biological integrity can be maintained at the local, regional and

landscape scales by taking into consideration historic conditions and where appropriate, restoring ecosystem components.

Nuisance/Invasive Species

Nuisance aquatic vegetation around the Felsenthal NWR region includes Cuban bulrush, fanwort, hydrilla, American lotus, water hyacinth, and giant salvinia. This vegetation covers up to 75% of the water surface by mid-summer. Cuban bulrush is a relatively new invasive to the Refuge. These nuisance aquatic plants will out-compete native vegetation and negatively impact the fisheries resource. The ramifications of the use of aquatic herbicides and/or the stocking of diploid grass carp to control vegetation needs to be carefully considered. The decay of aquatic vegetation in late summer/fall causes oxygen depletion and may result in fish die-offs.

Nuisance wildlife species are also an issue on the refuge. Beavers have few natural predators, have a prolific reproductive rate, thrive in altered hydrological habitat and can impact thousands of acres of prime habitat. Because beavers have the potential to destroy or alter thousands of acres of bottomland hardwood habitat, beaver control is a management priority and a management policy needs to be developed and implemented.

Feral hogs, an exotic invasive species, have the ability to set back succession, facilitate invasive plant species, decrease diversity, and directly and indirectly negatively impact native wildlife species. In addition, refuge officials, in cooperation with officials from U.S. Department of Agriculture's Wildlife Service's Disease Program, collected biological samples from 46 feral swine during spring and summer 2012. Of the 46 pigs tested, 10 (22%) tested positive for swine brucellosis and 16 (35%) tested positive for pseudorabies. Swine brucellosis is transmissible to humans and psuedorabies can impact domestic swine producers. Due to the potential impacts to humans and negative impacts to habitat, control of feral hogs must be a management priority.

Water Quality

A proposed point-source wastewater discharge to the Ouachita River 22 river miles upstream of Felsenthal NWR threatens downstream water quality and water use on the refuge. The proposed wastewater outfall would contain the combined effluent from four entities: El Dorado Water Utilities, El Dorado Chemical Company, Great Lakes Chemical Corporation (now Chemtura Chemical Corporation), and Lion Oil Company. The effluent would likely contain high levels of ammonia, nutrients, and dissolved solids.

ATVs/UTVs

Currently, Felsenthal NWR supports a network of 22 ATV/UTV trails and totaling 65 miles of trail. ATV/UTV use is a common and historic activity on Felsenthal NWR that facilitates public access in support of wildlife-dependent activities. ATVs and UTVs are primarily used to facilitate hunting, trapping, and fishing activities on Felsenthal NWR. However, refuge staff recently completed an evaluation of Felsenthal NWR's trail system and concluded that many of the trails were out of compliance with Executive Order (E.O.) 11644, E.O. 11989, and Refuge Manual 8 RM 7. These policies require that refuge managers close ATV/UTV trails that cause adverse effects on soil, vegetation, wildlife, or wildlife habitat. The scientific literature is replete with descriptions of the adverse effects of ATV/UTV use to the physical environment and to wildlife. In terms of the physical environment, science supports the fact that ATV/UTV use can negatively affect soil and hydrologic function through soil compaction, increased erosion, and stream sediment deposition. These effects can impact water quality, vegetative composition and structure, and wildlife habitat, particularly in

wetland habitats. Negative effects on wildlife by ATV/UTV use include alterations in animal behavior, habitat fragmentation, habitat loss, and direct and indirect mortality. These negative impacts are known to affect fish, mussels, amphibians, reptiles, birds and mammals. The impacts of ATV/UTV use on the physical environment and wildlife are cumulative, universal, and can be achieved by low intensity traffic over a short period of time.

OPPORTUNITIES

The refuge should seek to establish new and strengthen current partnerships with conservation organizations, such as The Nature Conservancy, Arkansas Game and Fish Commission, Arkansas Department of Environmental Quality, etc. The refuge relies on partnerships with several organizations and individuals for help with refuge programs, biological surveys and monitoring, and habitat restoration that support the refuge's purpose. Opportunities exist to establish an outstanding research and monitoring site and develop wetland and hydric soil indicator reference sites, etc.

DECISION FRAMEWORK

The Southeast's Regions, Regional Director, will select a preferred alternative based on the Service and Refuge System missions, the purposes for which the refuge was established, other legal mandates, and public and partner responses to this draft HMP/EA. The selection among alternatives is based on the degree to which an alternative meets the purpose and need. The alternative selected could be the proposed action in the draft HMP/EA, the no action alternative, or a combination of actions of alternatives presented. The final decision will identify the desired combination of species protection and habitat management for the refuge. A Finding of No Significant Impact (FONSI) will present and explain the decision, and certify that we have met agency compliance requirements and that the HMP, when implemented, will achieve the purposes of the refuge and help fulfill the Refuge System mission. Once the Regional Director has signed the FONSI and we have completed the HMP for the refuge, we will notify the public, and implementation can begin.

CHAPTER II. THE PLANNING POLICIES AND PROCESS

INTRODUCTION

This chapter explains the planning policies and planning steps in developing the HMP; describes the influences of other national, regional, ecosystem, and State plans; and identifies refuge operational or step-down plans.

REFUGE SYSTEM PLANNING POLICY

The planning policy provides guidance, systematic direction, and minimum requirements for developing HMPs, and stipulates a systematic decision making process that fulfills those requirements. This policy also establishes requirements and guidance for Refuge System planning, including CCPs and step-down management plans. It states that we will manage refuges in accordance with an approved CCP and HMP which, when implemented, will achieve refuge purposes; help fulfill the Refuge System mission; maintain and, where appropriate, restore the ecological integrity of each refuge and the Refuge System; and meet other mandates [Fish and Wildlife Service Manual (602 FW 1,2,3) and (620 FW 1)].

The HMP policy (620 FW 1) stipulates that each HMP shall identify and describe the following:

A. Use available biological information and ecological principles to provide the foundation for developing habitat goals, objectives, and subsequent management strategies and decisions.

B. Derive habitat goals, objectives, and management strategies from the individual refuge purpose(s) and System mission that provides a foundation to conserve and protect functional communities of native fish, wildlife and plants, and explicitly link international, national, regional, State, and ecosystem goals and objectives as appropriate. Additionally, derive HMPs from, and ensure their consistency with other conservation plans such as threatened and endangered species recovery plans, Service ecosystem plans, the North American Waterfowl Management Plan, State conservation plans, etc.

C. Consider opportunities, constraints, or limitations posed by existing special designations (e.g., designated wilderness, wilderness study areas, wild and scenic rivers, Western Hemisphere Shorebird Reserve Network sites, Convention on Wetlands of International Importance [RAMSAR], research natural areas, marine protected areas, and public use natural areas) when implementing habitat goals, objectives, and applying management strategies.

D. View the highest measure of biological integrity, diversity, and environmental health as those intact and self-sustaining habitats and wildlife populations that existed under historic conditions (see 601 FW 3). Refuge purpose(s) may, however, compromise these components at larger landscape scales. When evaluating the appropriate management direction for refuges, refuge managers consider their refuge's contribution at multiple landscape scales.

E. Consider a range of habitat management strategies to meet specific wildlife or habitat management goals and objectives. To select appropriate strategies, consult with external partners such as other Federal, State, and tribal natural resource agencies and consider the natural/historic frequency and timing of processes such as flooding and fires. Where it is not appropriate or feasible to restore ecosystem function, refuge management strategies will mimic natural processes to the extent practicable. For example, prescribed burning simulates natural fire regimes and water level

management mimics natural hydrological cycles. Consider constraints and potential positive and negative effects on wildlife, plants, and other resources.

F. Use adaptive management to assess and modify management strategies to achieve habitat objectives.

G. Manage invasive species to improve or stabilize biotic communities to minimize unacceptable change to ecosystem structure and function, and prevent new and expanded infestations of invasive species.

H. Use peer review to provide credible, independent, and expert assessment of refuge habitat management and ensure that we use appropriate techniques, protocols, and processes in the management of refuge habitats.

The use of sound science is also mandated by the Refuge Improvement Act and subsequent Service policies. The Refuge System planning policy specifically requires that CCPs be based on a "comprehensive assessment of the existing scientific literature." Refuge planning policy also states that "refuge planning will reflect conservation goals and objectives for the landscapes in which refuges are located. Refuges must review goals and objectives of existing ecosystem plans and determine how the refuge can best contribute to the functioning of the ecosystem." (603 FW 3).

OTHER MANDATES

Although Service and Refuge System policy plus each refuge's unique legislated purposes provide foundation for its management, other Federal laws, executive orders, treaties, interstate compacts, and regulations on the conservation and protection of natural and cultural resources also affect how national wildlife refuges are managed. The Digest of Federal Resource Laws of Interest to the USFWS lists many of them, and can be accessed at http://fws.gov/laws/lawsdigest.html; accessed November 2013.

Federal laws also require the Service to identify and preserve its important historic structures, archaeological sites, and artifacts. The National Environmental Policy Act (NEPA) mandates our consideration of cultural resources in planning Federal actions. The National Historic Preservation Act (Pub. L. 102–575; 16 U.S.C. 470) requires Federal agencies to locate and protect historic resources—archaeological sites and historic structures eligible for listing or listed in the National Register of Historic Places and museum property—on their land or on land affected by their activities. It also requires agencies to establish a program for those activities and carry them out in consultation with state historic preservation offices (SHPOs).

Our Regional Historic Preservation Officer in Savanna, Georgia, oversees our compliance with the National Historic Preservation Act and our consultations with state preservation offices. We must also comply with the Archaeological Resources Protection Act (pub. L. 96–95, 16 U.S.C. 470aa-mm) which requires that we protect our archaeological sites from vandalism or looting and issue permits for site excavation.

Chapter V-Environmental Consequences evaluates this HMP's compliance with the cultural and historic acts cited above, as well as, the Clean Water Act, Clean Air Act, and Endangered Species Act. We designed this draft HMP/EA to fulfill our NEPA compliance.

THE COMPREHENSIVE CONSERVATION PLANNING PROCESS

Service policy (550 FW 1 and 2) establishes a planning process that also facilitates compliance with NEPA. Each of the individual steps is described in detail in the planning policies and NEPA Reference Handbook (http://www.fws.gov/r9esnepa/).

Planning Process

The key to effective conservation begins with community involvement. To ensure future management of the refuge reflects the issues, concerns, and opportunities expressed by the public, a variety of public involvement techniques were used.

Development of the CCP/EA for Felsenthal and Overflow NWRs was initiated in October 2007. The planning team responsible for the development of the Draft CCP/EA was established in January 2008. It included natural resource management professionals representing both Felsenthal and Overflow NWRs, Service staff, and the Arkansas Game and Fish Commission. Felsenthal NWR's Biological Review was held in June 2008 and the report was completed in December 2008. Public input to the development of the CCP was obtained, in part, through five public scoping meetings held in four different counties, Ashley, Bradley, Desha, and Union Counties, Arkansas, during June and July 2008. These public scoping meetings were attended by approximately 35 stakeholders. Both written and verbal comments were received from stakeholders.

In September 2010 the final CCP was released. This document established the goals and objectives in which Felsenthal NWR is currently operating under. Although much of the information in the CCP is still relevant, the HMP will modify the Refuge's objectives and strategies based on current information.

Public input will be sought in the development of the HMP. Three public meetings will be held in the local area to outline the HMP of the refuge. At its completion, the HMP will be reviewed, evaluated, and subsequently updated approximately every 15 years with the CCP in accordance with the Refuge Improvement Act and Service planning policy (602 FWS 1, 3, and 4), and the HMP policy (620 FW1). However, when significant new information becomes available, ecological conditions change, or when we identify the need to do so, the plan will be reviewed sooner. Plan revisions will require NEPA compliance. If minor plan revisions are required and they meet the criteria of a categorical exclusion, then an environmental action statement, in accordance with (550 FW 3.3C) will only be needed. But if the plan requires a major revision, then the HMP process starts anew.

EXISTING REFUGE OPERATIONAL PLANS

Step-Down Management Plans

The Service Manual (602 FW 4, Refuge Planning Policy) lists more than 25 step-down management plans that may be appropriate to ensure safe, effective, and efficient operation on every refuge. These plans contain specific strategies and implementation schedules for achieving refuge goals and objectives. Some plans require annual revisions; others are on a 5 to 10 year revision schedule. Some plans require additional NEPA analysis, public involvement, and compatibility determinations before they can be implemented. The Fire Management Plan, finalized in 2009, is currently the only refuge step-down plan completed that influences the habitat management program. The plan is reviewed annually.

FORMULATING ALTERNATIVES USING REFUGE RESOURCES OF CONCERN AND FOCAL SPECIES MANAGEMENT

DEFINING REFUGE RESOURCES OF CONCERN AND MANAGEMENT PRIORITIES

As described in the policy on Habitat Management Planning (620 FW 1), Resources of Concern are defined as:

> "all plant and/or animal species, species groups, or communities specifically identified in refuge purpose(s), System mission, or international, national, regional, State, or ecosystem conservation plans or acts. For example, waterfowl and shorebirds are a resource of concern on a refuge whose purpose is to protect migratory waterfowl and shorebirds. Federal or State threatened and endangered species on that same refuge are also a resource of concern under terms of the respective endangered species acts".

Habitats or plant communities are also resources of concern when they are specifically identified in refuge purposes, when they support species or species groups identified in refuge purposes, when they support Service trust resources, and/or when they are important in the maintenance or restoration of biological integrity, diversity, and environmental health (USFWS 2007b).

FOCAL SPECIES MANAGEMENT

To understand the above process and how it was incorporated into our HMP effort, the idea of focal species management and the definition of focal species must be understood. A focal species is a species or group of species (guild) that is directly targeted for conservation and habitat management actions. The selection of focal species is associated with important habitat elements or ecosystem attributes of identified species with the greatest and most urgent conservation needs. These needs are based on the Service's BCC (2008), national, ecoregional, and regional plans, and the State of Arkansas' wildlife action plan.

Focal species for the refuge have been determined to be those specific species requiring immediate conservation action due to declining populations and other factors. Vulnerability to threats has limited the life history requirements needed to ensure their persistence into the future. Once identified, these species were used to define the compositional ecosystem spatial and functional features imbedded in habitat management objectives, strategies, and conservation actions contained in this HMP.

The use of focal species facilitated the complex tasks of writing habitat objectives for refuge purpose species (e.g., migratory birds and endangered species) and other Service trust species (e.g., interjurisdictional fish), while incorporating legal mandates of maintaining and enhancing biological integrity, diversity, and environmental health on refuge lands. Identifying focal species served as a shortcut to simplify dealing with a huge list of wildlife species (birds, native plants, insects, fish, reptiles, amphibians, etc.) that currently reside or seasonally utilize the refuge, and focus habitat management objectives on a shortened list of migratory birds and other wildlife species.

For example, there are over 900 species of migratory birds in North America that are trust species for the Service. The Service's national focal species strategy in its strategic migratory bird management plan (2004 to 2014) has shortened this list to 412 focal bird species. The selection of focal species is a subset of the bird species protected by the Migratory Bird Treaty Act. In 2008, the Service's BCC list narrowed to 139 focal species, targeted for conservation actions based on declining trend data. This list and other ecoregional and State plans reduced our HMP biological planning efforts to two focal bird guilds, 13 refuge focal bird species, two mammals, two Invertebrates, one reptile, one fish and one plant. These focal guilds and species are listed below and are separated by habitat type. It should be noted some species may be found in one or more habitat types:

REFUGE FOCUS GUILDS

- Migrating and wintering dabbling duck
- Migratory landbirds

REFUGE FOCAL SPECIES BY HABITAT TYPE

Upland Pine (Open Pine)

- Red-cockaded Woodpecker (E)
- Bachman's Sparrow
- Brown-headed Nuthatch
- Northern Bobwhite

Upland Hardwoods/Pine Forest

- Kentucky Warbler
- Swainson's Warbler
- Worm-eating Warbler
- Wood Thrush

Bottomland Hardwood Forest

- Cerulean Warbler
- Prothonotary Warbler
- Mallard
- Wood Duck
- Rafinesque's Big-ear Bat
- American Black Bear

Aquatic/Riverine Habitat

- Rabbitsfoot (T)
- Pink Muckett (T)
- Ouachita Rock Pocket (E)
- Western Chicken Turtle
- Alligator Gar

*() E - endangered and T - Threatened

The focal species approach was then used to write wildlife and habitat objectives that linked focal species to habitat management strategies and new conservation actions targeting these wildlife species. It is a multi-species management approach in which the life history and habitat structural requirements of focal species and guilds have been used to define the future management direction and desired conservation outcomes for the refuge, based on the best contribution the refuge makes to both State and regional landscape conservation scales. Targeting conservation actions to a few focal species, specifically in habitat management objectives, is made with the assumption that hundreds of other fish, wildlife, and native plant species will benefit.

Monitoring will be an integral component of biological planning using focal species, such as presence/absence as an inexpensive measure to gauge environmental health, relative abundance, and density of focal species as measures of biological integrity and diversity. Our habitat objectives incorporating specific focal species are based on numerous hypotheses and assumptions using the most recent and best available plant and wildlife survey information. These assumptions will be tested in on-going refuge monitoring studies where focal species serve as key targets for monitoring endeavors to test the effectiveness of habitat management strategies and conservation actions, or to adjust strategies and actions when outcomes do not meet expectations.

CHAPTER III. AFFECTED ENVIRONMENT

For a description of the affected environment, please refer to Chapter II, Refuge Overview, in the Draft Habitat Management Plan (Section A).

CHAPTER IV. DESCRIPTION OF ALTERNATIVES

INTRODUCTION

This chapter presents our process for formulating alternatives; Actions that are common to all alternatives; and Descriptions of the three alternatives we analyzed in detail.

The alternatives considered, including the Service's preferred alternative are:

Alternative A – Current Management. This alternative fulfills the NEPA requirement for a no action alternative, one that proposes no change in the current management of the refuge. Alternative A is to continue to manage the refuge as we do at the present time.

Alternative B – Proposed Alternative. This alternative will focus on focal species with proactive habitat management. Alternative B is our proposed alternative and the action that we recommend for final selection.

Alternative C – Historic Habitat Management. This alternative proposes to return to a water management program which would raise the water levels in the pool December 15 – January 15 to 68' msl, propose an annual drawdown of the Felsenthal pool for waterfowl food production, and initiate uneven-aged management of a portion of the upland pine.

At the end of this chapter, a matrix compares how each alternative addresses significant issues, supports major programs, and achieves refuge goals and objectives.

DEVELOPING ALTERNATIVES, INCLUDING THE NO ACTION ALTERNATIVE

Management alternatives were developed after identifying a wide range of possible management objectives and strategies that could achieve refuge goals. These alternatives can be described as packages of complementary objectives and strategies designed to meet refuge purposes and the Refuge System mission and goals as described in Chapter 1, and stepped down into refuge-specific goals used as the framework for each alternative. Management objectives and strategies developed for each alternative respond to public issues and opportunities identified during the planning process.

We fully analyze three alternatives that characterize different ways of managing the refuge in this Environmental Assessment. We believe they represent a reasonable range of alternative proposals for achieving the refuge purpose, vision and goals, and address the issues described in Chapter 1. Unless otherwise noted, all actions would be implemented by refuge staff.

Alternative A satisfies NEPA requirements for a No Action Alternative. It describes the refuge's existing management activities and serves as a baseline for comparing and contrasting Alternatives B and C. Implementing Alternative A would continue current habitat management regimes in their present format.

Alternative B, the Service's proposed alternative, combines actions that we believe would most effectively achieve refuge purposes, vision and goals, and respond to public needs. Alternative B also incorporates the principles of strategic habitat conservation and focal species management, as both reflect the most recent advances in the fields of conservation science and delivery of conservation actions on the ground by the Service. Under Alternative B, the refuge would implement adaptive management tools and interventions that mimic natural processes to enhance habitat

restoration where deemed most appropriate. At the same time, the refuge would strategically reduce the use of management actions that are contrary to the directions of the BIDEH policy, such as artificially managing water levels. Alternative B would include a combination of passive and active management approaches to foster or achieve more ecologically sustainable habitats than occur on the refuge at present.

In Alternative B, the habitat condition objectives and general management strategies include the following:

- Managing for natural range of conditions in upland habitats (native forest, early successional, and shrubland habitats) to restore lost elements of BIDEH for priority resources of concern.

- Managing the refuge's forested wetland and aquatic systems consistently with BIDEH, and considering their sustainability in an altered hydrological system.

- Restoring mature upland forested habitats, through planting and active forest management, to manage for priority resources of concern (endangered red-cockaded woodpecker and forest interior-dwelling birds).

- Increasing avian diversity and abundance of targeted focal bird species.

Alternative C habitat management emphasizes a return of a water management program that would raise water levels in the pool to 68' msl from December 15 to January 15 with every third year the pool would not be raised in an effort to try an mimic natural hydrological processes. In addition, a portion of the upland pine (RCW habitat) would be managed under an uneven-aged management protocol and only the small isolated pines tracts would be converted to upland hardwood. Annual drawdown of the Felsenthal pool would put an increased emphasis on waterfowl.

FORMULATING ALTERNATIVES USING REFUGE RESOURCES OF CONCERN (ROCS) AND FOCAL SPECIES MANAGEMENT

Relating Resources of Concern to Goals, Objectives, and Strategies

Refuge goals and objectives define each of the management alternatives identified below. As described in Chapter 2, the first step in our planning process was to map out the refuge's resources of concern and prioritize focal management species that were used in developing goals and objectives. Goals are intentionally broad, descriptive statements of the desired future condition for the refuge's resources of concern. By design, they are less quantitative and more prescriptive in defining the future desired habitat conditions of our management.

Our goal statements include the principal elements of the refuge purposes, Refuge System mission, and refuge-specific habitat vision statement developed by the public during the CCP process (USFWS 2010). All these inputs provided the framework for stepping down specific management objectives and strategies. The refuge goals were established in the 2010 CCP, and are common to all of the alternatives, but objectives and strategies may vary between alternatives (USFWS 2010).

A rationale accompanies each objective to explain its context and why we think it is important. We will use the objectives in the alternative selected for the final HMP. We identified strategies for each of the objectives. These are specific actions, tools, techniques, or a combination of these that may be used to achieve the objective. Respective lists of strategies under each objective represent a

potential suite of actions to be implemented in step-down plans that will achieve the desired future habitat and wildlife outcomes.

The balance of this chapter is organized as follows. Actions common to all alternatives are described first. Each alterative considers the habitat goal set out in the CCP and describes the different objectives and strategies that will be utilized to achieve that goal. In some cases the HMP objective may modify CCP wildlife population goals and objectives, e.g. RCW or DEDs.

FEATURES COMMON TO ALL ALTERNATIVES

All of the alternatives share some common actions. Some are required by law or policy, or represent NEPA decisions that have recently gone through public review and are binding in many of our decisions. Other may be administrative actions that do not require public review, but are highlighted in this public document. They may be actions crucial to achieving refuge purposes, vision, and goals. There are at least eight components of refuge management that are common to all alternatives and are described below. They include:

- Conducting adaptive resource management
- Managing invasive species
- Monitoring and abatement of diseases affecting wildlife and forest health
- Control of pest animals
- Removing unnecessary structures and site restoration
- Conducting appropriate use and compatibility determinations
- Facilitating and conducting biological research and investigations
- Protection of cultural resources

ADAPTIVE RESOURCE MANAGEMENT

In all of the alternatives, HMP goals and objectives were developed to support rationales and management strategies by using a thorough assessment of available science derived from scientific literature, on-site refuge data, expert opinion within and outside the Service, and sound professional judgment. Biological objectives describe desired future conditions for wildlife and refuge habitats. In all the alternatives, it is assumed that we employ adaptive resource management as a strategy to ensure a quick and efficient response to new information and events. The need for adaptive management is compelling because our present knowledge and information on refuge habitats and species is incomplete, provisional, and subject to change as new information is acquired. Adaptive management is a proactive process of learning what works on the ground by constantly adjusting strategies to respond to new information, spatial and temporal changes, and environmental and climatic events, whether foreseen or unforeseen, measured against a clearly defined goal or set of conditions.

On March 9, 2007, the Secretary of the Interior issued Order No. 3270 that provides policy on the procedures for implementing adaptive management in DOI agencies. A published guidebook for managers and practitioners defines adaptive management and the conditions under which we should consider it, and the process for implementing and evaluating its effectiveness. You may view this reference at the following site: *http://www.doi.gov/initiatives/AdaptiveManagement/documents.html* (accessed February 2012). As it relates to refuge management, adaptive management promotes flexible decision-making through an iterative learning process to deal with uncertainty, resulting in more effective decisions. At the refuge level, monitoring habitat management actions and outcomes and key resources of concern will be critical to the process.

Climate change is expected to exacerbate the current rate of habitat fragmentation and loss, change habitat composition and structure, simplify ecosystem function, increase the prevalence of weed and disease species, degrade water quality, and alter hydrology. It will be especially important to continually evaluate management activities and the status of the refuge's resources in order to respond to negative impacts as quickly as possible.

At the refuge level, monitoring and assessing management actions and outcomes, and tracking critical resources and indicators of environmental health will be very important. The refuge will be responsible for changing management actions and strategies if they do not produce the desired conditions. Significant changes in management actions and strategies from what we present in our final HMP may warrant additional NEPA analysis and public comment. Minor changes will be documented as an important element of the adaptive management process; NEPA analysis and public comment are not warranted.

Many of our alternative's objectives identify increased monitoring elements. If monitoring activities are conducted by non-Service personnel, these activities must be determined compatible by the refuge manager in a compatibility determination. Our future habitat and species inventory and monitoring plan will detail how and what we monitor and will also incorporate an adaptive management approach to support the goals and objectives of the refuge.

MANAGING INVASIVE SPECIES

The establishment and spread of invasive species, especially invasive plants, is a major problem that reaches across all refuge habitat cover-types. We use the definition of invasive species found in the Service Manual (620 FW 1.4E):

"Invasive species are alien species whose introduction does or is likely to cause economic or environmental harm, or harm to human health. Alien species, or non-indigenous species, are species that are not native to a particular ecosystem. We are prohibited by Executive Order, law and policy from authorizing, funding, or carrying out actions that are likely to cause or promote the introduction of invasive species in the United States or elsewhere."

The unchecked spread of invasive plants and animals threatens the biological integrity, diversity, and environmental health of all refuge habitats. In many cases, invasive species have a competitive advantage over native plants and animals and out-compete them, reducing the availability of desirable native food and cover plants for wildlife. Invasive plants reproduce rapidly over large areas of the landscape and have few or no natural controls to keep them in check. Invasive vegetation usually spreads aggressively by runners or rhizomes, produces large numbers of seeds and disperses seeds through various means such as wind, water, wildlife, or people. Invasive wildlife, is best held in check through alert monitoring; if found, appropriate techniques need to be matched to the particular species of concern.

Controlling and managing invasive species is a strategy for maintaining the biological integrity and diversity of all habitats. The national strategy recommends the following priority order of action for invasive species management:

- Control or contain large established infestations
- Prevent invasion of potential invaders
- Eradicate new or small infestations

Potential management strategies for preventing invasive species, prioritizing control efforts for established invasive species, and controlling invasive species are described in detail below. Prior to the initiation of invasive species control efforts, refuge staff must understand the biology of the species to be controlled. A number of resources are available on the internet to assist with this. Some sources are included below (all accessed February 2012):

- National Invasive Species Information Center *http://invasivespeciesinfo.gov/index.shtml*
- USGS Invasive Species Program *http://biology.usgs.gov/invasive/*
- Weeds Gone Wild *http://www.nps.gov/plants/alien/index.htm*

Refuge staff should conduct appropriate and applicable pest detection, environmental surveillance, and monitoring before, during, and after any management activity to determine whether pest management goals are achieved and whether activity caused any significant unanticipated effects. The lowest risk, most targeted approach for managing invasive species should always be utilized.

Early Detection and Rapid Response

Where prevention is not possible, early detection and rapid response are the next best strategies. Success will depend in part on participation by all refuge staff, contractors, volunteers, and visitors in efforts to report and respond to invasions. The refuge manager must have access to up-to-date reliable scientific and management information on species that are likely to invade. The University of Arkansas Cooperative Extension Service is an important source of information *http://www.arinvasives.org*.

Prioritizing Invasive Plant Species Control Efforts

The first step in prioritizing invasive species control efforts is to determine the abundance and distribution of invasive species on the refuge or management unit. However, control efforts should not be delayed to collect statistically rigorous survey data. Baseline data regarding the location of many invasives on the refuge already may be available from observations of staff, volunteers, contractors, and refuge visitors. These observations should be documented and mapped on refuge GIS. If a more formalized mapping procedure is desired, the North American Weed Management Association (*http://www.naisma.org*; accessed November 2013) has information on mapping procedures.

There are a number of ranking tools to assist land managers with the daunting task of prioritizing their invasive plant control efforts (Morse et al. 2004, Hierbert and Stubbendieck 1993, APRS Implementation Team 2000). The Fulfilling the Promise Team recommends using the following order of priority to determine appropriate actions: smallest scale of infestation, poses greatest threat to land management objectives, and greatest ease of control.

When limited resources prevent the treatment of entire populations, the following order of priority is recommended: treat the smallest infestations (satellite populations), treat infestations on pathways of spread, and treat the perimeter and advancing front of large infestations.

To prevent the spread of invasives along transportation corridors, maintain invasive species-free zones along trails, around parking lots and boat launches, and at other related facilities. These areas will be inspected often, and new infestations will be controlled immediately. Minimize the number and size of roads on the refuge. Remove all mud, dirt, and plant parts from all equipment between projects or when equipment is moved from one location to another.

Mechanical

Mechanical removal of invasive organisms can be effective against some herbaceous plants, shrubs and saplings, and aquatic organisms. This is particularly effective for plants that are annuals or have a taproot. Care should be taken to minimize soil disturbance to prevent creating conditions ideal for weed seed germination. Repeated cutting over a growing period is needed for effective control of many invasive plant species. Care should be taken to properly remove and dispose of any plant parts that can resprout. Treatments should be timed to prevent seed set and resprouting. The following methods are available: hand-pulling, pulling with hand tools (weed wrench, etc.), mowing, brush-hogging, weed-eating, stabbing (cutting roots while leaving in place), girdling (removing cambium layer), mulching, tilling, smothering, and flooding.

The advantages of mechanical treatment are low cost for equipment and supplies and minimal damage to neighboring plants and the environment. The disadvantages are higher costs for labor and inability to control large areas. For many invasive species, mechanical treatments alone are not effective, especially for mature or well-established plants. For some invasive plants, mechanical treatment alone exacerbates the problem. Mechanical treatments are most effective when combined with herbicide treatments.

Herbicides

There are many chemicals available to control invasive and undesirable plants. They may work in different ways and be very target-specific, or affect a wide range of species. Herbicides may be pre-emergent, i.e., applied prior to germination to prevent germination or kill the seedling, or post-emergent and have various modes of action (auxin mimic, amino acid inhibitor, mitosis inhibitor, photosynthesis inhibitor, lipid biosynthesis inhibitor). Products may come in granular, pelleted, dust or liquid forms. Common application methods include foliar spray, basal bark, hack and squirt, injection, and cut stump. The timing of applications is critical to achieve good control, as the growth stage at which an invasive plant will be most effectively controlled varies with different species. All pesticides must be mixed, loaded and applied in accordance with label specifications and all applicators of restricted use chemicals must be certified with the Arkansas Department of Agriculture or working under the supervision of a certified applicator.

The advantages are that the right chemicals, applied correctly, can produce desired results over a large area for a reasonable cost. The disadvantages are that the chemicals may affect non-target species at the site or contaminate surface or groundwater. Proper planning includes using the most target-specific, least hazardous (for humans and the environment), and most effective chemical for the job. Additionally, one should research minimum effective dosage, as the chemical labels often give higher than necessary concentrations. Herbicides often are most effective when used in combination with mechanical methods.

Within refuge lands, all chemicals, including adjuvants designed to enhance effectiveness are covered by Service and Departmental regulations and a pesticide use proposal (PUP) (7 RM 14) is required for all pesticide applications. Attention to protective gear, licensing requirements and other regulations is essential.

Biological Control

Biological control is the use of animals or disease organisms that feed upon or parasitize the invasive species target. Usually, the control agent is imported from the invasive species' home country, and artificially high numbers of the control agent are fostered and maintained. There are also

conservation or augmentation biological control methods in which populations of biological agents already in the environment (native) are maintained or enhanced to target an invasive species. The advantages of this method are that it avoids the use of chemicals and can provide relatively inexpensive and permanent control over large areas. Appropriate control agents do not exist for all invasive species. Petitions are submitted and approved by the USDA Technical Advisory Group on weed biological control before any proposed biological control agent can be released in the United States.

The introduction of Grass carp (*Cteno pharyngodon idella)* can be an important and cost-effective biological contol for submerged nuisance, exotic, and/or invasive aquatic plants (www.uaex.edu/publications/pdf/mp44/aquatic-weed-control-grass-carp.pdf). Grass carp are native to the large rivers of eastern Russia and China. Normally, managers are averse to introducing non-native species because exotic species can have negative impacts to native species and ecosystem balance. However, researchers have discovered a method to sterilize grass carp by treating grass carp eggs with heat, cold, or pressure to inhibit the second maturation division of the fertilized egg. This process produces grass carp with abnormal chromosome numbers. The normal diploid grass carp has a chromosome number (2N) of 48, and the triploid grass carp has a chromosome number (3N) of 72. The extra chromosomes result in sterility (Allen and Wattendorf 1987). Triploid grass carp provide the following benefits: effective control of certain aquatic plants; sterile and wil not reproduce and populations will not increase; feed only on plants and not fish eggs or young fish; become dormant during the winter and resume intensive feeding when water temperature reaches 68°F; live for approximately 10 years thereby reducing the cost of re-stocking. Also, hydrilla *(Hydrilla verticillata),* widely considered to be the most problematic non-native aquatic plant in the U.S., is one of the grass carp's most preferred plants to feed upon (Pine and Anderson 1991).

Six non-native plant species are found on Felsenthal NWR and are listed below:

- Chinese tallow tree *(Triadica sebifera)*
- Mimosa *(Albizia julibrissin)*
- Water Hyacinth *(Eichhornis crassipes)*
- Hydrilla *(Hydrilla verticillata)*
- Cuban bulrush *(Oxycaryum cubense)*
- Japanese Climbing Fern *(Lygodium japonicum)*

CONTROL OF NON-NATIVE AND OTHER PEST ANIMALS

Many exotic animals and at times native animals can interfere with management objectives. The Refuge Manual (7 RM 14.4A) defines an animal pest as “any terrestrial or aquatic animal which interferes, or threatens to interfere, at an unacceptable level, with the attainment of refuge objectives or which poses a threat to human health.” In order to meet management objectives under all alternatives, pest animals will be controlled on the refuge to maintain acceptable population sizes. Acceptable population sizes vary with species and management situation. The impacts of specific pest animal species or groups are described further below.

In controlling animal pests, whether alien or native species, we use an integrated approach. Integrated pest management is defined as “a dynamic approach to pest management which utilizes a full knowledge of a pest problem through understanding of the ecology of the pest and ecologically related organisms and through continuous monitoring of their populations. Once an acceptable level of pest damage is determined, control programs are carefully designed using a combination of compatible techniques to limit damage to that level.” We will use integrated pest management to

control pests, which is a sustainable ecosystem-based decision making process for managing invasive species, pests, and diseases through a combination of biological, physical, cultural, chemical, and other practices. The goal of integrated pest management is to remove or reduce only the target organism(s) with the least possible risk to other organisms. Pest animals that present problems to refuge management include feral hogs, beaver, nutria, and southern pine beetle.

We will use the following strategies in animal pest management:

- Determine the need for site-specific control, based on the potential to negatively affect wildlife and habitat management objectives on the refuge.
- Employ integrated pest management techniques when a species is having a significant impact on an area resulting in major habitat replacement or damaging rare species.
- Monitor results to ensure that pests do not exceed acceptable levels.

Although we will employ an adaptive management approach to pest animal problems, we also expect that lethal control or removal of individual animals will be required. Unfortunately, establishing general thresholds for lethal action is difficult. Instead, a case-by-case analysis and specific site characteristics will be used to determine the best solutions as needed to fulfill habitat and wildlife management objectives. Trapping or lethal control of mammals will be relied on as a management practice to control and/or manage pest animals that negatively impact refuge habitats. Trapping to control feral hogs, beaver, or nutria can help to protect desirable vegetation, achieve desirable interspersion of wetland vegetation, and protect rarer species. Trapping is also useful for surveys and monitoring of some species, facilities protection, research, feral animal control, disease control, and public health and safety.

Feral hogs (*Sus scrofa*) are one of the most invasive, destructive, exotic species in North America. Because they are prolific, hog populations grow at an explosive rate (Seward *et al.* 2004). Much scientific literature exists that documents adverse impacts by feral swine to habitat productivity and reproduction of most native wildlife (Lipscomb 1989; Belden 1972; Belden and Pelton 1976; Yarrow 1987; Jacobi 1980; Baron 1980; Lacki and Lancia 1986; Willy 1987). Being omnivorous, feral swine utilize virtually every component of the habitat resulting in direct competition with native wildlife, reductions in carrying capacities, and adverse impacts to reproduction/recruitment. In addition, existing documentation indicates feral swine serve as a source for many diseases that impact wildlife, domestic livestock and humans. A partial list of these diseases include black plague (Clark et al. 1983), bovine tuberculosis (Nettles et al. 1989), brucellosis (Becker et al. 1978), coccidiosis (Greiner et al. 1982), foot and mouth disease (Pech and Hone 1988), hog cholera (Nettles et al. 1989), Leptospirosis (Clark et al. 1983), parvo (New et al. 1994), pseudorabies (Clark et al. 1983), swine fever (Dahle and Leiss 1992), and Trichinosis (Nettles et al. 1989). In fact, recent results of feral swine disease monitoring on Felsenthal NWR discovered that 22% and 35% of the feral pigs tested were infected with swine brucellocis and pseudorabies, respectively. Methods for feral swine control/eradication include trapping and shooting by Service employees.

Beavers (*Castor canadensis*) 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 that beavers, on average, damaged $164/acre (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 have not been in demand; therefore, little trapping is conducted, causing beaver numbers to be high (Hill 1982).

Methods to control beavers include trapping and shooting by Service employees, through interagency agreements with USDA-APHIS, and trapping by the public. To minimize habitat loss, removing beaver dams manually, with heavy equipment or by explosives is done by Service employees. Dams that are small enough to remove by hand or are located in a culvert or water control structure will be removed manually. If a dam is so large it cannot be removed manually, it can either be removed by machinery or explosives. Explosives are used only by certified employees of the Service or APHIS and all state and local laws are followed.

The nutria (*Myocastor coypus*) is a semiaquatic rodent native to southern South America. Nutria were intentionally released into the U.S. in support of the fur farming trade during the 1930's and nutria were later introduced to many areas to control aquatic vegetation (Sealander and Heidt 1990). Nutria populations are now well established in the U.S. including Felsenthal NWR. Nutria do not represent a valuable fur resource and their value for vegetation control is at best overrated because they more often feed on desirable vegetation, especially waterfowl foods, and avoid nuisance aquatic vegetation (Lowery 1974, Linscombe and Kinler 1997). In fact, at high population densities, foraging by nutria can significantly impact natural plant communities and can negatively impact a host of native wildlife including waterfowl, wading birds, and muskrats. Digging and rooting by nutria in aquatic systems can contribute to severe erosion. Nutria can serve as hosts for several pathogens that can infect people, pets, and livestock such as tuberculosis and septicemia. Also, nutria can carry parasites such as blood flukes, tapeworms, liver flukes, giardia, and harmful nematodes. Nutria have a high reproductive potential and few, if any, natural predators; therefore, population control is challenging (Lowery 1974, Sealander and Heidt 1990). The most practical control measures include recreational trapping by the public and shooting by refuge staff.

Southern pine bark beetles (*Dendroctonus frontalis*), are native beetles found extensively in southern pine habitats. The southern pine bark beetle is the most destructive forest insect in the south. Weakening of trees by flooding, windstorms, and especially drought commonly precedes outbreaks. Trees of all sizes are attacked, but usually trees larger than six inches in diameter are infested first. Adult beetles are usually attracted to weakened trees. The first indication of attack is usually yellowing or browning of needles. The trunk will usually reveal white, yellow, or sometimes red-brown pitch tubes, about as large as a wad of gum. Under drought conditions, pitch tubes may be very small or absent, and only reddish-brown boring dust will be present. Removal of the bark will show a distinctive winding "S" shaped gallery pattern. In active spots, trees in the center have dark reddish-brown foliage. Foliage will change to light greenish or yellowish green on the edges of active spots. In epidemics, they attack trees that appear healthy and vigorous. Initial attacks are in the mid-trunk and then the length of the tree. Adult beetles bore through the bark and excavate long winding "S" shaped galleries. Eggs are laid in niches along the galleries. Larvae feed in the cambium until grown, and then excavate cells near the bark surface in which to pupate. After pupation, adult beetles chew through the bark and emerge. The complete cycle of the attack takes from 25 to 40 days, depending on the temperature.

Most southern pine bark beetle spot infestations should not need to be controlled, are self-limiting, and will not expand to a level that threatens RCW foraging or nesting habitat. However, when bark beetle populations become epidemic or individual infestations have the high potential to expand and jeopardize pine stands or RCW clusters, control measures are warranted. Epidemic levels seem to recur on a 5 to 10 year basis, but do not appear related to pine stand conditions. Rather certain stands may be more likely to become infested during severe outbreaks. Both age of the stand and overall stocking density (stems/acre and BA) tend to be correlated with higher potential for infestation.

When epidemic southern pine bark beetle levels occur, control measures need to be done aggressively and timely to prevent large-scale stand mortality and possible loss of RCW clusters. Control measures should be based on a risk assessment of existing size and potential to expand, threat to RCW foraging and nesting habitat associated with active and inactive clusters, and high public use areas (e.g., Woodpecker Trail, Visitor Center). Priority for control should be on active clusters. Provided sufficient funding and staffing are available, monitoring and locating infestations is best achieved through aerial surveys. During extreme conditions, recurring aerial flights may be needed on a weekly basis to deal with the epidemic. Once the infestation is located, its threat can be better assessed. Under epidemic situations, control will normally consist of the creation of a 150- 200 foot buffer around the spot and the possible removal of infested trees. The buffer is created through the removal of non-infested trees or those which have yet to show signs of pitch tubes or fading of needle color in the crown. Only dead trees or red needle trees (e.g., beetle vacated) are left at the site. Treatment is typically accomplished through a contract logger that is responsible for felling all marked trees and removing merchantable material. All trees are felled to the center of the designated spot, and loggers need to treat each site as soon as possible to limit spread.

PROTECTING CULTURAL RESOURCES

As a Federal land management agency, we are responsible for locating and protecting all historic resources, specifically archeological sites and historic structures eligible for, or listed in, the National Register of Historic Places. This applies not only to refuge lands, but also to lands affected by refuge activities, including museum properties. Data collected from several field investigations and archeological studies indicate that over 200 archeological/cultural sites have been identified at Felsenthal NWR.

Under all the alternatives, we will evaluate the potential for impact on archeological, prehistoric and historical resources, and will consult with the regional historic officer before new refuge activities or actions are planned. We will be especially thorough in upland areas along waterways or areas surrounded by marsh, where the probability of locating new cultural resources is higher. This care will ensure that we comply with section 106 of the National Historic Preservation Act, regardless of the alternative.

DESCRIPTION OF ALTERNATIVES

Serving as a basis for each alternative, a number of objectives were developed to help achieve the refuge's purpose and the mission of the Refuge System. Objectives are desired conditions or outcomes for this planning effort, consolidated into three alternatives. These alternatives represent different management approaches for managing the refuge over a 15-year time frame while still meeting the refuge purposes and goals. The Service would continue with its management of Felsenthal NWR in accordance with the goals outlined in the CCP (USFWS 2010); however Alternative B and C modify or replace certain objectives identified below (USFWS 2010). The three alternatives are summarized below. A comparison of each alternative follows the general descriptions (Table 15).

ALTERNATIVE A - (CURRENT MANAGEMENT - NO ACTION)

This alternative primarily portrays current management, representing a "No Action" alternative, as outlined in the CCP (USFWS 2010). It is the baseline for comparing the other two alternatives. Our

habitat management program would continue in its present manner, which involves active management 9,490 acre of upland habitat to include fire for RCWs, RCW population goal would remain at 34 as outlined in the Recovery Plan, and a modified water management regime from years past (CCP Goal 1, Objective 1.1). In this alternative's scenario, water and habitat management would be conducted as outlined in the CCP (CCP Goal 2, Objective 2.1-2.12). While natural resource protection and conservation actions would continue, generally speaking, the habitat manipulation programs we would conduct would include the removal of invasive species and enhancement actions for federally listed endangered and threatened species. The goal and objective numbers referenced below relate to the original goal and objectives numbers in the CCP that was released in 2010 (USFWS 2010) and only the ones listed below are proposed to be modified or replaced by Alternative B and/or C.

Figure 22 depicts the broad habitat types we predict would result under implementation of Alternative A management objectives and strategies.

Objective 1.1: Threatened and Endangered Species - Red Cockaded Woodpecker: Over the 15-year life of the CCP, continue to support threatened and endangered species through surveys, habitat management, research, and recovery (CCP Goal 1 remains the same).

Discussion: During 2007, Felsenthal NWR was home to 11 active colonies of red-cockaded woodpeckers (RCWs), a number that has remained relatively constant (11 to 14 colonies) over the last few years. The RCW was listed in the *Federal Register* as endangered in 1970 (35 FR 16047), and received federal protection under the Endangered Species Act of 1973, as amended. The RCW has high priority in refuge management.

Strategies:

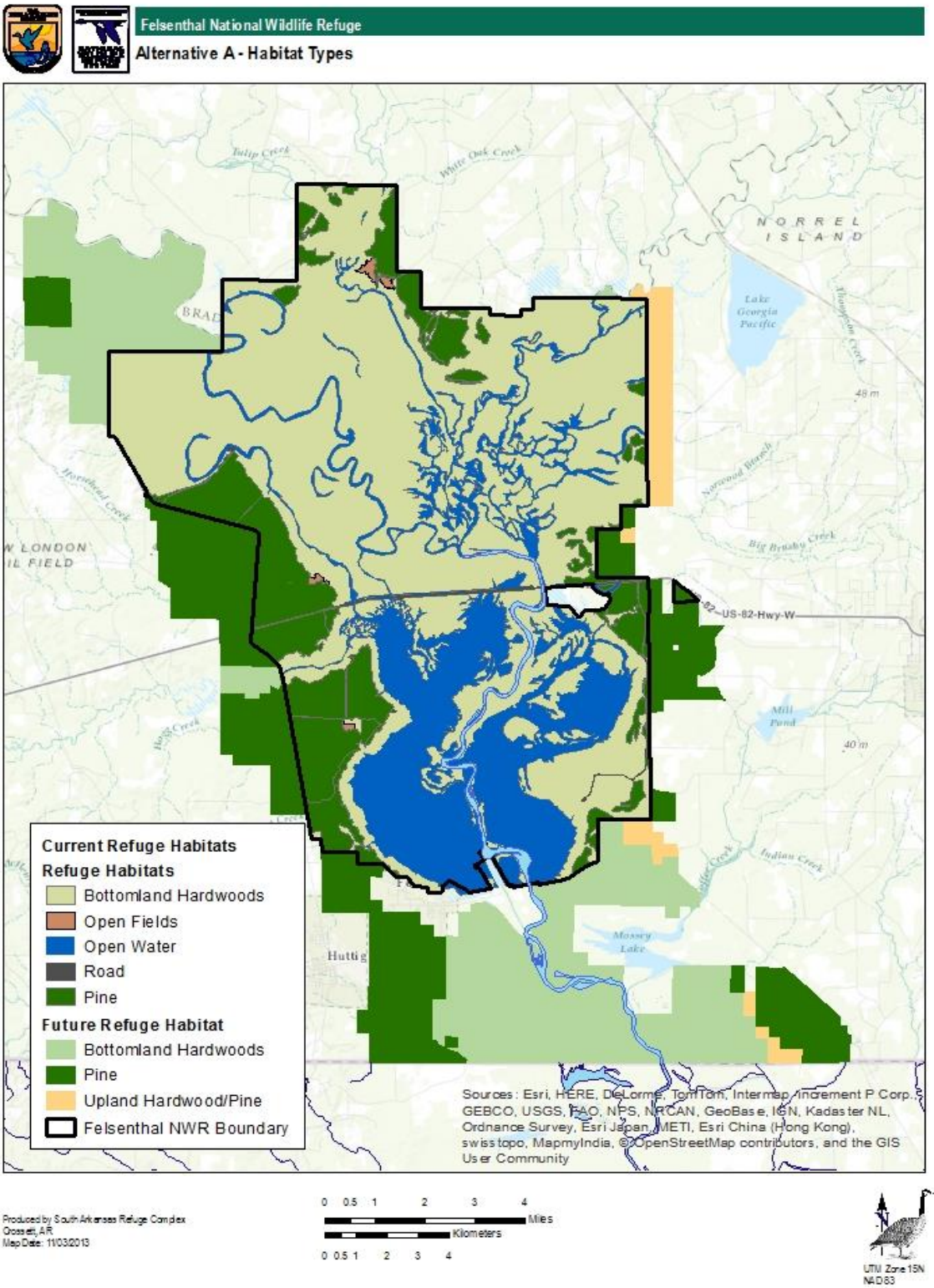
- Reach or exceed 22 active RCW clusters.
- Complete an RCW Management Plan.
- Maintain a wildlife biologist on staff.
- Evaluate whether RCW habitat can be improved through better control of sprouting hardwood rootstocks in suitable nesting and foraging habitat (need fire monitoring plan).

Goal 2. Protect, maintain, enhance, and where appropriate, restore suitable habitat for the conservation and management of migratory birds, resident wildlife, fish, and native plants, including all federal and state threatened and endangered species endemic to Felsenthal NWR (Same as CCP Goal 2).

Discussion: The Lower Mississippi River Ecosystem includes the alluvial plain of the Mississippi River downstream of its confluence with the Ohio River and the delta plain and associated marshes and swamps created by the meanderings of the Mississippi River and its tributaries (USFWS 2002). The drainage basins and tributaries of the Ouachita River, which include Felsenthal NWR, are part of the West Gulf Coastal Plain section of the Lower Mississippi River Ecosystem.

The refuge, characterized by bottomland hardwoods and wetlands, are managed for the conservation, enhancement, and restoration of bottomland hardwoods; moist soil management; endangered species protection; environmental education; and compatible wildlife-dependent recreation in the Lower Mississippi River Ecosystem. The natural ecosystem provides a model that guides Service efforts to enhance, restore, and conserve the natural functional processes and habitat types, while maintaining economic productivity and recreational opportunities.

Figure 22. Felsenthal National Wildlife Refuge, Alternative A, the No Action Alternative



The Lower Mississippi River Ecosystem serves as a primary wintering habitat for mid-continental waterfowl populations, as well as, breeding and migration habitat for migratory songbirds. The expansive lower Mississippi river floodplain forests of the past are now fragmented bottomland hardwood patches due to conversion from agriculture and flood control projects.

Objective 2.1. (Forest Management) Over the 15-year life of the CCP, manage 50,000 acres of forests to provide a diversity of native plant and animal species found in the Ouachita/Saline River Basin, to fulfill the mission and purposes of the refuge (*CCP Objective 2.1*).

Discussion: Forest management treatments are needed to maintain or improve the general health, productivity, and plant diversity of the forest. Much of the forest is overstocked and needs to be gradually thinned to reduce stress, to lessen the chance for epidemics of damaging insects, to remove diseased trees, and to enhance vertical and horizontal diversity. Developing a broader range of tree ages, sizes, densities, and heights will increase diversity. Where previous landowner practices have degraded wildlife habitat, regeneration cuts may be used.

There are no established age limits for any tree species. Wildlife habitat needs, general health of trees, diseases, insect epidemics, tree species mix, overstocking, understocking, and existence of cavities are examples of factors that have to be considered in enhancing or maintaining the forest to meet wildlife habitat needs. Many other factors also need to be considered in deciding whether an area should receive forest management treatments. Every tree is judged for its current and future value to wildlife before a decision is made to cut it or leave it.

As mentioned above, there are ever-increasing concerns about forest-breeding birds, which have prompted new research to determine their habitat requirements, especially those for forest interior-dependent birds. The Forest Resource Conservation Working Group's-Desired Forest Conditions guidelines have been established for bottomland hardwood habitats and will be used to guide forest management to provide benefits for a variety of priority wildlife species. At the landscape level on the refuge, mature loblolly and shortleaf pine, pine/hardwood, upland, and bottomland hardwoods will be the focus. All present forest management guidelines concerning forest interior birds are to be applied to all forest types of the refuge and are designed to minimize impacts to these birds.

Approximately 5,000 acres of pine habitat and 10,500 acres of bottomland hardwood habitat have been silviculturally treated since 1988. Some additional pine acreage (approximately 1,500) was treated prior to 1988, and the entire area was treated prior to the property being transferred to the Service. Currently, silvicultural/wildlife management in the bottomland hardwoods reflects the guidelines established by the LMVJV Forest Resource Conservation Working Group. These recommendations fall within the parameters stated in the 1995 Revision of the Forest Management Plan/NEPA documents and have been implemented for the last 6 years.

Strategies:

- Instead of actively managing the entire bottomland forest, approximately 15 percent will be passively managed as an old-growth component.
- Instead of a 20 year cutting cycle with a 100 year even-aged rotation age, there will be a 10 year uneven-aged cutting cycle with no fixed rotation age. No more than 10 percent of the forest will be subject to harvesting during any one year.
- Restore historic range of variation in forest structure, following the requirements of songbirds, bats, and other priority species.

- Instead of 40 acre even-aged regeneration cuts, the group selection / patch cut methods will be applied using 0.5- to 7 acre regeneration cuts. Generally, group/patch openings will be used to obtain new shade intolerant hardwood regeneration.
- Continue to improve small game habitats via forest management activities.

Objective 2.2. (Forest Management) Over the 15-year life of the CCP, actively manage approximately 9,000 acres of pine stands for RCW habitat in accordance with the recovery plan (*CCP Objective 2.2*).

Discussion: As dictated by the Endangered Species Act and RCW management guidelines, pine habitat will be managed for the RCW. Some stands will be thinned to provide the open park-like conditions preferred by the RCW. The RCW would lose some foraging habitat by thinning, but in the long term the remaining trees will be healthier and will increase in diameter, thus increasing forage. Thinning also reduces the threat of damage to trees by insects such the southern pine beetle.

Regeneration cuts of 5 to 20 acres in pine stands may be needed to provide future foraging habitat for the RCW. Older trees approaching 60 years old must be maintained for potential foraging and cavity trees to replace those 80 plus year old that are lost to natural mortality. The current checkerboard pattern of stands greater than 60-years old, alternating with stands between 37 and 42 years old (in 40 acre blocks) needs to be broken up. Special attention must be given to long-term management of existing foraging habitat for each colony of RCWs.

The use of prescribed fire on a 1 to 3 year rotation basis will be necessary to control encroachment by hardwood midstory in RCW colony sites. In some areas, an annual burn would benefit other species such as the Bachman's sparrow. It may also be necessary to conduct growing-season burns in some areas to effectively control hardwood mid- and under-story.

Strategies:

- Expand existing early successional stage vegetation acres with fire to reduce midstory and promote a grassy/herbaceous understory with patches of scrub/shrub (usually oak) using a combination of dormant and growing season burning.
- Expand sparse canopy and low to moderate basal area in mature (sawtimber) pine forests (10-20 feet/2 acre to 70 feet/2 acre), except adjacent to floodplain where higher basal area and more hardwood mixed in the stands is preferred.
- Retain snags over 15 inches for cavity nesting species, not posing a safety hazard to personnel and visitors.
- When stands become overstocked, thinning will be applied in the matrix between group openings to reduce stem density, with a residual stand basal area target of about 60-70 feet/2 per acre.

Objective 2.3. (Green-tree Reservoir) Over the 15-year life of this CCP, enhance management on the 21,000 acre green-tree reservoir to achieve a sustainable wetland forest that provides forage for waterfowl, migratory birds, mammals, reptiles, amphibians, and fishes. Emulate natural flooding within the Felsenthal NWR lowland forest *(CCP Objective 2.3*).

Discussion: Naturally flooded lowland forests, such as the Felsenthal NWR bottomlands, follow a cycle of wet and dry years. The wet years provide resources for waterfowl and the dry years provide resources for ground-dwelling forest animals. The dry years also allow trees to recover from flood-induced stress encountered during the wet years. Several back-to-back dry years are necessary to

allow acorns to germinate and grow to a height that is above the high water mark and grow into a new generation of mature acorn-producing lowland oak trees.

Green-tree reservoirs are wetland forests that are artificially flooded to attract fall/winter waterfowl. Eight species of waterfowl (one carnivore, the hooded merganser; two grazing herbivores, Canada goose and gadwall (*Anas strepera*); three seed-eating grazers, pintail (*Anas acuta*), green-winged teal (*Anas crecca*), and ring-necked duck (*Aythya fuligula*); and two omnivores, the mallard and wood duck) use flooded green-tree reservoirs during the winter migration. In contrast to dynamic and unpredictable flooding of naturally-flooded forests, green-tree reservoirs are generally flooded in the fall and remain at full pool throughout the duck season and beyond. When GTRs are flooded weeks prior to the duck season and through the spring, negative consequences to wildlife habitat occur. Trees undergo a change in respiration strategy, inhibition of photosynthesis, redirection of protein synthesis, changes in mineral nutrition, alteration in amounts and balances of growth hormones, and production of toxic compounds. Long-term flooding causes decreased acorn production, increased stress and disease of trees, and subsequent mortality.

As previously mentioned, it has become apparent from studies conducted by USGS that the hardwood forest in the Felsenthal NWR green-tree reservoir is being impacted by the constant and prolonged flooding regime. In June 2007, a new project leader was assigned to the South Arkansas NWR Complex and one of the first issues to be addressed was green-tree reservoir water management. After a review of all pertinent information and collaboration with staff, other Service personnel associated with long-term green-tree reservoir management, non-governmental organization partners from Ducks Unlimited, and others, a decision was made to alter the water management in the green-tree reservoir in an effort to improve forest health and thus provide better wintering habitat for waterfowl.

Strategies:

- Elevation mapping of the lowland forest should be completed to assist field staff in decisions concerning duration and extent of flooding at various elevations.
- The lowland forest should never be intentionally flooded prior to tree dormancy.
- Tree/seedling vigor and growth should be monitored annually to allow for adaptive management of water levels.
- Every 10 to 15 years the lowland forest should not be intentionally flooded for 2- to 3-years to nurse a new crop of red oak seedlings.
- A 7-year flooding schedule should be followed that closely emulates historic winter flood conditions.
- Flooding should be gradual to allow resources to be efficiently utilized.
- Water staff gauges should be placed at critical locations to allow for proper monitoring of water elevations and to assist in locating beaver dams to avoid pockets of tree mortality.
- Conduct baseline inventory of forest conditions for future reference to changes in waterfowl numbers and hunter harvest effort.

Objective 2.4. (Fire Management) Annually manage and maintain prescribed and wildfire response programs on the 9,490 acres of pine forest on the refuge to achieve desired habitats and reduce fuels (*CCP Objective 2.4*).

Discussion: Prescribed fire is a primary habitat management tool on the 9,490 acres of pine forest on the refuge. The objectives of the prescribed burning program are wildlife habitat improvement for the RCW and other species, fuel reduction, site preparation, and understory management. The

prescribed burns are managed on a rotational basis. The refuge rotates the area burned every year so that all areas included in the burn program are burned once every 3 years.

Prescribed burning in pine stands to control midstory for the RCW also benefits other species of wildlife, especially deer, rabbit, quail, Bachman's sparrow, and wild turkeys. There is a possibility that prescribed fire could temporarily displace, injure, and/or kill wildlife, especially some amphibians and reptiles or result in loss of bird nests. However, mortality impacts from fire management are not believed to be critical to the populations and the resultant habitat conditions are expected to benefit an important suite of species. Additionally, fire management also includes the provision of wildfire response.

Strategies:

- Annually monitor 100 percent of the prescribed fire management units that were burned to provide optimal habitat for RCWs.
- Burn on a 1 to 3 year burn rotation to accomplish habitat management objectives.
- Use prescribed fire to accomplish annual wildlife habitat management objectives for forest (particularly pine forests), grassland, and old field (managed and natural) habitats.
- Respond appropriately to all wildfires within a mile of refuge lands.

Objective 2.5. (Waterfowl) Over the 15 year life of this CCP, manage the 15,000 acre permanent pool and up to 21,000 acres of green-tree reservoir to support traditional abundance and use patterns of key waterfowl species in the Ouachita-Saline River floodplain ecosystem and to help meet continental and regional population goals of the North American Waterfowl Management Plan as stepped down through the LMVJV (*CCP Objective 2.5*).

Discussion: The process of relating habitat objectives for individual management areas to overall habitat objectives for the Lower Mississippi Valley (LMV) involved several steps. First, habitat objectives were allocated among states relative to historic abundance of waterfowl. Then, knowledgeable managers within states determined strategies for meeting state habitat objectives by allocating percentages of the objectives to habitats with managed or naturally flooded water regimes and habitats on public or private lands. One result of this “step-down” process was to clearly define the collective habitat objectives of state and federal wildlife areas in the LMV relative to objectives of the LMVJV, which in turn were related to the NAWMP. The collective objectives of state and federal wildlife areas then were assigned to individual management areas based on waterfowl management capabilities.

Because Felsenthal NWR does not have the capability to provide cropland or managed moist-soil habitat, the step-down objectives that were established for the refuge were entirely comprised of the bottomland forest habitat type. The acreage objective (21,000 acres) represents the approximate size of the green-tree reservoir, and the duck energy-day (DED) objective (2,646,000 DEDs) used a standard value of DEDs (126 DEDs/acre) assumed by the LMVJV to be available in this habitat type. Through recent research conducted in the LMV, the DED value has been adjusted for bottomland hardwoods containing 40 percent red oaks, to a value of 156 DEDs/acre. It is worth noting that this DED value is thought by many wetland managers to represent a conservative estimate of waterfowl foraging habitat actually available in the bottomland forest type, when resources such as moist-soil vegetation and invertebrates are factored in. Therefore, the refuge’s actual DED capability should far exceed the stated objective. Besides the value that bottomland forests provide as foraging habitat for waterfowl, they probably play an even more important role by isolating birds during pair bonding, providing thermal protection on cold, windy days, and providing escape cover.

Use of skilled forest management through use of thinnings prescribed for wildlife can create conditions where sunlight through canopy gaps stimulates germination of many plants adapted to the moist soil conditions. These understory plants provide abundant food for waterfowl in the form of seeds and invertebrates that use the structure created by the understory plants. As succession of the plant community continues, a midstory forms that provides critical cover for waterfowl during pair bonding, brood rearing, and when thermal cover is needed during winter.

High waterfowl harvest rates and hunting activity in Arkansas make sanctuary an important function of Arkansas refuges. Activities such as maintaining body temperature, searching for food and roost sites, avoiding disturbance, molting, courtship, and pair bonding are energy consuming activities for waterfowl in winter. The assumed interaction between disturbance, energetic costs, and low survival can at least partially be mitigated by sanctuary where waterfowl can rest and perform these activities with a minimum of interruption. Sanctuary, particularly when in close association to food resources, is critical for waterfowl to conserve energy to survive the winter period and conduct activities preparatory to perform other life functions, particularly reproduction. Due to the strategic location of Felsenthal NWR in the heavily hunted LMV, coupled with its ability to provide quality, forested wetland habitat, it has a critical role to provide important waterfowl sanctuary. The current waterfowl sanctuary at Felsenthal NWR is 9,050 acres of primarily bottomland hardwood forest and is seasonally flooded within the green-tree reservoir. Forest composition within this sanctuary is roughly 50 percent willow oak, 30 percent overcup oak, and 20 percent Nuttall oak. The waterfowl sanctuary is centered within the refuge boundary and is bounded by the pipeline on the north; the Ouachita River, Deep Slough, and Open Brake to the west; Open Brake and Open Brake cut to the south; and the Ouachita River, the Saline River, and Eagle Creek on the east (See Figure 14, Draft HMP, Section A).

Strategies:

- A water management plan should be developed and implemented for the permanent pool and green-tree reservoir, to provide habitat for wintering and resident waterfowl.
- Maintain the current level of designated waterfowl sanctuaries to provide areas of low disturbance critical for the area's wintering waterfowl to complete numerous activities necessary for adequate survival.

Objective 2.6. (Wetland-Dependent Birds – Shorebirds) Over the 15 year life of this CCP opportunistically provide fall (southbound) migration habitat as a contribution to the objectives set in the U.S. Shorebird Conservation Plan and the Lower Mississippi Valley/West Gulf Coastal Plain Shorebird Management Plan (*CCP Objective 2.6*).

Discussion: Felsenthal NWR provides very little migration habitat for shorebirds on the refuge due to water management limitations. The nature of the forest habitat, the permanent pool, and the green-tree reservoir allow for little opportunity to provide shorebird habitat.

Strategies:

- Where and when feasible, draw water down to create mudflats for migrating shorebirds.
- Develop partnership agreements with adjacent properties to facilitate information exchange and assistance.

Objective 2.7. (Wetland-Dependent Birds - Wading Birds) Within 1 year of the date of this CCP, monitor on an annual basis species presence, habitat use, and nesting activity of wading birds (*CCP Objective 2.7*).

Discussion: Felsenthal NWR provides significant habitat for breeding and wintering colonial waterbirds in the permanent pool, the green-tree reservoir, and other seasonal shallow water areas. Although this group of species is not a major priority, management for waterfowl should provide foraging habitat for wading birds. In addition to habitat management, rookeries should be protected from disturbance throughout the nesting season.
Strategy:

- Consider creating temporal sanctuaries around wading bird rookeries during the nesting season, to reduce disturbance when and where possible.

Objective 2.8. (Resident Wildlife) Over the 15 year life of this CCP, maintain and develop diversified habitats throughout the refuge's 65,000-acres, and promote management actions that will support healthy populations of resident wildlife species to meet the objectives of the National Wildlife Refuge Improvement Act (*Objective 2.8*).

Discussion: The habitats of Felsenthal NWR support a variety of mammals, including game species such as white-tailed deer, gray and fox squirrels, eastern cottontail and swamp rabbits, and furbearers such as raccoon, beaver, mink, opossum, striped skunk, coyote, bobcat, river otter, muskrat, nutria, red fox, and gray fox. Other nongame mammals are more rarely recorded on refuge lands but can be expected to include several species of rodents and bats. Several priority species (Species of Greatest Conservation Need) recognized by the State of Arkansas (State Wildlife Plan 2007) are known to, or may, inhabit refuge lands. These include the Rafinesque's big-eared bat, southeastern myotis bat, northern long-eared bat, eastern harvest mouse, and long-tailed weasel. White-tailed deer utilize a wide range of habitats, and most refuge forest management actions aimed at priority species, such as migratory birds, will provide direct benefits to deer by increasing the quality of deer habitat. Such active management will provide a diversity and abundance of understory, midstory, and overstory stand components (i.e., complex forest stand structure) to meet the needs of a variety of non-game forest birds and resident wildlife, including black bear and deer. Temporarily flooded bottomland forests provide ideal habitat for many species of mammals. Food and cover are abundant and diverse, and a variety of mammalian species are present. In addition to the black bear, which is primarily associated with upland forests joined by extensive forested wetland corridors, other forest wetland inhabitants are the white-tailed deer, bobcat, coyote, river otter, raccoon, gray fox, red fox, beaver, mink, swamp rabbit, cottontail rabbit, eastern gray squirrel, fox squirrel, nutria, opossum, muskrat, and skunk.

Forest management, on a selective basis, can benefit turkeys by increasing the diversity and availability of foods, in the form of hard and soft mast, as well as, grasses, sedges and forbs. Nesting habitat is often improved by selective thinning of trees which provides more ground cover for nest concealment. Removal of more than 50 percent of the overstory degrades turkey habitat in the short term by resulting in extremely rank undergrowth that is generally avoided by turkeys.

Strategies:

- Control invasive plants and animals.
- Maintain rare prairie habitats which may support several Arkansas species of conservation concern.

Objective 2.9. (Resident Wildlife - Reptiles and Amphibians) Over the 15 year life of this HMP, maintain and enhance habitat throughout the refuge's 65,000 acres for a diverse assemblage of reptile and amphibian species, particularly those recognized as species of special concern by state and/or federal agencies (*CCP Objective 2.9*).

Discussion: The floodplain forest, sloughs, brakes, and shallow lakes, as well as, remnant sand prairies and upland pine-dominated habitats of Felsenthal NWR, are suitable for numerous species of reptiles and amphibians. Multiple species of snakes, lizards, frogs, toads, salamanders, and turtles occupy the refuge. The refuge maintains a list of herpetofauna species which includes 83 species that have been identified or are expected in the three-county area of the refuge.

With the great variety of reptile and amphibian species, it is challenging to address all species with similar recommendations. However, common management concepts can provide benefits for many varied species in this group. Many reptile and amphibian species use multiple habitats for foraging, reproduction, hibernation, or dispersal and require connectivity between habitat types (e.g., shallow lakes and adjacent bottomland hardwood forests, cypress brakes and floodplain forests, floodplain forests and adjacent uplands, temporary wetlands and adjacent uplands) in order to meet distinct life cycle habitat needs. Connectivity throughout floodplain forests also allows for important migration and dispersal corridors. Construction of barriers to aquatic and terrestrial wildlife such as improved roads should be discouraged and other alternatives such as road underpasses sought.

Many reptiles and all amphibians are closely linked to aquatic habitats and respond positively to various inundation conditions. Green-tree management of the flooded "pool" portion of the refuge should mimic natural hydrologic patterns, with year-to-year variation in rates, periods, and depths of inundation. Resident reptiles and amphibians should respond well through time as this (managed) natural cycle varies conditions annually that benefit a variety of species needs. Within upland sites, isolated seasonal wetlands are a particularly important and rare habitat type for reptiles and amphibians. Isolated seasonal wetlands are fish-free, and have high amphibian productivity when surrounded by complementary upland habitats. These features should be noted and protected, or alternatively restored as appropriate upland sites are acquired within refuge lands.

Strategies:

- Maintain connectivity between habitats to allow reptiles and amphibians unrestricted movement between habitats needed for complete life cycles.
- Maintain or restore the natural hydrologic system and community structure, minimizing conversion of habitat types and hydrologic function as possible within legislative management constraints.

Objective 2.10. (Invasive and Nuisance Species Control) Over the 15 year life of this CCP, prioritize the need for the removal of nuisance/native or exotic/invasive plants and animals on the refuge that are hindering the ability to meet habitat/population objectives for federal trust species (*CCP Objective 2.10*).

Discussion: Felsenthal NWR has several documented native and nonnative invasive and exotic plant species. These invasive species impact the refuge's ability to carry out desired wildlife and habitat management objectives and at times also reduce the range of visitor service activities. Many invasive plant species are difficult to control without applying chemical treatments. The moist-soil conditions conducive to providing quality habitat for migratory waterfowl management frequently encourages germination of those invasive species.

Intrusion of invasive plants can displace native plant and animal species and change habitat productivity, through changes such as vegetative community, insect community, and structural environment.

Dense stands of nuisance aquatic vegetation are major fisheries management problems on Felsenthal NWR. Warmer than average winters and drier than average springs in recent years have

provided near optimal growing conditions for these plants. The coverage of macrophytes has exceeded acceptable levels (generally considered ≤ 30 percent), which has led to a number of negative ecological and socioeconomic consequences. These plants restrict access for recreational boaters and anglers, and may lead to an unbalanced fish community structure due to their effects on predator-prey ratios. The introduction of nonnative aquatic plant species in southern Arkansas has exacerbated the problem. Species such as hydrilla and water hyacinth are relative "newcomers" to southern Arkansas lakes and rivers. Hydrilla has become established on the refuge and has demonstrated why it is such a feared pest by infesting waters too deep for native vegetation to grow, thereby increasing the aerial coverage of macrophytes. Water hyacinth has primarily remained confined to the Arkansas River and its backwaters, but has also been found in the Ouachita River above Thatcher Lock and Dam.

Although beavers can provide additional beneficial wetland habitats, it is often necessary to implement some form of beaver control to reduce the negative impacts in floodplain forest habitats. The beaver's natural behavior of damming and flooding forested areas can provide beneficial wetland areas, but also kills flooded trees. In the constrained landscape of a national wildlife refuge, such creation of dead tree stands can accumulate to unsustainable levels, as they cannot be replaced within a reasonable time scale. In particular, beavers build dams and hold water during the summer months when trees are not adapted to flooding. This causes stress and ultimately mortality to individual flooded trees and flooded stands of trees. Beaver damage is easy to recognize from the air and on the ground in the form of flooding as a result of dam-building activities, and groupings of girdled and stressed or dead trees. Beaver activity and potential damage to forest resources should be continually assessed and beavers and dams removed if negative impacts are unacceptable within other management objectives. Individual beavers should be lethally removed by trapping (conibears, legholds, snares, etc.) and/or shooting. Beaver dams should be removed with heavy machinery, manually with hand tools, or with explosives.

Nutria are herbivorous, aquatic rodents. They are most problematic in coastal zones where they contribute to coastal erosion and marsh loss by eating the roots of marsh plants. In interior wetlands they tend to incur less dramatic impacts; however, they do cause impacts to natural vegetation. Nutria are extremely prolific breeders and thereby often difficult to control. Nutria are currently found in the "pool" of Felsenthal NWR. Likely negative impacts from this species include exclusion of the native muskrat through competition, removal of emergent vegetation by feeding on roots and stalks, and weakening of levees through burrowing behavior.

Feral hogs, which are present on Felsenthal NWR, should be specifically controlled as they are known to cause significant negative impacts on native herpetofaunal populations through direct predation, disturbance or destruction of site-specific plant communities (e.g., seasonal wetlands), and soil conditions.

Strategies:

- Implement systematic removal of invasive plant species by mechanical and chemical means, and by prescribed burning.
- Develop nuisance/exotic/invasive plant/animal control plan.
- Beaver control activities should continue, with seasonal assessment of forest damage potential, removal of dams to decrease summer flooding, and systematic removal of associated beavers to discontinue dam building.
- Control nutria through systematic removal opportunities.
- Control feral hogs through systematic removal and under an objective of eradication from refuge lands.

Objective 2.11. (Open Land) Over the 15 year life of this CCP, implement restoration techniques to enhance approximately 250 acres of wildlife openings (e.g. primarily sand prairies) for early successional habitat diversity (*CCP Objective 2.11*).

Discussion: Prairies are rare throughout southern Arkansas and Felsenthal NWR currently has several remnant prairies which are a direct result of early geomorphologic forces resulting in Lake Monroe; an early Paleocene lake that formed during the late Pleistocene and early Holocene eras. The lake, which was originally 40 miles long and 18 miles wide, left original beach terraces/dunes in place and today remain as prairie habitat, many of which are self-maintained (without fire).

The Arkansas Natural Heritage Commission conducted an inventory of prairie habitats on Felsenthal NWR that resulted in the documentation on 11 high-quality remnant prairie areas in Ashley and Bradley Counties (ANHC 2000, 2001, 2002). Efforts should be made to fully document the vegetation structure, soil composition, and geological history of the sites and in all cases use restoration management techniques that will enhance not only the ecosystem but also habitat for the northern bobwhite quail, American woodcock, and an array of sparrows typically wintering in southern Arkansas.

Strategies:

- Maintain openings with the use of fire and mowing.
- Promote early successional habitat diversity by supplemental planting of native forbs and grasses.
- Use herbicide for conversion to native plant species on roadsides.

Objective 2.12. (Aquatic Resources) Over the 15 year life of this CCP, maintain and enhance the refuge's approximately 18,000 acres of aquatic habitats through adaptive management to benefit fish populations and provide improved access for sport fishing opportunities (*CCP Objective 2.12*).

Discussion: Most of the 15,000 acre Felsenthal Pool, a reservoir impounded by the creation of the Ouachita-Black River Navigation Project, is less than 1 meter in depth, making it ideal for the growth of aquatic vegetation. Due to the shallow nature of the reservoir, native aquatic vegetation became established soon after impoundment. However, coverage increased relatively slowly during the first 10 years following impoundment (1985-1995). Then, during the late 1990s and early 2000s, macrophyte species such as fanwort, American lotus, fragrant water-lily, duckweeds, and various marginal plant species began to spread rapidly throughout the reservoir. By 2004, almost all of the 15,000 acres impounded in 1985 were completely captured by aquatic vegetation. Then, in 2004, hydrilla was discovered at Felsenthal NWR, which began to colonize deeper water than the native species previously noted. Hydrilla became established in backwater areas, as well as, along the Ouachita River channel. Its spread over the last 4-years has been rapid, and the consequences have been severe. Although no quantitative estimates have been made, it is estimated that as of August 2007, more than 90 percent of the off-channel portions of the Felsenthal Pool are captured by aquatic vegetation seasonally.

The majority of the Felsenthal Pool is inaccessible to anglers and other boaters during the summer and fall months, due to nuisance aquatic vegetation. Consequently, accessible areas are highly congested. This has caused visitation by anglers to decrease by almost 50 percent since 2004, from around 400,000 trips/year to 200,000 trips/year (USFWS unpublished data). The social and economic consequences of this decline in visitation to the three counties surrounding the refuge are likely quite significant.

Aquatic plants may be controlled by chemical, biological, and/or mechanical means. The U.S. Army Corps of Engineers (USACE) is charged with maintaining a 9 foot navigation channel at all times, which prevents the reservoir from being drawn down as a means of controlling unwanted vegetation. Biological control methods are preferred because they are relatively inexpensive and long-lasting (Beyers and Carlson 1993). Grass carp are the most commonly used fish species for aquatic vegetation control in the United States (Chilton and Muoneke 1992). These fish are herbivorous, and when stocked at appropriate rates, have proven to be extremely effective at controlling or eliminating unwanted aquatic vegetation. Stott et al. (1971) and Shireman (1982) reported that the use of herbicides to control nuisance submerged aquatic vegetation was 6 and 14 times more expensive, respectively, than using grass carp. Chilton and Muoneke (1992) suggest that an integrated approach, where herbicide treatments are combined with grass carp stocking, may be the most effective means of aquatic vegetation control.

An experimental herbicide treatment was conducted by the Service and the AGFC during 2000-2002. Numerous plots throughout the reservoir, ranging in size from 2 to 20 acres, were treated with herbicides to assess their effectiveness at clearing small areas for fishing as well as boat lanes to access these areas. Some areas were covered with emergent species such as American lotus and water-lilies, while most areas were choked with fanwort. Herbicide treatment of the emergent species was highly successful, and some areas remained free of vegetation for almost 3 years. However, treatment of the submerged vegetation was unsuccessful in almost all areas. The continuous flow of water through the reservoir prevented the systemic herbicides from being effective at treating the submerged species. In some areas where emergent species were eliminated, submerged species such as fanwort became established in their place. Managers concluded that small-scale herbicide treatments were not effective for submerged aquatic vegetation control on the Felsenthal Pool.
The AGFC has recommended reducing the aerial coverage of aquatic vegetation to 50 percent of the off- channel portions of the Felsenthal Pool, using an integrated, adaptive approach that includes triploid grass carp stocking and herbicide applications. In 2006-2007, the AGFC conducted a telemetry study to determine if triploid grass carp would stay within the confines of the refuge. Forty-eight fish were implanted with radio transmitters and radio tracked for a 1year period. During this time, the fish were tracked between 1 and 4 times each month. The results showed that no fish moved south of the refuge through the lock and dam system, even though the gates on the lock and dam were open for an extended time period. All radio-marked fish remained in the boundaries of the refuge except for two fish, which moved north of the refuge. Based on the results of this study, it was decided that most fish would remain within the refuge boundary and stocking should be conducted.

To control the submergent macrophytes (hydrilla, fanwort, etc.), triploid grass carp should be stocked at a rate of 10 triploid, yearling grass carp per acre, with additional stockings in subsequent years to maintain this density. As noted in numerous AGFC sampling reports, diploid grass carp have been stocked throughout the Felsenthal Pool watershed, and are known to currently inhabit the reservoir in low densities. However, because Felsenthal NWR is controlled by the Service, and due to its close proximity to the Louisiana state line, it is recommended that triploid grass carp be stocked in this system. Emergent macrophytes (American lotus, fragrant water-lily, etc.) should be controlled with periodic applications of species-appropriate herbicides, applied in historically open water areas of the refuge.

Strategies:

- In cooperation with the AGFC, continue to conduct stocking of the Felsenthal Pool with triploid grass carp, to maintain a density greater than or equal to 10 grass carp of less than 24 inches total length per acre.
- Continue efforts to control emergent vegetation (lotus, water-lily) in the open-water areas with periodic herbicidal applications.

- Continue to monitor the effectiveness of vegetation treatments and consider contracting with local universities to conduct monitoring/research activities.
- Evaluate working with the USACE to strategically draw down the permanent pool every 5 to 7 years.

ALTERNATIVE B – PROACTIVE HABITAT RESTORATION AND MANAGEMENT (PROPOSED ALTERNATIVE)

Alternative B is the alternative our planning team recommends to our Regional Director for implementation. It includes an array of management actions that, in our professional judgment, work best towards achieving the refuge's purposes, vision and goals, and would make an important contribution to conserving Federal trust resources of concern. It is the alternative that would most effectively address the issues identified in Chapter 1. We believe it is the most reasonable, feasible, practicable, sustainable, and efficient alternative to achieve the desired future habitat conditions for the conservation of the greatest number of fish, wildlife, and plant resources, while enhancing the biological resources of the West Gulf Coastal Plain. This alternative involves direct human actions and manipulations to restore degraded and manipulated habitats onto a trajectory that will ultimately allow them to persist naturally.

The biological and habitat objectives and management strategies of *Alternative B* are based on the following underlying hypotheses and assumptions that were used to decide the future management direction for the refuge, including the desired habitat conditions depicted in Figure 23:

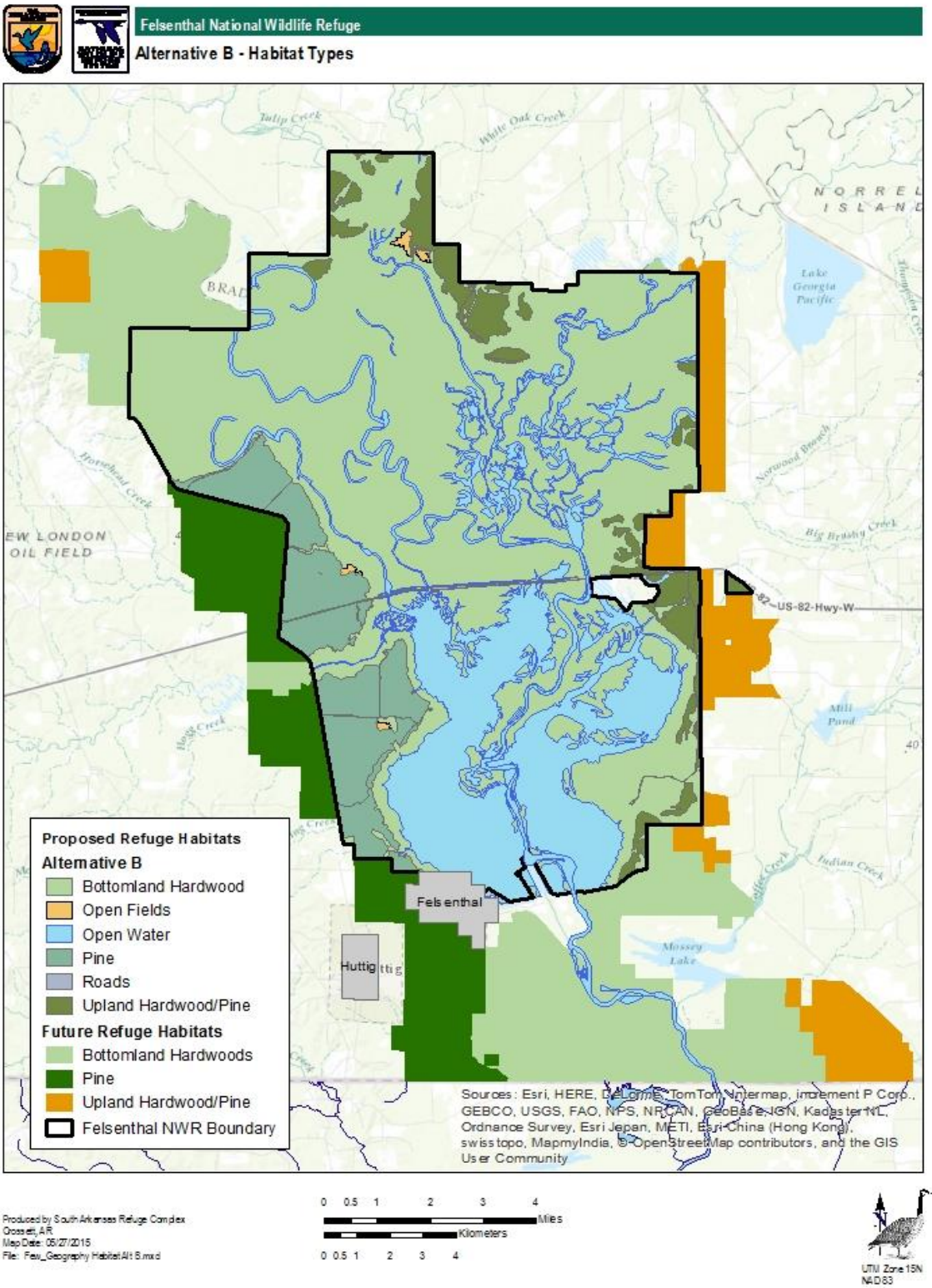
- Focal species management would be the best approach to conserve continental migratory bird populations, while maintaining, enhancing, and restoring biological integrity, diversity, and environmental health of refuge lands.
- Managing forested habitats and improving refuge forest management are the best approaches to optimize forest interior bird conservation and other resident wildlife, e.g. black bear.
- Increasing avian diversity and abundance on refuge habitats is best accomplished by conserving, protecting and restoring native plant community cover types.
- Selecting certain focal species as indicator and umbrella species to gauge ecosystem function, biological diversity, integrity, and environmental health, improves environmental health monitoring.

In the discussion that follows, we describe in detail the objectives, strategies and associated rationales that we would use to implement *Alternative B* habitat management objectives. The goals remain the same and are taken directly out of the approved 2010 CCP (USFWS 2010); however the objectives, rationals, and strategies are proposed to be modified or replaced.

Goal 2. Protect, maintain, enhance, and where appropriate, restore suitable habitat for the conservation and management of migratory birds, resident wildlife, fish, and native plants, including all federal and state threatened and endangered species endemic to Felsenthal NWR. (Same as CCP Goal 2).

Objective 2.1. (Upland Pine) *(Replaces CCP Objectives 1.1, 2.2, 2.4, 2.8, 2.9, 2.10, and Modifies CCP Objective 2.11)* Conserve and enhance 6,200 acres of upland pine habitat to conserve red-cockaded woodpecker and other open pine focal species, Northern bobwhite, Bachman's sparrow, and brown-headed nuthatch, using sound silvicultural practices and prescribed fire. Upland pine habitat is characterized by the following attributes:

Figure 23. Felsenthal National Wildlife Refuge, Alternative B, Proactive Habitat Restoration and Management (Proposed Alternative)



- There are 45 or more stems/ha (18 or more stems/ac) of pines that are ≥ 60 years in age *and* ≥ 35 cm (14 in) dbh. Minimum basal area for these pines is 4.6 m^2/ha (20 ft^2/ac). Recommended minimum rotation ages apply to all land managed as foraging habitat.

- Basal area of pines 25.4 – 35 cm (10 – 14 in) dbh is between 0 and 9.2 m^2/ha (0 and 40 ft^2/ac).

- Basal area of pines < 25.4 cm (< 10 in) dbh is below 2.3 m^2/ha (10 ft^2/ac) *and* below 50 stems/ha (20 stems/ac).

- Basal area of all pines ≥ 25.4 cm (10 in) dbh is at least 9.2 m^2/ha (40 ft^2/ac). That is, the minimum basal area for pines in categories (a) and (b) above is 9.2 m^2/ha (40 ft^2/ac).

- Groundcovers of native bunchgrass and/or other native, fire-tolerant, fire-dependent herbs total 40 percent or more of ground and midstory plants and are dense enough to carry growing season fire at least once every 5 years.

- No hardwood midstory exists, or if a hardwood midstory is present it is sparse and less than 2.1 m (7 ft) in height.

- Canopy hardwoods are absent or less than 10 percent of the number of canopy trees in longleaf forests and less than 30 percent of the number of canopy trees in loblolly and shortleaf forests. Xeric and sub-xeric oak inclusions that are naturally existing and likely to have been present prior to fire suppression may be retained but are not counted in the total area dedicated to foraging habitat.

- All of this habitat is within 0.8 km (0.5 mi) of the center of the cluster, and preferably, 50 percent or more is within 0.4 km (0.25 mi) of the cluster center.

- Foraging habitat is not separated by more than 61 m (200 ft) of non-foraging areas. Non-foraging areas include (1) any predominantly hardwood forest, (2) pine stands less than 30 years in age, (3) cleared land such as agricultural lands or recently clearcut areas, (4) paved roadways, (5) utility rights of way, and (6) bodies of water.

Rationale:

Open pine management with characteristics described above can generally be described as low canopy cover, low basal area with a herbaceous understory. Open pine habitat provides important habitat for priority bird species and other wildlife. The West Gulf Coastal Plain/Ouachitas Open Pine Landbird Plan (LMVJV, 2011) has identified 11 species of conservation concern. Of those 11, four species, red-cockaded woodpecker, Bachman's sparrow, brown-headed nuthatch, and Northern bobwhite, are considered umbrella species. Collectively the habitat requirements of these four species will meet the needs of all priority species within this habitat. Populations and habitat objectives were developed for these species. Table 13 steps those objectives down to refuge level. The management of these areas for open pine habitat is further supported by the open pine decision model (See Figure 21, Draft HMP, Chapter IV, Section A).

Table 13. Total area required to support estimated viable populations of four focal species on Felsenthal NWR.

Species	Minimum viable Population Size (pairs)	Area required to support a viable Population Size (acres)	Recovery Plan Population and Habitat Objectives	WGCPO Population Objectives (pairs)	WGCPO Habitat Objectives (acres)	Felsenthal's Proposed Population Objective (pairs)	Felsenthal's Proposed Habitat Objective (acres)
Red-cockaded Woodpecker	N/A	N /A	34 Clusters (6,800 acres)	34 Clusters	8,100	13 Clusters	6,200
Northern bobwhite	60	1008	N/A	262,156	4,405,051	360	6,200
Brown-headed nuthatch	28	244	N/A	56,029	491,500	700	6,200
Bachman's sparrow	46	341	N/A	75,622	560,598	828	6,200

As RCW management is a high priority, the refuge will manage 13-14 RCW clusters on 6,200 acres with no active recruitment on the current fee title lands. The refuge will be striving for 300 acres/cluster (120 acres foraging habitat/cluster) for loblolly pine management. The remaining acreage (3,200 acres) will be transitioned or restored to upland hardwood/pine and we will reduce fire frequency within these converted acres. Upland hardwood/pine is the historic condition of the converted area and is further supported by the open pine management decision model (See Figure 21, Draft HMP, Chapter IV, Section A). The Pine Island RCW cluster is isolated. Its isolation may inhibit expansion or even contribute to their extirpation (Conner and Rudolph 1991). If this cluster is abandoned or lost, this area will be transitioned to an upland/hardwood forest type as well, further reducing the RCW pine acreage to 5,553 acres. The uplands on the north and east of the Ouachita River will be managed for hardwoods with a pine component. The upland, south and west of the river, will be managed for RCWs (Figure 23).

Recently, Felsenthal/Upper Ouachita NWRs expanded their acquisition boundaries which will ultimately allow for the conservation of more than 177,000 contiguous acres of wildlife habitat. In addition, a total of 50 RCW clusters will come under federal protection. For Felsenthal NWR, approximately 11,118 acres of upland habitat will be acquired. The refuge's HMP must take into consideration the adjacent population of RCWs. Figure 23 shows what the refuge may look like in the future if all lands were acquired. Essentially the west side of the refuge would be the pine habitat,

hence our RCW management focus.

The Nature Conservancy (TNC) owns 3,794 acres within Felsenthal NWR's acquisition boundary. One hundred eighty-five acres of this property, located east of the Ouachita River, consists of a sand prairie and upland hardwood pine site and is not considered RCW habitat. Two thousand nine hundred and sixty-two acres on the west side of the refuge's acquisition boundary is under a RCW habitat conservation plan (HCP). An additional 647 acres of 15-20 year old pine plantations/hardwood drainages is not covered by the HCP. These 647 acres are not RCW habitat under the current RCW guidelines. The HCP outlines 100 acres/cluster with the goal of 29 clusters on 2,962 acres. Currently, TNC manages 25 active RCW clusters. See Figure 16 in the Draft HMP, Section A, which shows 28-¼ mile (private lands standard) and ½ mile (federal standard) RCW habitat partitions.

In addition, a private landowner owns over 5,000 acres within the acquisition boundary. Of those 5,000 acres, approximately 4,000 acres could be RCW habitat. These lands are on a 25-30 year rotation. With a 25-30 year rotation, none of these lands can be considered RCW habitat under the recovery plan guidelines.

Taking these factors into consideration, TNC's birds are relying on the refuge's habitat. So the proposed population goal for the refuge will be 14 clusters with a future goal of 39 clusters on 9,162 acres of RCW habitat once the TNC lands are acquired. This includes no active RCW recruitment. If the Service is able to acquire all of the lands within the acquisition boundary, we would have 12,609 acres of RCW habitat with 39 clusters; which provides 323 acres/cluster. With the current land base and looking into the future land acquisition, we are currently maxed out in terms of habitat. Careful consideration needs to be given when considering population recruitment actions (artificial cavities, translocations, etc.) to ensure adequate foraging habitat is available.

When taking into consideration the refuge population and adjacent population (See Figure 23), lack of suitable and continuous pine habitat within these partitions is evident. Adding to the issue is the RCWs propensity to be located in close proximity to each other hence competition for the limited pine acres. Throw in loblolly's growth rates and fie sensitivity, plus the lack of adequate regeneration in the RCW partitions, good quality foraging habitat may not be sustainable in the long-term. Management is a spatial and temporal quagmire. For these reasons the population goal has been reduced. It should be noted the population may expand and/or contract due to the juxtaposition of the habitat and clusters. In 2015, two additional clusters may have formed. However, several long standing RCW clusters had no known reproduction. The sustainability of the new clusters is yet to be seen.

Although RCWs are the primary focus for forest management activities, the other three focal species respond well to active forest management. Management, including timber harvest strategies and prescribed fires, are used to produce and sustain suitable open pine habitat. Frequent fires reduce hardwood encroachment and encourage a herbaceous understory. In addition timber harvests can reduce basal area and canopy cover required by these species.

Managing forest landscapes for diversity involves managing patterns of succession. Some successional stages have more species than others. For open pine habitat, the refuge maintains 132 acres of old fields in an early successional habitat. These fields are located near refuge ponds. This habitat provides nesting and brood rearing habitat for turkeys and quail, migrating and wintering habitat for sparrows, and foraging for several bat species.

Strategies:

- Maintain or enhance forest health through the development of monitoring protocols for insect

and disease vectors.

- Minimize forest fragmentation; in all stand improvement activities, avoid fragmenting larger forest patches when possible.
- Follow guidelines detailed in the Arkansas Forestry Commission document titled Best Management Practices for Water Quality Protection during forest management activities.
- Control invasive and noxious plant and animal species.
- Maintain 132 acres of old fields as early successional habitat with prescribed fire or through mechanical means.
- Utilize triggers outlined in the *Red-cockaded Recovery Plan* as thresholds for stand improvement interventions to maintain and enhance wildlife habitat needs for priority focal management species.

Monitoring Elements:

- Establish point-count monitoring surveys for forest communities; include the monitoring of habitat structure and composition with associated points to assess bird use; monitoring should capture both breeding and migrating forest bird species. Use the presence and abundance of the focal species as an indicator species for environmental health of mature upland pine forest stands.
- Refuge forester will monitor harvests 1 year post harvest and every 5 years thereafter in order to insure that objectives are being met and to identify any changes that need to be made to forest management activities.
- Map invasive plants to guide future refuge forest habitat maintenance, management and reforestation decisions.
- Updated RCW habitat inventories should be conducted within ½ mile of all active partitions found within a compartment between each timber harvest that occurs in a particular compartment.
- Conduct forest inventories to document stand-specific information such as but not limited to species composition, overstory canopy cover, midstory cover, understory cover, basal area, tree stocking, regeneration presence or absence of exotic insects at damaging levels.

Objective 2.2. *(Upland Pine / Hardwoods)* *(New Objective)* Maintain, enhance, and restore 3,388 acres of historic mixed pine/ hardwoods to conserve focal species; e.g. Kentucky warbler, worm-eating warbler, and wood thrush, using sound silvicultural practices o achieve desired forest conditions. Upland hardwood habitat is characterized by the following attributes:

- Dominated by hard mast species
- Diversified forest canopy structure

- Dense patches of ground cover
- Patchy midstory

Rationale:

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 three decades 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 south Arkansas. Bragg (2003) noted in the review of the government land office (GLO) surveys only 17% of the witness tress were pine. Further stating that much of the area above the overflow was dominated by hardwoods, often interspersed with loblolly and shortleaf pine. He also noted that good hardwood sites, especially those close to bottomlands, often yielded very large witness trees. It is basically impossible to determine the exact forest composition using GLO records for a variety of reasons. However, it is not hard to derive from multiple sources and scientific reasoning that hardwoods were a large part of the upland system in and around Felsenthal NWR. Unfortunately little attention seems to be given to the decline of upland hardwoods (mostly due to the focus on bottomland hardwood forested wetlands). Animal species associated with this habitat type include wood thrush, worm-eating warbler, eastern spadefoot toad, Louisiana waterthrush, and Chuck-will's-widow. For these reasons upland hardwood forest will be retained and restored as much as possible on Felsenthal NWR outside of the red-cockaded woodpecker foraging habitat.

Felsenthal 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 on 3,388 acres. These 3,388 acres will be transitioned or restored to upland hardwood/pine and we will reduce or eliminate fire within these converted acres. Upland hardwood/pine is the historic condition of the converted area and is further supported by the open pine management decision model (See Figure 23).

Strategies:

- Utilize triggers outlined in Table 14 as thresholds for stand improvement interventions to maintain and enhance wildlife habitat needs for priority focal management species.

  The purpose of the forest habitat management strategy is to establish and maintain the desired forest conditions specified in the objectives. 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 Appendix B.

A combination of silvicultural methods will be utilized to meet these forest management objectives for upland pine / hardwood forest. The silvicultural methods are the same as those listed under Objective 2.1.

- Maintain or enhance forest health through the development of monitoring protocols for insect and disease vectors.
- Minimize forest fragmentation; in all stand improvement activities, avoid fragmenting larger forest patches when possible.
- Regeneration cuts should be designed in a pattern that minimizes edge; circular or square cuts have the least amount of edge produced.
- Follow guidelines detailed in the Arkansas Forestry Commission document titled *Best Management Practices for Water Quality Protection* in forest management activities.
- Manage bald eagle nest sites in accordance with State and national bald eagle guidelines (USFWS 2007c), utilizing forest management techniques or prescribed fire, and observing recommended time-of-year restrictions and buffer zone guidelines.
- Control invasive and noxious plant and animal species.

Monitoring Elements:

- Establish point-count monitoring surveys for forest communities; include the monitoring of habitat condition and characteristics with associated points to assess bird use; monitoring should capture both breeding and migrating forest bird species. Use the presence of the focal species as an indicator species for environmental health of upland hardwood/pine forest stands.
- Refuge forester will monitor harvests 1 year post harvest and every 5 years thereafter in order to insure that objectives are being met and to identify any changes that need to be made to any forest management activities.
- Map invasive plants to guide future refuge forest habitat maintenance, management and reforestation decisions. Conduct forest inventories to document stand-specific information such as but not limited to species composition, overstory canopy cover, midstory cover, understory cover, basal area, tree stocking, regeneration presence or absence of exotic insects at damaging levels.

Objective 2.3. ***(Bottomland Hardwoods)*** *(Modifies CCP Objectives 2.1, 2.5, and 2.11, and replaces 2.8, 2.9, and 2.10)* Protect, maintain, enhance, and restore 40,000 acres forested wetland cover-types with less than 10% invasive species to support species of management concern listed below by providing desired forest conditions as outlined by the LMVJV Forest Resource Working Group (Table 14)**.**

- Cerulean Warbler
- ProthontaryWarbler
- Mallard

- Wood Duck
- Rafinesque's Big-ear Bat
- American Black Bear
- Pondberry (E)

Table 14. Desired stand conditions for bottomland hardwood forests within the Mississippi Alluvial Valley.

Forest variables [1]	Desired stand structure	Conditions that may warrant management
Primary Management Factors		
Overstory canopy cover	60 – 70 %	>80%
Midstory cover	25 – 40 %	<20% or >50%
Basal area	60 – 70 ft^2 / acre with ≥25% in older age classes[2]	>90ft^2 / acre or ≥60% in older age classes
Tree stocking	60 – 70 %	<50% or >90%
Secondary Management Factors		
Dominant trees[3]	>2 / acre	<1 / acre
Understory cover	25 – 40%	<20%
Regeneration[4]	30 – 40% of area	<20% of area
Coarse woody debris (>10 inch diameter)	≥200 ft^3 / acres	<100ft^3 / acre
Small cavities (<10 inch diameter)	>4 visible holes / acre **or** >4 "snag" stems ≥4 inch dbh **or** ≥2 stems >20 inch dbh	<2 visible holes / acre **or** <2 snags ≥4 inch dbh **or** <1 stem ≥20 inch dbh
Den trees/large cavities[5] (>10 inch diameter)	1 visible hole / 10 acres **or** ≥2 stems ≥26 inch dbh (≥8 ft^2 BA ≥26 inch dbh)	0 visible holes / 10 acres **or** <1 stem ≥26 inch dbh (<4 ft^2 BA ≥ 26 inch dbh)
Standing dead and/or stressed trees[5]	>6 stems / acre ≥10 inch dbh **or** ≥2 stems ≥20 inch dbh (>4 ft^2 BA ≥ 10 inch dbh)	<4 stems ≥10 inch dbh / acre **or** <1 stem ≥20 inch dbh (<2 ft^2 BA ≥ 10 inch dbh)

(LMVJV Forest Resource Conservation Working Group. 2007. Restoration, Management, and Monitoring of Forest Resources in the Mississippi Alluvial Valley: Recommendations for Enhancing Wildlife Habitat. Edited by R. Wilson, K. Ribbeck, S. King, and D. Twedt.)

Rationale:

Since the establishment of refuge, it has provided migratory and wintering bird habitat. Bottomland hardwood forests are very productive as a result of abundant water and alluvial deposits. These riverine systems are maintained by the natural hydrologic cycles of wet and dry periods. These forests contain a diversity of species.

These forests are heavily impacted by anthropogenic changes. Hydrologic regimes have been altered with navigation and flood control projects, levees and roads, and ditches. These changes have altered timing, duration depth, and frequency of flood events. Hydrologic processes underlie the plant communities of the forest system.

Restoration and maintenance of these bottomland hardwood forests are important to maintain biological integrity and to support wildlife populations. Forest structure and species diversity are important to a variety of wildlife. It is well documented that forest interior songbirds benefit from vertical structure within forested environments. Wintering waterfowl benefit from hard mast produced from certain species within the bottomlands. Bats use foraging habitat within the open areas near water bodies and benefit from diurnal and maternal roosting sites provided by large cavity trees. American black bear benefit from trees that provide large cavities for den locations. This objective will achieve a diverse forest with areas of thick understory, as well as, areas of well-developed midstory and overstory to produce hard and soft mast, and provide snags and cavities.

Strategies:

- Utilize triggers outlined in Table 14 as thresholds for stand improvement interventions to maintain and enhance wildlife habitat needs for priority focal management species.

- Maintain or enhance forest health through the development of monitoring protocols for insect and disease vectors.

  The purpose of the forest habitat management strategy is to establish and maintain the desired forest conditions specified in the objectives. 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 Appendix B.

  A combination of silvicultural methods will be utilized to meet the forest management objectives for bottomland hardwood forest. The silvicultural methods are listed under Objective 1.

- Stay within the management parameters described by the LMVJV Forest Resource Working Group in order to provide desired forest conditions.

- Minimize forest fragmentation; in all stand improvement activities, avoid fragmenting larger forest patches when possible.

- Regeneration cuts should be designed in a pattern that minimizes edge; circular or square cuts have the least amount of edge produced.

- Follow guidelines detailed in the Arkansas Forestry Commission document titled *Best Management Practices for Water Quality Protection*.

- Manage bald eagle nest sites in accordance with State and national bald eagle guidelines (USFWS 2007c), utilizing forest management techniques or prescribed fire and observing recommended time-of-year restrictions and buffer zone guidelines.

- Control invasive and noxious plant and animal species.

Monitoring Elements:

- Conduct appropriate monitoring and survey programs as funding and staffing permits to measure our success with respect to our objectives. The results may trigger adjustments to management strategies, or reevaluation or refinement of our objectives. Details of planned monitoring will be developed in a subsequent inventory and monitoring plan. Examples of monitoring or surveys that we may implement include:

- Conduct forest inventories to document stand-specific information such as but not limited to species composition, overstory canopy cover, midstory cover, understory cover, basal area, tree stocking, regeneration presence or absence of exotic insects at damaging levels.

- Map invasive plants to guide future refuge forest habitat maintenance, management, and reforestation decisions.

- Establish point-count monitoring surveys for listed forest communities; include the monitoring of habitat condition and characteristics with associated points to assess bird use; monitoring should capture both breeding and migrating forest bird species. Use the presence of the focal species as an indicator species for environmental health of mature bottomland forest stands.

- Monitor changing bald eagle nesting sites and make public use modifications or other habitat management actions necessary to protect sites during critical nesting periods.

Objective 2.4. (Water Management/Sanctuaries) *(Replaces CCP Objective 2.3 and modifies CCP Objective 2.5)* Mimic natural hydrological processes to enhance and restore forested wetlands to meet the needs of wetland dependent migratory birds including wintering waterfowl and forest breeding birds***.***

Rationale:

For approximately 20 years, the bottomland hardwood forest within Felsenthal NWR was intentionally flooded in the fall and winter to provide habitat for migrating and wintering waterfowl. This green tree reservoir (GTR)-type management involved raising the gates of the Felsenthal Lock and Dam an additional 5 feet to increase the permanent pool elevation from 65'msl to 70'msl and inundating 21,000 acres of forest. This strategy was justified at the time because early reports on the effects of GTR management indicated either no impacts or positive impacts of the flooding regime on tree health and mast production (Merz and Brakhage 1964; Broadfoot 1967). However, later studies demonstrated long-term negative impacts of GTR management on forest composition, structure, and

health (Malecki et al. 1983; Young et al. 1995; King and Allen 1996; King et al. 1998; Fredrickson 2005; Gray and Kaminski 2005; Ervin et al. 2006), including a shift to more flood-tolerant species and reduced woody species regeneration. In fact, site specific data collected by the US Geological Survey on the effects of long-term flooding of the bottomland hardwood forest within Felsenthal NWR indicate increased tree stress, increased mortality rates, decreased tree vigor, inadequate advanced regeneration, and forest composition that is shifting to the most water-tolerant tree species and a severe decline in red oak species (Allen 1992; King 1995; Allen et al. 1996; King et al. 1998; Keeland et al. 2010). The loss of red oak species (willow oak and Nuttall oak) is particularly alarming because these 2 species provide palatable acorns of high energy, and ideal size for mallard and wood duck consumption (Barras 1993). The primary objective of the refuge is to provide high-quality wintering and resident waterfowl habitat, therefore these changes are unacceptable.

Traditional GTR management involves impounding a stand of bottomland hardwood forest with a low levee system and water control structures and then artificially or naturally flooding the impounded area to provide waterfowl habitat. Flood water is released from the impounded area after waterfowl migrate to the nesting grounds. Felsenthal NWRs GTR-management strategy involved gradually raising the water level to 70'msl beginning as early as November 1, holding water at this level for a few weeks, and then gradually lowering the water to reach 65'msl by early March. However, as noted by King et al. (1998) this schedule was often altered because heavy rainfall prevented dewatering and floodwaters typically remained until spring or early summer growing seasons. This spring/early summer flooding often increased the pool level to 75'msl and above because artificially maintaining high water levels during winter exacerbated the effects of late winter/early spring flooding and resulted in floods lasting longer into the growing season than would have occurred had the area not been artificially flooded during the winter (King and Allen 1996). Therefore, the nature of managed and natural flooding at Felsenthal NWR does not lend itself to successful GTR management. Continuing attempts at traditional GTR-type management at Felsenthal NWR will negatively affect long-term habitat integrity of the bottomland hardwood forest and conflicts with the Biological Integrity Diversity and Environmental Health (BIDEH) policy.

If proper GTR management is possible, it must mimic natural hydrologic cycles. Natural flooding is inherently dynamic and characterized by variation in timing, duration, and depth of flood events and includes years without flooding. The years without flooding are critical for ensuring woody plant regeneration and improving overall forest health. Often, successive dry years are necessary to ensure advanced regeneration of red oak species. Since 2010, managers at Felsenthal NWR have chosen to not intentionally flood the refuges bottomland forest in an effort to improve overall forest health and facilitate advanced red oak regeneration. Interestingly, in the 5 years that the bottomland forest was not intentionally flooded, natural flooding occurred for several days each year providing valuable wintering habitat for waterfowl. Furthermore, the staff has documented substantial advanced red oak regeneration as a result of no artificial flooding. Therefore, it is clear that the optimal strategy for restoring forest health, providing high-quality wintering waterfowl habitat, and healthy habitats for many other forest-dependent wildlife species is to discontinue artificial/intentional flooding of the forest and allow natural flooding to occur on the refuge.

As quality wetland habitats become smaller and scarcer, and continental populations of waterfowl decline, the issue of human disturbance becomes increasingly important. These disturbances cause birds to leave quality habitats and negatively affect foraging and behavioral interactions. Therefore, a critical component of waterfowl management on Felsenthal NWR is the provision of waterfowl sanctuary. Wintering waterfowl need access to areas that are free from human disturbance to complete seasonal and annual life cycle events such as feeding, resting, molting, and pair bonding for reproduction. Currently, Felsenthal NWR provides approximately 9,050 acres of waterfowl sanctuary. The current sanctuary was established two decades ago under the water management

scheme that involved intentionally flooding 21,000 acres of bottomland hardwood forest annually, a practice that inundated 7,444 acres of refuge waterfowl sanctuary. Since 2010, in an effort to emulate natural flooding and to improve forest health, refuge managers have not intentionally flooded the GTR. As noted above, this decision to not flood the GTR has had a positive effect on forest health and forest regeneration. However, when water levels measured on the Ouachita River at the Felsenthal Lock and Dam remain at the summer pool level (65'msl), then only 3,183 acres of the 9,050-acre waterfowl sanctuary are inundated. Therefore, most of the current waterfowl sanctuary is not suitable waterfowl habitat. Not intentionally flooding the GTR and allowing only natural flooding cycles requires a relocation of the waterfowl sanctuary to a portion of the refuge that will provide consistent waterfowl habitat at the 65'msl water level.

Strategies:

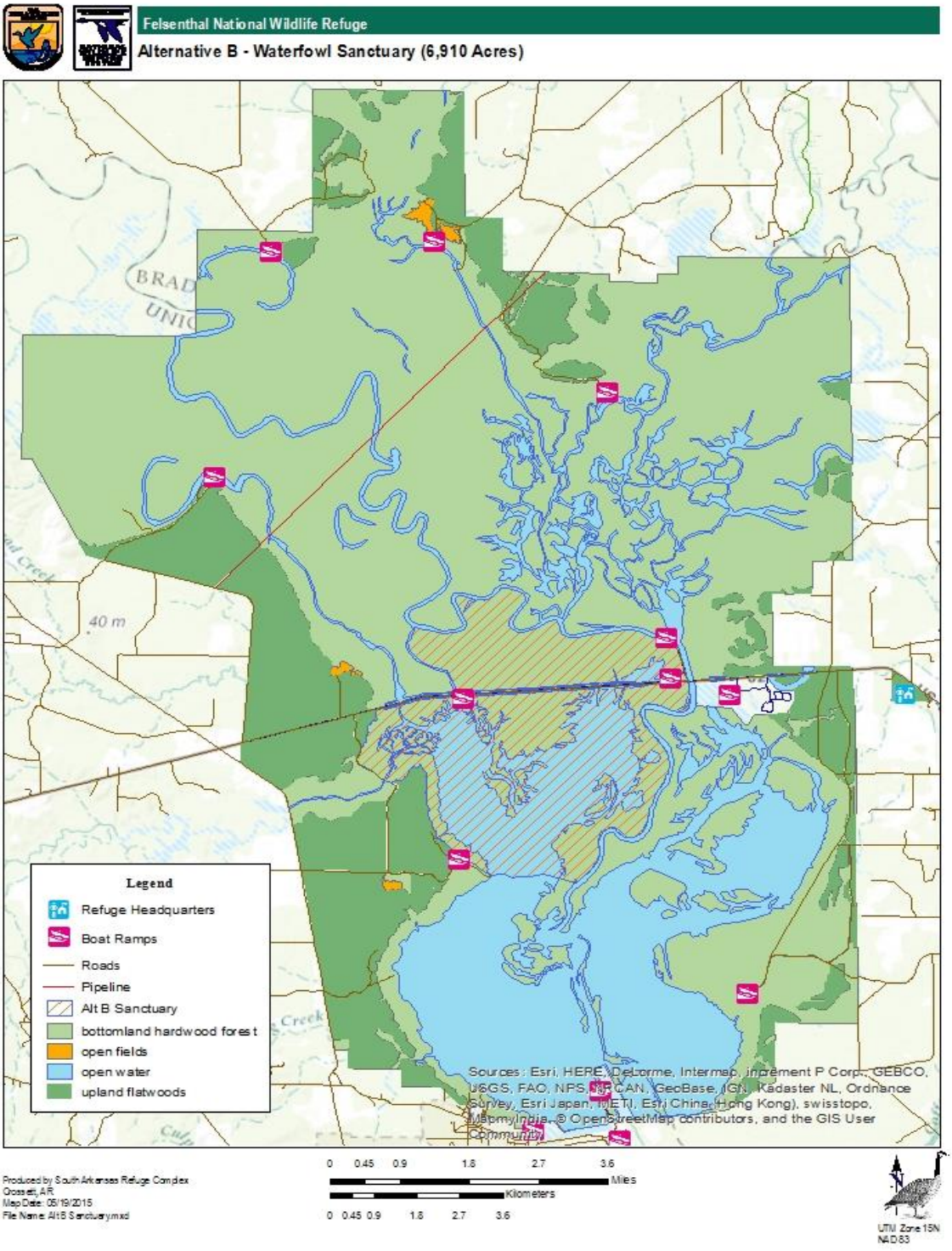
- No intentional flooding of the refuge's bottomland hardwood forest above the 65'msl level.
- Relocate the waterfowl sanctuary to an area with optimum waterfowl habitat at the 65'msl level (Figure 24)
- Control invasive and noxious plant and animal species to include using approved herbicides, mechanical removal, beaver dam removal, and lethal removal of feral hogs, nutria, and beavers.

Monitoring Elements:

- Conduct appropriate surveys to assess waterfowl use of refuge habitats
- Continue monitoring the GTR study plots to document forest health, composition, and regeneration.
- Establish point-count monitoring surveys for listed forest communities; include the monitoring of habitat condition and characteristics with associated points to assess bird use; monitoring should capture both breeding and migrating forest bird species. Use the presence of the focal species as an indicator species for environmental health of mature bottomland forest stands.

Objective 2.5. ***(Moist Soil/Felsenthal Pool Drawdown)*** *(Modifies CCP Objective 2.5, 2.6, 2.7, and 2.12)* Create a mosaic of structurally diverse habitat across 4,000 acres of wetland habitat for migrating and resident shorebirds and waterfowl once every three years through the drawdown of the Felsenthal pool.

Figure 24. New Proposed Waterfowl Sanctuary Locations on Felsenthal National Wildlife Refuge, Alternative B (Proposed Action).



Seasonal objectives will include the following habitat condition targets and acreage:

- Fall shorebirds (July 1 to September 30): Provide 500 to 1,000 acres of various wetland habitats consisting of shallow water depths to mudflat (1 to 6 inches) with little to no vegetation (less than 15 percent coverage) as supplemental feeding and roosting areas for fall migrants.

- Migrating and wintering waterfowl: Provide 3,000 acres of feeding and resting habitats by conducting a slow drawdown and re-flooding regimes within moist-soil areas to provide natural foods dominated by wild millet, panic grasses, sprangletop, nutsedge, and smartweeds with various water depths ranging from 4 to 12 inches. These areas will consist of predominately annual emergent moist-soil vegetation with patches of perennials and open water areas, created from gradual drawdown and re-flood schedules.

Rationale:

In 1995, the refuge and Corps of Engineers conducted a one foot drawn down of the Felsenthal Pool. On July 1, the pool was lowered one-tenth foot increments each day until the 64.0' msl pool was reached. The pool was then gradually flooded around November 1 until it reached 65' msl. The drawdown was viewed as a complete success. Plant response was excellent, and the staff estimated no less the 310,000 ducks utilizing the refuge in late November, 1995.

Hemi-marsh and native vegetation management provide broad cover and optimal food resources, resulting in the best habitat management outcomes for migrating, staging and wintering waterfowl. Areas managed to create shallow water levels, native emergent patches, and a hemi-marsh condition provide habitat conditions for waterfowl use throughout the fall migrating and wintering periods to sustain the annual life cycle requirements of waterfowl (Bookhout et al. 1989). The emergent plant component is a 50:50 mix of emergent stands and open water, and consists of a wide diversity of native annual moist-soil plants, such as wild millet, panic grasses, sedges, sprangletop, smartweeds, spikerushes, and beggarsticks. Managing native vegetation in the form of moist-soil crops has more benefits for waterfowl than managing agricultural crops.

Howard and Wells (2007) noted future drawdowns of the Felsenthal pool would likely increase food quality and quantity for waterfowl species. Although the encroachment of woody vegetation also increased during the drawdown, fluctuating drawdown cycles (once every three years) should subject these seedlings to flooding stress.

Although managed areas may deviate from the historic natural conditions in a wetland area, they constitute a management option that is consistent with the BIDEH policy. Effectively managed moist soil areas can contribute to diversity on the local scale, and can contribute to the landscape-scale conservation of species, which concentrate during migration and winter. Current estimates of waterfowl carrying capacity within managed moist soil habitats, expressed as duck energy days/ac (DEDs/ac), is 1,868 DEDs/ac (Reinecke and Kaminski 2006). A 1-foot drawdown of Felsenthal NWR's permanent pool will result in 4,000 acres of moist soil vegetation and an additional 7,472,000 DEDs. For comparison, Felsenthal NWRs 21,000 acres of flooded bottomland hardwoods yield 3,276,000 DEDs (156 DEDs/ac). Therefore, the drawdown and subsequent moist soil vegetation response will be a substantial benefit to waterfowl. Water level manipulation is intended to mimic natural hydrological regimes in a controlled and enhanced manner to maximize plant production. Periodic drawdowns may also alleviate stress to the bottomland hardwood forest during the growing season.

Strategies:

- To the extent feasible, conduct a slow one foot drawdown of the Felsenthal pool (64' msl) around July 1 to increase the production of invertebrates and wetland plant foods for shorebirds and waterfowl.

- Conduct drawdown and reflooding schedules to maximize seed yields of annual moist-soil plants and develop structural diversity and mudflat habitats for shorebirds and waterfowl every three years.

- Water levels are raised slowly in the fall (November 1)(not to exceed 0.10 msl/day) to provide a continuous supply of food resources.

- Control invasive and noxious plant and animal species to include using approved herbicides, mechanical removal, beaver dam removal, and lethal removal of feral hogs, nutria, and beavers.

- Coordinate with U.S. Army Corps of Engineers in advance of a planned drawdown.

Monitoring Elements:

- Conduct appropriate surveys to assess shorebird and waterfowl use of managed mudflat and moist soil habitats.

- Conduct vegetation surveys to assess species composition to determine DEDs and monitor hardwood encroachment.

Objective 6. ***(Water Quality for Trust Fishery Resources, Migratory Birds, and Resident Wildlife)*** *(Modifies CCP Objective 2.12)* Manage the Felsenthal Pool and other aquatic habitats for interjurisdictional fish species, threatened and endangered species, and improve water quality to perpetuate fish and migratory bird resources with less than 10% invasive species.

Focal species for this habitat include:

- Rabbitsfoot (T)

- Pink Muckett (E)

- Ouachita Rock Pocket (E)

- Winged Mapleleaf (E)

- Western Chicken Turtle

- Alligator Gar

*() E - endangered and T – Threatened

Rationale:

Same as Alternative A with the following exceptions.

Mercury contamination and various forms of point and nonpoint pollution sources pose serious threats to water quality, aquatic fauna, and humans who use the refuge. The El Dorado wastewater pipeline remains a potential source of pollution and eutrophication of refuge waters including the permanent pool. Increased eutrophication of the permanent pool could exacerbate the existing problem of nuisance aquatic vegetation to the point that it could become uncontrollable. Aquatic vegetation became established soon after the permanent pool was created and coverage increased rather slowly during the first 10 years of impoundment (1985-1995). During the late 1990's and early 2000's, various aquatic plants spread rapidly throughout the reservoir. By August 2007, over 90% of the off-channel portion of the pool was captured by aquatic vegetation. The extensive coverage of aquatic vegetation has led to a number of negative consequences such as restricted access for boaters and anglers, the creation of an unbalanced fish community due to the effects on predator : prey relationships, and documented fish kills from low dissolved oxygen levels that result from the dense vegetation. Refuge management in cooperation with the AGFC have implemented a 2-part strategy for controlling invasive aquatic vegetation that includes herbicide applications to control emergent aquatic vegetation and the release of triploid grass carp to control submerged vegetation.

Cuban bulrush (*Oxycarym cubense*), a non-native rush from the West Indies and South America, was discovered within the Felsenthal Pool in 2012. Cuban bulrush can be described as a free floating epiphytic plant, as it requires a raft of other aquatic vegetation to attach to. Once Cuban bulrush becomes established on the host vegetation, it rapidly outgrows and eventually kills the other plants creating a monotypic self-sustaining population of Cuban bulrush. Floating mats of Cuban bulrush can occur in freshwater ditches, marshes, ponds, lakes, rivers, and swamps. Mats of Cuban bulrush impede navigation and recreational use by obstructing shorelines and access areas. Beneath the mats, habitat quality for aquatic organisms is degraded by increased organic matter and low dissolved oxygen. Cuban bulrush reproduces sexually through the production of achenes, or more commonly via vegetative means. It was previously described to be a vigorous invasive plant with growth rates similar to giant salvinia and water lettuce. Given its rapid growth rate, ability to out compete native species, and potential means of long distance dispersal; Cuban bulrush will require intensive management and persistent monitoring. Since the discovery of Cuban bulrush on Felsenthal NWR, refuge management has worked closely with Arkansas Game and Fish Commission fisheries biologists who have applied successful experimental herbicide treatments to the plant on portions of the refuge.

The presence of diverse and reproducing populations of mussels indicates a healthy aquatic system. Felsenthal NWR contains approximately 37 river miles of mussel habitat, supports 36 mussel beds, and is home to 2 endangered mussels and 1 proposed threatened mussel species. Implementation of best management practices to reduce sediment runoff from trail maintenance and forest management activities will further improve water quality within the refuge. Execution of these management strategies decreases siltation, pollution, and subsequently improves habitat quality for mussels and other aquatic life. Elimination of refuge 18.3 miles ATV/UTV trail that cause severe erosion can improve refuge water quality.

Strategies:

- Conduct fisheries inventories and water quality assessments to evaluate resource conservation needs and receive direction from fisheries biologists regarding management recommendations to protect and enhance refuge fish and other aquatic species.

- Control invasive and noxious plant species including the use of herbicides and biological control (triploid grass crap).

- Utilize forest management best management practices to maintain or improve water quality
- Eliminate 18.3 miles of ATV/UTV trails that cause erosion, sedimentation, and wildlife disturbance (Figure 25). (see Appendix A ATV/UTV Compatibility Determination).

Monitoring Elements:

- Conduct water quality monitoring to assess effects of point and nonpoint sources of pollution
- Implement periodic freshwater mussel surveys to detect shifts in species composition and abundance
- Monitor the effectiveness of nuisance and invasive vegetation control
- In cooperation with the U.S. Army Corps of Engineers and AGFC evaluate the on the drawdowns on water quality and the fisheries resource.

ALTERNATIVE C –HABITAT MANAGEMENT

Alternative C is an alternative our planning team has considered and evaluated. This alternative like alternative B involves direct human actions and manipulations to restore degraded and manipulated habitats. This alternative will attempt to achieve the desired future habitat conditions for the conservation of the greatest number of fish, wildlife, and plant resources, while enhancing the biological resources of the West Gulf Coastal Plain.

The biological and habitat objectives and management strategies of *Alternative C* are based on the following underlying hypotheses and assumptions that were used to decide the future management direction for the refuge, including the desired habitat conditions depicted in Figure 26:

- Focal species management would be the best approach to conserve continental migratory bird populations, while maintaining, enhancing, and restoring biological integrity, diversity, and environmental health of refuge lands.
- Managing forested habitats and improving refuge forest management are the best approaches to optimize forest interior bird conservation and other resident wildlife, e.g. black bear.
- Increasing avian diversity and abundance on refuge habitats is best accomplished by conserving, protecting and restoring native plant community cover types.
- Selecting certain focal species as indicator and umbrella species to gauge ecosystem function, biological diversity, integrity, and environmental health, improves environmental health monitoring.

In the discussion that follows, we describe in detail the objectives, strategies and associated rationales that we would use to implement *Alternative C* habitat management objectives. The goals remain the same and are taken directly out of the approved 2010 CCP (USFWS 2010); however the objectives, rationales, and strategies are proposed to be modified or replaced as described below.

Goal 2. Protect, maintain, enhance, and where appropriate, restore suitable habitat for the conservation and management of migratory birds, resident wildlife, fish, and native plants, including all federal and state threatened and endangered species endemic to Felsenthal NWR. (same as CCP Goal 2).

Figure 25. Proposed ATV Trail Closures on Felsenthal National Wildlife Refuge, Alternative B (Proposed Alternative).

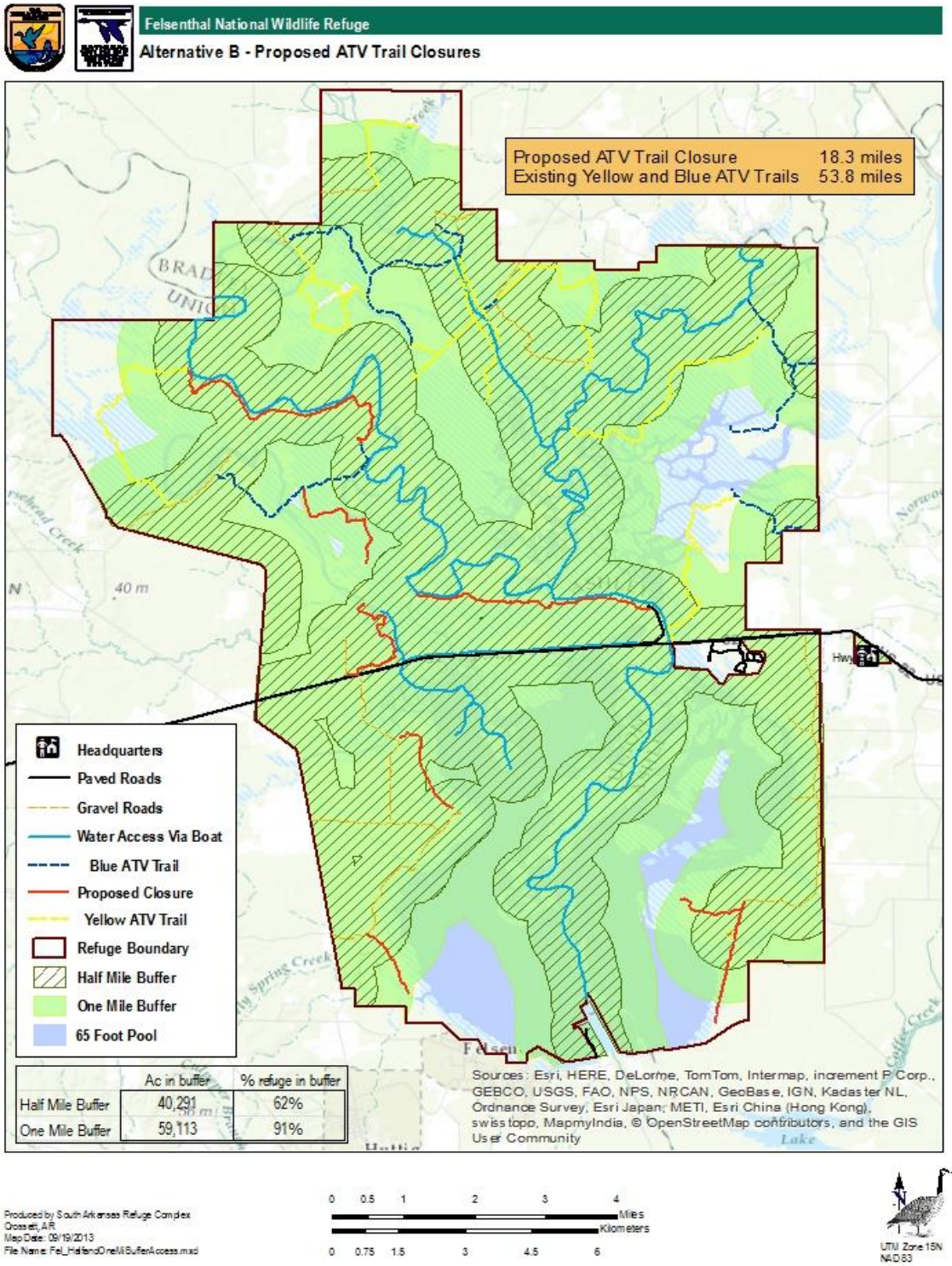
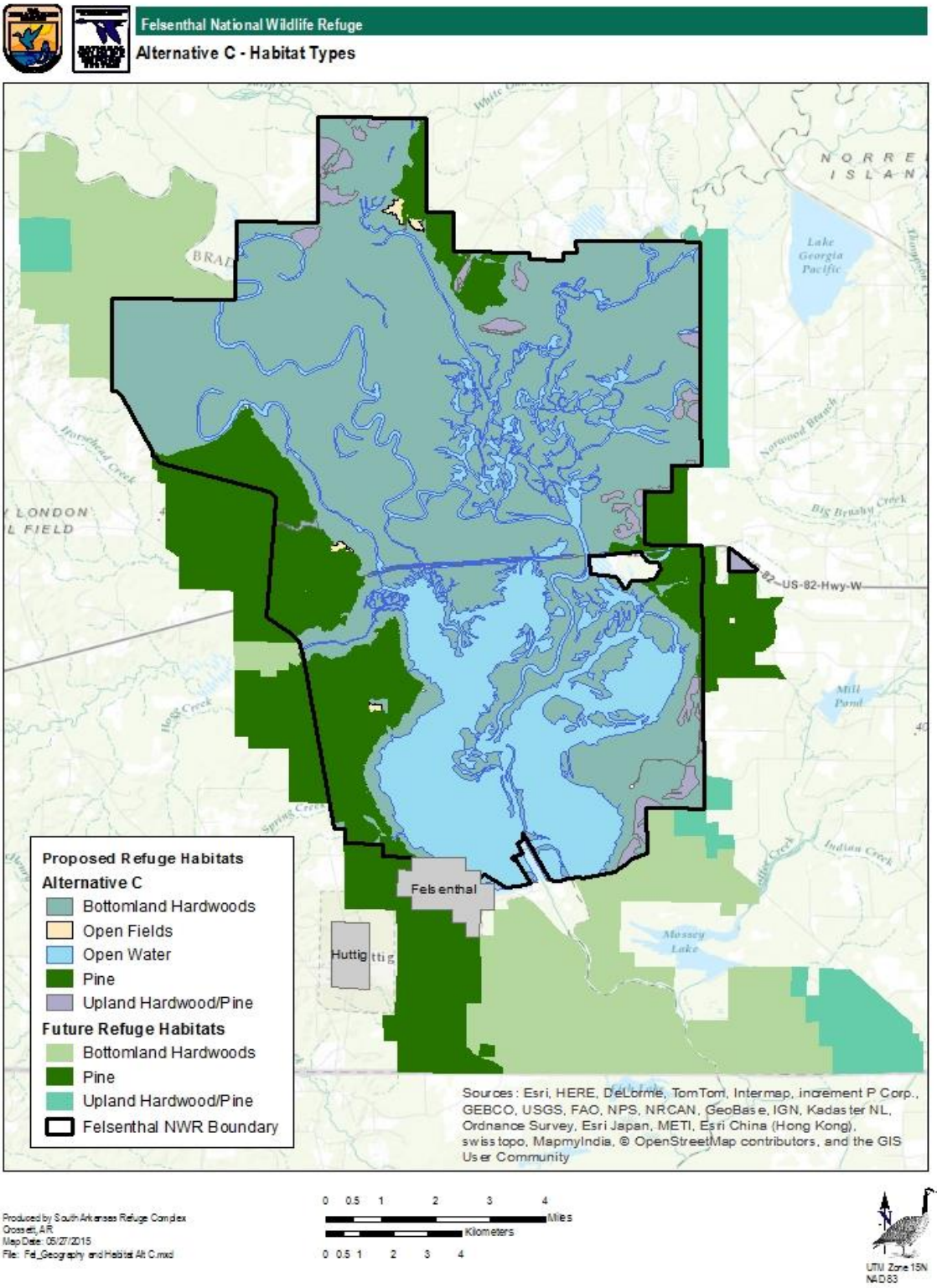


Figure 26. Felsenthal National Wildlife Refuge, Alternative C, Historic Habitat Management.



Objective 2.1. (Upland Pine) *(Replaces CCP Objectives 1.1, 2.2, and 2.4, 2.8, 2.9, 2.10 and Modifies CCP Objective 2.11)* Conserve and enhance 8,159 acres upland pine habitat to conserve red-cockaded woodpecker and other open pine focal species, Northern bobwhite, Bachman's sparrow, and brown-headed nuthatch, using sound silvicultural practices and prescribed fire. Upland pine habitat is characterized by the following attributes:

- There are 45 or more stems/ha (18 or more stems/ac) of pines that are $\geq$ 60 years in age *and* $\geq$ 35 cm (14 in) dbh. Minimum basal area for these pines is 4.6 m^2/ha (20 ft^2/ac). Recommended minimum rotation ages apply to all land managed as foraging habitat.

- Basal area of pines 25.4 – 35 cm (10 – 14 in) dbh is between 0 and 9.2 m^2/ha (0 and 40 ft^2/ac).

- Basal area of pines < 25.4 cm (< 10 in) dbh is below 2.3 m^2/ha (10 ft^2/ac) *and* below 50 stems/ha (20 stems/ac).

- Basal area of all pines $\geq$ 25.4 cm (10 in) dbh is at least 9.2 m^2/ha (40 ft^2/ac). That is, the minimum basal area for pines in categories (a) and (b) above is 9.2 m^2/ha (40 ft^2/ac).

- Groundcovers of native bunchgrass and/or other native, fire-tolerant, fire-dependent herbs total 40 percent or more of ground and midstory plants and are dense enough to carry growing season fire at least once every 5 years.

- No hardwood midstory exists, or if a hardwood midstory is present it is sparse and less than 2.1 m (7 ft) in height.

- Canopy hardwoods are absent or less than 10 percent of the number of canopy trees in longleaf forests and less than 30 percent of the number of canopy trees in loblolly and shortleaf forests. Xeric and sub-xeric oak inclusions that are naturally existing and likely to have been present prior to fire suppression may be retained but are not counted in the total area dedicated to foraging habitat.

- All of this habitat is within 0.8 km (0.5 mi) of the center of the cluster, and preferably, 50 percent or more is within 0.4 km (0.25 mi) of the cluster center.

- Foraging habitat is not separated by more than 61 m (200 ft) of non-foraging areas. Non-foraging areas include (1) any predominantly hardwood forest, (2) pine stands less than 30 years in age, (3) cleared land such as agricultural lands or recently clearcut areas, (4) paved roadways, (5) utility rights of way, and (6) bodies of water.

Rationale:

As indicated under Alternative B and is true for this alternative, open pine management will continue and RCW management would follow the RCW management guidelines outlined in the Recovery plan. Prescribed fire, thinning, regeneration cuts, mulching, and herbicides will be used in the managed of this habitat type. The continual challenge will be to provide adequate foraging habitat. As with Alternative B regeneration cuts in pine stands will be needed to provide future foraging habitat for the RCW, and will usually be ≤ 25 acres in size. Older trees approaching 60 years old must be maintained for potential foraging and cavity trees to replace those 100 plus years old that are lost to natural mortality. Special attention must be given to long-term management of existing foraging

habitat for each colony of RCWs.

As with Alternative B, this Alternative takes into consideration the neighboring population of RCWs. However, under this Alternative 500 acres (Pine Island area) will be managed under an uneven-aged system using single tree and group selection methods. Uneven-aged management may allow for reduced foraging habitat per cluster (200 acres vs. 300 acres). For these 500 acres, prescribed fire would be reduced or eliminated and the use of herbicides will be source of hardwood midstory control. Uneven-aged management would also require a five year entry level rotation for stand development. The reduced foraging base required under this management regime would allow for additional recruitment clusters (4). So the proposed population goal for the refuge will be 18 clusters on 8,159 acres with a future goal of 43 clusters on approximately 15,975 acres as additional lands are acquired. It should be noted not all of this acreage can provide RCW habitat as hardwood drainages bisect stands. In addition, when stands are regenerated these areas may become unavailable to RCWs in the short-term. If the uneven-aged management regime is successful, additional clusters may be added in other areas.

Using the habitat and population objectives set forth by the West Gulf Coastal Plan Open Pine Landbird Plan (LMVJV 2011) the refuge stepped down the objectives for the four focal species (See Table 13 above)

Strategies:

- Utilize triggers outlined in the *Red-cockaded Recovery Plan* as thresholds for stand improvement interventions to maintain and enhance wildlife habitat needs for priority focal management species.

- The purpose of the forest habitat management strategy is to establish and maintain the desired forest conditions specified in the objectives. 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 Appendix B.

- A combination of silvicultural methods will be utilized to meet the forest management objectives described in for upland pine forest. The silvicultural methods are outlined in Alternative B.

- Include approximately 100 acres that are currently located within passively managed demonstration areas into RCW management.

- Minimize forest fragmentation; in all stand improvement activities, avoid fragmenting larger forest patches when possible.

- Follow guidelines detailed in the Arkansas Forestry Commission document titled Best Management Practices for Water Quality Protection.

- Manage bald eagle nest sites in accordance with State and national bald eagle guidelines (USFWS 2007c), utilizing forest management techniques or prescribed fire, and observing

recommended time-of-year restrictions and buffer zone guidelines.

- Control invasive and noxious plant and animal species.
- Manage 500 acres under an uneven-aged silvicultural system.

Monitoring Elements:

- Establish point-count monitoring surveys for listed forest communities; include the monitoring of habitat condition and characteristics with associated points to assess bird use; monitoring should capture both breeding and migrating forest bird species. Use the presence of the focal species as an indicator species for environmental health of mature upland pine forest stands.
- Refuge forester will monitor harvests 1 year post harvest and every 5 years thereafter in order to insure that objectives are being met and to identify any changes that need to be made to forest management activities.
- Map invasive plants to guide future refuge forest habitat maintenance, management and reforestation decisions.
- Updated RCW habitat inventories should be conducted within ½ mile of all active partitions found within a compartment between each timber harvest that occurs in a particular compartment.
- Conduct forest inventories to document stand-specific information such as but not limited to species composition, overstory canopy cover, midstory cover, understory cover, basal area, tree stocking, regeneration presence or absence of exotic insects at damaging levels.

Objective 2.2. *(Upland Pine / Hardwoods)* *(New Objective)* Allow 1,219 acres of upland pine/ hardwood stands to naturally succeed toward a more hardwood dominated forest.

- Dominated by hard mast species
- Diversified forest canopy structure
- Dense patches of ground cover
- Patchy midstory

Rationale:

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 three decades 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 south Arkansas. Bragg (2003) noted in the review of the GLO surveys only 17% of the witness tress were pine. Bragg (2003) further states that much of the area above the overflow was dominated by hardwoods, often interspersed with loblolly and shortleaf pine. He also noted that good hardwood sites, especially those close to bottomlands, often yielded very large witness trees. It is basically impossible to determine the exact forest composition using GLO records for a variety of reasons. However, it is not hard to derive from multiple sources and scientific reasoning that hardwoods were a large part of the upland system in and around Felsenthal NWR. Unfortunately, little attention seems to be given to the decline of upland hardwoods (mostly due to the focus on bottomland hardwood forested wetlands). Animal species associated with this habitat type include wood thrush, worm-eating warbler, eastern spadefoot toad, Louisiana waterthrush, and Chuck-will's-widow.

Felsenthal 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 on 1,241 acres. These 1,241 acres will transition to upland hardwood/pine and we will reduce or eliminate fire within these converted acres. Upland hardwood/pine is the historic condition of the converted area and is further supported by the open pine management decision model (See Figure 21, Draft HMP, Section A).

Strategies:

- Passively Manage Forest
- Insects, diseases, lightning and wind affect and alter forest composition and help increase wildlife habitat diversity; however, in some cases these natural forces of change may destroy critical wildlife habitat or endanger the safety of the visiting public. In the case of insect damaged tress, salvage can be used to remove damaged or dead trees, or these trees may be allowed to remain. Trees with active beetle infestations and a limited number of unaffected trees around the infection may be removed to control insect spread; single tree and small multitree (2-5 trees) spots which pose no threat of spreading will be retained and monitored; dead and dying trees which have been abandoned by the beetles will be retained to provide snags for the benefit of wildlife; and commercial loggers may be used to implement salvage emergency actions. Large groups of damaged trees due to non-insect related causes (i.e., wind thrown, ice/storm damaged and other physically damaged trees) will normally not be salvaged unless it is determined that these trees present a potential safety hazard. Salvage harvests primarily serve as a mechanism to stop the spread of an active disease or insect outbreak, but removes snags that are beneficial to many species of wildlife (e.g., insects, cavity nesters).
- Restrict prescribed fire.
- Control invasive and noxious plant and animal species.

Monitoring Elements:

- Establish point-count monitoring surveys for listed forest communities; include the monitoring of habitat condition and characteristics with associated points to assess bird use; monitoring should capture both breeding and migrating forest bird species. Use the presence of the focal species as an indicator species for environmental health of upland hardwood/pine forest

stands.

- Map invasive plants to guide future refuge forest habitat maintenance.

- Conduct forest inventories to document stand-specific information such as but not limited to species composition, overstory canopy cover, midstory cover, understory cover, basal area, tree stocking, regeneration presence or absence of exotic insects at damaging levels.

Objective 2.3. ***(Bottomland Hardwoods)*** (*Modifies CCP Objectives 2.1, 2.5, 2.8, 2.9, 2.10 and 2.11)* Protect, maintain, enhance, and restore forested wetland cover-types with less than 10% invasive species to support species of management concern listed below by providing desired forest conditions as outlined by the LMVJV Forest Resource Working Group (USFWS 2007)***.***

- 60-70% Overstory Canopy Cover

- 25-40% Midstory Cover

- 60-70ft²/acre of Basal Area (≥25% in older age classes)

- 60-70% tree stocking

Wildlife Resources of Concern include:

- Cerculean Warbler
- ProthontaryWarbler
- Mallard
- Wood Duck
- Rafinesque's Big-ear Bat
- American Black Bear
- Pondberry (E)

Rationale:

Forest structure and species diversity are important to a variety of wildlife. It is well documented that forest interior songbirds benefit from vertical structure within forested environments. Wintering waterfowl benefit from hard mast produced from certain species within the bottomlands. Bats use foraging habitat within the open areas near water bodies and benefit from diurnal and maternal roosting sites provided by large cavity trees. American black bear benefit from trees that provide large cavities for den locations. This objective will achieve a diverse forest with areas of thick understory, as well as, areas of well-developed midstory and overstory to produce hard and soft mast, and provide snags and cavities.

Bottomland research conducted by USGS, after the construction of the lock and dam, has shown a lack of desirable regeneration found in the lower elevations of the bottomland habitat. This lack of regeneration is more evident at the lower elevations. Considering these findings forest management at the lower elevations could accelerate the conversion of this forest to a less diverse, more water tolerant forest or in some cases from a bottomland hardwood forest to a more shrub –scrub (i.e. buttonbush) type habitat. For this reason these areas will be passively managed.

Strategies:

- Passively manage bottomland hardwood forest between 65’ and 67’ msl with limited human disturbance with the exception of invasive species control.

- Utilize triggers outlined in Table 14 (above) as thresholds for stand improvement interventions for those areas above 67’msl to maintain and enhance wildlife habitat needs for priority focal management species. Maintain or enhance forest health through the development of monitoring protocols for insect and disease vectors.

- The purpose of the forest habitat management strategy is to establish and maintain the desired forest conditions specified in the objectives. 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 Appendix B

- A combination of silvicultural methods will be utilized to meet the forest management objectives.

- Stay within the management parameters described by the LMVJV Forest Resource Working Group in order to provide desired forest conditions in areas located above 67’ msl.

- Minimize forest fragmentation; in all stand improvement activities, avoid fragmenting larger forest patches when possible.

- Regeneration cuts should be designed in a pattern that minimizes edge; circular or square cuts have the least amount of edge produced.

- Follow guidelines detailed in the Arkansas Forestry Commission document titled *Best Management Practices for Water Quality Protection*.

- Manage bald eagle nest sites in accordance with State and national bald eagle guidelines (USFWS 2007c), utilizing forest management techniques or prescribed fire and observing recommended time-of-year restrictions and buffer zone guidelines.

- Control invasive and noxious plant and animal species.

Monitoring Elements:

- Conduct appropriate monitoring and survey programs as funding and staffing permits to measure our success with respect to our objectives. The results may trigger adjustments to management strategies, or reevaluation or refinement of our objectives. Details of planned monitoring will be developed in a subsequent inventory and monitoring plan. Examples of monitoring or surveys that we may implement include:

- Conduct forest inventories to document stand-specific information such as but not limited to species composition, overstory canopy cover, midstory cover, understory cover, basal area,

tree stocking, regeneration presence or absence of exotic insects at damaging levels.

- Map invasive plants to guide future refuge forest habitat maintenance, management, and reforestation decisions.

- Establish point-count monitoring surveys for listed forest communities; include the monitoring of habitat condition and characteristics with associated points to assess bird use; monitoring should capture both breeding and migrating forest bird species. Use the presence of the focal species as an indicator species for environmental health of mature bottomland forest stands.

- Monitor changing bald eagle nesting sites and make public use modifications or other habitat management actions necessary to protect sites during critical nesting periods.

Objective 2.4. (Water Management/Sanctuaries) *(Replaces CCP Objective 2.3 and modifies CCP Objective 2.5)* Intentionally flood bottomland hardwood habitat to 68' msl during late fall and winter to provide an additional 12,600 acres of waterfowl habitat and provide 9,050 acres of waterfowl sanctuary*.*

Rationale:

For approximately 20 years, the bottomland hardwood forest within Felsenthal NWR was intentionally flooded in the fall and winter to provide habitat for migrating and wintering waterfowl. This green tree reservoir (GTR)-type management involved raising the gates of the Felsenthal Lock and Dam an additional 5 feet to increase the permanent pool elevation from 65'msl to 70'msl and inundating 21,000 acres of forest. This strategy was justified at the time because early reports on the effects of GTR management indicated either no impacts or positive impacts of the flooding regime on tree health and mast production (Merz and Brakhage 1964; Broadfoot 1967). However, later studies demonstrated long-term negative impacts of GTR management on forest composition, structure, and health (Malecki et al. 1983; Young et al. 1995; King and Allen 1996; King et al. 1998; Fredrickson 2005; Gray and Kaminski 2005; Ervin et al. 2006), including a shift to more flood-tolerant species and reduced woody species regeneration. In fact, site specific data collected by the US Geological Survey on the effects of long-term flooding of the bottomland hardwood forest within Felsenthal NWR indicate increased tree stress, increased mortality rates, decreased tree vigor, inadequate advanced regeneration, and forest composition that is shifting to the most water-tolerant tree species and a severe decline in red oak species (Allen 1992; King 1995; Allen et al. 1996; King et al. 1998; Keeland et al. 2010). The losses of red oak species (willow oak and Nuttall oak) are particularly alarming because these 2 species provide palatable acorns of high energy, and ideal size for mallard and wood duck consumption (Barras 1993). The primary objective of the refuge is to provide high-quality wintering and resident waterfowl habitat, therefore these changes are unacceptable.

Traditional GTR management involves impounding a stand of bottomland hardwood forest with a low levee system and water control structures and then artificially or naturally flooding the impounded area to provide waterfowl habitat. This strategy involves gradually raising the water level to 68'msl beginning December 15 and then gradually lowering the water to reach 65'msl by the middle of February before green up. However, as noted by King et al. (1998) past schedules have often altered because heavy rainfall prevented dewatering and floodwaters typically remained until spring or early summer growing seasons. This spring/early summer flooding often increased the pool level to 75'msl and above because artificially maintaining high water levels during winter exacerbated the effects of late winter/early spring flooding and resulted in floods lasting longer into the growing season than would have occurred had the area not been artificially flooded during the winter (King

and Allen 1996). Therefore, the challenge of managing the water levels and natural flooding at Felsenthal NWR can lead to unsuccessful GTR management. Allowing for a smaller flood window (December 15 to January 15) and every third year no management, this strategy tries to mimic natural flood cycles. If proper GTR management is possible, it must mimic natural hydrologic cycles. Natural flooding is inherently dynamic and characterized by variation in timing, duration, and depth of flood events and includes years without flooding. The years without flooding are critical for ensuring woody plant regeneration and improving overall forest health.

As quality wetland habitats become smaller and scarcer, and continental populations of waterfowl decline, the issue of human disturbance becomes increasingly important. These disturbances cause birds to leave quality habitats and negatively affect foraging and behavioral interactions. Therefore, a critical component of waterfowl management on Felsenthal NWR is the provision of waterfowl sanctuary. Wintering waterfowl need access to areas that are free from human disturbance to complete seasonal and annual life cycle events such as feeding, resting, molting, and pair bonding for reproduction. Currently, Felsenthal NWR provides approximately 9,050 acres of waterfowl sanctuary. The current sanctuary was established two decades ago under the water management scheme that involved intentionally flooding 21,000 acres of bottomland hardwood forest annually, a practice that inundated 7,444 acres of refuge waterfowl sanctuary. Flooding to 68' will inundate approximately 12,600 acres of bottomland hardwood habitat with approximately 4,466 of those acres being located within the current sanctuary boundary. The staff agrees that a total of 6,072 acres will maintain an adequate amount of sanctuary habitat.

Strategies:

- Intentionally flood bottomland hardwood forest to 68'msl starting December 15
    - Raise water levels one tenth (.1) per day until 68"msl is achieved.
    - Start a slow drawdown starting January 15 until 65 'msl is reached
    - Every third year do not flood as to mimic natural flooding regimes.
- Maintain the existing waterfowl sanctuary

Monitoring Elements:

- Conduct appropriate surveys to assess waterfowl use of refuge habitats
- Continue monitoring the GTR study plots to document forest health, composition, and regeneration.
- Establish point-count monitoring surveys for listed forest communities; include the monitoring of habitat condition and characteristics with associated points to assess bird use; monitoring should capture both breeding and migrating forest bird species. Use the presence of the focal species as an indicator species for environmental health of mature bottomland forest stands.

Objective 2.5. ***(Moist Soil/Felsenthal Pool Drawdown)*** *(Modifies CCP Objective 2.5, 2.6, 2.7, and 2.12)* Create a mosaic of habitat structural diversity across 4,000 acres of wetland habitat for migrating and resident shorebirds and waterfowl every year through the drawdown of the Felsenthal pool.

Seasonal objectives will include the following habitat condition targets and acreage:

- Fall shorebirds (July 1 to September 30): Provide 500 to 1,000 acres of various wetland habitats consisting of shallow water depths to mudflat (1 to 6 inches) with little to no vegetation (less than 15 percent coverage) as supplemental feeding and roosting areas for fall migrants.

- Migrating and wintering waterfowl: Provide 3,000 acres of feeding and resting habitats by conducting a slow drawdown and re-flooding regimes within moist-soil areas to provide natural foods dominated by wild millet, panic grasses, sprangletop, nutsedge, and smartweeds with various water depths ranging from 4 to 12 inches. These areas will consist of predominately annual emergent moist-soil vegetation with patches of perennials and open water areas, created from gradual drawdown and re-flood schedules.

Rationale:

As stated under Alternative B, a 1-foot drawdown annually of Felsenthal NWR's permanent pool will result in 4,000 acres of moist soil vegetation and an additional 7,472,000 DEDs. For comparison, Felsenthal NWRs 21,000 acres of flooded bottomland hardwoods yield 3,276,000 DEDs (156 DEDs/ac). Therefore, the drawdown and subsequent moist soil vegetation response will be a substantial benefit to waterfowl. Water level manipulation is intended to mimic natural hydrological regimes in a controlled and enhanced manner to maximize plant production. Annual drawdowns may also alleviate stress to the bottomland hardwood forest during the growing season.

Howard and Wells (2007) noted future drawdowns of the Felsenthal pool would likely increase food quality and quantity for waterfowl species. Although the encroachment of woody vegetation also increased during the drawdown in 1995, the refuge will need to monitor vegetation composition. If undesirable vegetation increases above a desired threshold, a drawdown may be avoided to subject woody vegetation to flooding stress.

It should be noted the navigational concerns (commerce on river) would take precedent over any planned drawdown.

Strategies:

- To the extent feasible, conduct a slow one foot drawdown of the Felsenthal pool (64' msl) around July 1 to increase the production of invertebrates and wetland plant foods for shorebirds and waterfowl.

- Conduct drawdown and reflooding schedules to maximize seed yields of annual moist-soil plants and develop structural diversity and mudflat habitats for shorebirds and waterfowl every year.

- Water levels are raised slowly in the fall (November 1)(not to exceed 0.10 msl/day) to provide a continuous supply of food resources.

- Control invasive and noxious plant and animal species to include using approved herbicides, mechanical removal, beaver dam removal, and lethal removal of feral hogs, nutria, and beavers.

- If vegetation surveys show woody vegetation above a desired threshold, refrain from a drawdown for one year to induce flooding stress on the undesirable vegetation.

Monitoring Elements:

- Conduct appropriate surveys to assess shorebird and waterfowl use of managed mudflat and moist soil habitats.
- Conduct vegetation surveys to assess desired species composition and monitor hardwood (scrub/shrub) encroachment.

Objective 6. ***(Water Quality for Trust Fishery Resources, Migratory Birds, and Resident Wildlife)*** *(Modifies CCP Objective 2.12)* Manage the Felsenthal Pool and other aquatic habitats for interjurisdictional fish species, threatened and endangered species, and improve water quality to perpetuate fish and migratory bird resources with less than 10% invasive species.

Focal species for this habitat include:

- Rabbitsfoot (T)
- Pink Muckett (T)
- Ouachita Rock Pocket (E)
- Western Chicken Turtle
- Alligator Gar

*() E - endangered and T – Threatened

Rationale:

Same as Alternative B

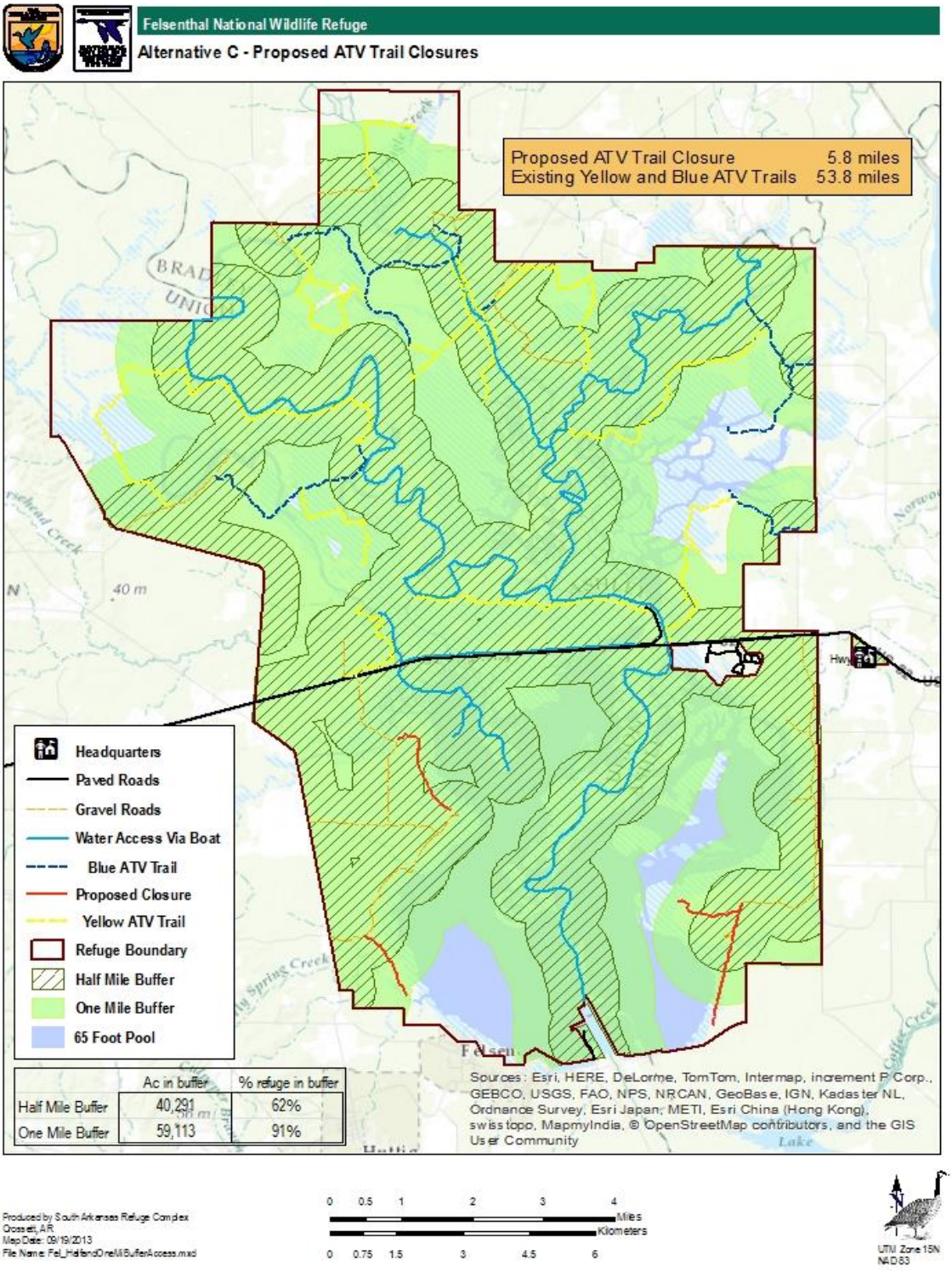
Strategies:

- Control invasive and noxious plant species including the use of herbicides and biological control (grass crap).
- Eliminate 5.8 miles of ATV trails that cause soil erosion, impacting water quality and reduce wildlife disturbance (Figure 27).

Monitoring Elements:

- Conduct fisheries inventories and water quality assessments to evaluate resource conservation needs and receive direction from fisheries biologists regarding management recommendations to protect and enhance refuge fish and other aquatic species.
- Every 10 years conduct mussel survey to determine bed locations, size and species composition.

Figure 27. Proposed ATV Trail Closures on Felsenthal National Wildlife Refuge, Alternative C.



Comparison of the Alternatives

Table 15. Comparison of alternatives by management objective for Felsenthal National Wildlife Refuge

Objectives	Alternative A (Current Management – No Action Alternative)	Alternative B (Proposed Alternative)	Alternative C
Objective 2.1 Upland Pine (Open Pine)			
Acres Fire Managed Acres Unevenaged Managed Acres	9,000 9,490 None	6,200 6,200 None	8,159 8,159 500
RCW Cluster (population objective)	22	13-14	18
Consider Neighboring Population of RCWs	No	Yes	Yes
Open Fields	Not mentioned in the CCP	132 acres	132 acres
Objective 2.2 Upland Hardwood/Pine			
Acres	188 acres (no objective in CCP is mentioned)	3,388 acres	1,219 acres
Objective 2.3 Bottomland Hardwoods			
Acres	40,000	40,000	40,000
Passively Managed Acres	None	5,551 (GP's Sustainable Forestry and Certification Program)	5,551 (GP's Sustainable Forestry and Certification Program) Plus all lands between 65' and 67" msl

Objectives	Alternative A (Current Management – No Action Alternative)	Alternative B (Proposed Alternative)	Alternative C
Objective 2.4 Water Management/ Sanctuaries			
GTR Management	No Flooding for two to three years – Mimic historic winter flooding Various scenarios can be utilized but fluctuates	None – Allow natural winter flood events	Starting Dec. 15 raise the pool one tenth/day until the 68' msl level is reached. Start the drawdown on January 16 to 65'msl
Sanctuary	9.050 acres	6,910 acres (old area removed would be opened to small game, big game hunting and fishing)	9,050 acres
Objective 2.5 Drawdown of the Felsenthal Pool/Moist Soil			
Drawdown	None	1 foot drawdown every 3 years	1 foot drawdown every year
Objective 2.6 Aquatic Resources			
Water Quality Monitoring and Mussel Bed Survey	None	Yes	Yes
ATV Trails	Maintain existing	Eliminate 18.3 miles of ATV trails	Eliminate 5.8 miles

ALTERNATIVES CONSIDERED BUT ELIMINATED FROM FURTHER ANALYSIS

Refuge staff has considered passively managing the entire refuge. Many individuals and groups feel a hands-off approach to habitat management to be the best or more natural way. However, altered hydrology, extensive flooding, channelization, ditching, lack of natural disturbances (fire), invasives species, etc., have altered processes that were once important and necessary to maintain diverse healthy habitats. Active management is needed to achieve desired forest/habitat conditions. Without active management Felsenthal NWR will not be able fulfill the purposes for which the refuge was established or mission of the Refuge System. In addition the refuge would not be able to meet its obligations under the Endangered Species Act. Passively managing habitats favor a more shade tolerant component in the bottomlands and hardwood dominated component in the uplands. For these reasons, passively managing the entire refuge has been dismissed from further consideration. However, the refuge does maintain a limited amount of passively managed areas (see endangered forests and demonstration areas). Although limited in area, passively managed forests and habitats are important as they serve as experimental controls to measure management actions on more actively managed acres.

Refuge staff considered but eliminated from detailed analysis the management practice of raising water in the permanent pool to 70' msl each fall and winter for waterfowl. Research conducted by the US Geological Survey on the effects of long-term flooding of the bottomland hardwood forest within Felsenthal NWR indicate increased tree stress, increased mortality rates, decreased tree vigor, inadequate advanced regeneration, and forest composition that is shifting to the most water-tolerant tree species and a severe decline in red oak species (Allen 1992; King 1995; Allen et al. 1996; King et al. 1998; Keeland et al. 2010). Therefore, it is clear that the practice of intentionally flooding the refuge to the 70' msl level is damaging ecosystem health and does not comply with the principles of adaptive resource management or the BIDEH policy.

CHAPTER V. ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

This chapter describes the environmental consequences we predict from implementing management alternatives presented in chapter 4. Where detailed information is available, we present a more analytic comparison between alternatives and their anticipated consequences. These consequences are described as impacts or effects. In absence of detailed information, we make comparisons based on our professional judgment and strategies of the three alternatives: current management or no action (alternative A); proactive habitat enhancement and restoration management and revising the RCW objectives in the Service-preferred alternative (alternative B); and a modified water management option, and uneven-aged management on a portion of the upland pine, revise RCW management objectives (Alternative C).

We focus our discussion on the impacts associated with the goals and significant issues identified in Chapter 1, Purpose of, and Need for, Action. The direct, indirect, short-term, long-term, and cumulative influences of both beneficial and adverse effects likely to occur over the life span of this HMP are discussed. Beyond the 15-year planning horizon, we consider a more speculative description of environmental consequences with particular emphasis on climate change predictions and associated sea level rise impacts based on current models. We will also consider the relationship between short-term uses of the human environment and the enhancement of long-term productivity, potential irreversible and irretrievable commitments of resources, and environmental justice. At the end of this chapter, a matrix summarizes the effects predicted for each alternative and allows for a side-by-side comparison.

Regulations adopted by the Council for Environmental Quality and the Service on implementing NEPA require that we assess the importance of the effects of all alternatives based on their context and intensity.

The context of our impact analysis ranged from small scale to large, from the invertebrate community on the Refuge to the Mississippi flyway population for a migratory bird. Table 16 illustrates the range in scale, from a square meter to nearly 37 million acres, of the context of various Service actions.

Table 16. Impact Contexts for Service Actions Under HMP at Felsenthal NWR.

Invertebrate/vegetation sampling size (m^2)	0.000247 acres (square meter)
Bird Point Counts	0.001 to 0.5 acres
Pintail Potholes	0.1 to 200 acres
Refuge Management Units	1,111 to 3,823 acres
Felsenthal Pool	10,000 acres
Felsenthal NWR Refuge Lands	64,902 acres

Southern Arkansas Refuge Complex Lands	108,000 acres
Ashley, Bradley, and Union Counties	1,671,040 acres
State of Arkansas	34,034,560 acres
West Gulf Coastal Plain	37,129,777 acres

Although the area of the refuge only covers a small percentage of these larger geographical regions, it represents a hotspot of biodiversity across the regional landscape. Our proposed conservation objectives and strategies for focal species and habitat management actions are consistent with Arkansas' comprehensive wildlife action plan and contribute to achieving bird population objectives for bird species of greatest conservation need on Felsenthal NWR.

The impacts of the management action on some of the environmental attributes are also, at times, described as beneficial or adverse. Generally, an impact will be described as 'beneficial' if it results in a condition that improves the biological health, population size of native or naturally occurring species, or the robustness or sustainability of that characteristic. However, many times value judgments cannot be given for ecological change. A change in habitat that is beneficial for certain species of waterfowl may be adverse for others with different habitat preferences. Factors which reduce the population of a species may be adverse for the species and positive for others. Therefore, sometimes our impact assessments do not describe impacts as either positive or negative, or describe them specifically in term of what the impact applies to.

SUMMARY OF EFFECTS BY ALTERNATIVE

The following section describes the environmental consequences of adopting each refuge management alternative.

IMPACTS OF REFUGE MANAGEMENT ON THE SOCIOECONOMIC ENVIRONMENT

Impacts of Refuge Management on Socioeconomic Environment that would not vary by alternative

The sociological aspects of forest habitat management programs are complex, and vary widely across geographic boundaries. These activities, particularly the cutting of trees, while appreciated and promoted in rural America, are less likely to be viewed the same way by people in urban settings and backgrounds. In many cases, urban America sees and hears only the negative aspects of forest management and associates forest management programs on refuges with wildlife destruction and commercialization of the resource rather than with the objectives of wildlife habitat improvement, improved forest health, and other benefits to the environment. In spite of the potential of managing for diverse public and equally diverse populations of wildlife, it is impossible to please all interest groups and individuals. Some would object to management in any form, and it would be difficult to argue against the pursuit of natural values.

Realistically, there are few remaining areas where protection of the habitat alone is the only necessary management option. This is especially true in cases where man has already caused significant impacts on the landscape, as at Felsenthal NWR. The majorities of habitats are degraded, are far from natural, and have the growing inability to support the historical abundance and diversity of fauna that is necessary and expected. These concerns and issues would be addressed in environmental education and interpretation programs about the refuge's forest management program.

By law (Refuge Revenue Sharing Act (16 U.S.C. 715s)), the refuge is exempt from paying property tax and instead makes revenue sharing payments to the three counties in which the refuge is located: Ashley, Bradley, and Union (See Table 3). The law provides a method of collecting monetary receipts from revenue generating activities (e.g., timber harvest revenue, commercial activities) on refuges within the nation, pooling them together, and paying them out to counties containing refuge lands. Payment for acquired land is computed on whichever of the following formulas is greatest: (1) three-fourths of one percent of the fair market value of the lands acquired in fee title; (2) 25 percent of the net refuge receipts collected; or (3) 75 cents per acre of the lands acquired in fee title within the county. If the receipts generated on refuges do not meet the entitlement amount, Congress may approve additional funds to make up the shortfall. Commercial activities such timber harvest would have positive impact on the local communities by replacing loss property taxes with revenue sharing payments.

Impacts of Refuge Management on Socioeconomic Environment in Alternative A

Same as Impacts of Refuge Management on Socioeconomic Environment that would not vary by alternative

Impacts of Refuge Management on Socioeconomic Environment in Alternative B

Same as Impacts of Refuge Management on Socioeconomic Environment that would not vary by alternative plus the 1-foot drawdown should not significantly impact commercial navigation. The minimum level will be 64 feet, one foot lower that the authorized pool. It is our understanding navigation will not be impacted. A 9-foot navigation channel would still be available to the Crossett Harbor when the pool is at 64 feet, NGVD. Commercial traffic north of the Crossett Harbor may be negatively impacted with the drawdown.

Impacts of Refuge Management on Socioeconomic Environment in Alternative C

Same as Impacts of Refuge Management on Socioeconomic Environment in Alternative B. However, with an annual drawdown impacts may increase. It should be noted navigational issues/needs will take precedent over any drawdown.

IMPACTS ON THE CULTURAL RESOURCES

Impacts on the Cultural Resources that would not vary by alternative

Refuge lands are protected from development or destructive land uses that may result in substantial impacts on cultural and historic resources. Regardless of which alternative we select, we would protect known cultural and historic resources. For compliance with section

106 of the National Historic Preservation Act, the refuge staff will, during the early planning stages of proposed new actions, provide the regional historic preservation officer with a description and location of all projects, activities, routine maintenance, and operations that affect ground and structures, details on requests for compatible uses, and the range of alternatives considered. That office will analyze those undertakings for their potential to affect historic and prehistoric sites, and consult with the State historic preservation officer and other parties as appropriate. We will notify the State and local government officials to identify concerns about the impacts of those undertakings. If previously unknown historical or cultural resources are detected during habitat management operations, the Regional Historic Preservation Officer will be notified immediately. We expect all of the alternatives to have local long-term minor beneficial impacts through education and awareness and local negligible adverse impacts on cultural and historical resources on the refuge.

Impacts on the Cultural Resources in Alternative A

Same as Impacts on the Cultural Resources that would not vary by alternative

Impacts on the Cultural Resources in Alternative B

Same as Impacts on the Cultural Resources that would not vary by alternative

Impacts on the Cultural Resources in Alternative C

Same as Impacts on the Cultural Resources that would not vary by alternative

IMPACTS ON AIR QUALITY

Impacts on Air Quality that would not vary by alternative

The greatest impact to the environment from prescribed burning conducted on Felsenthal NWR is the production of smoke and the release of components that make up wildfire smoke. Smoke is composed of water vapor, particulate matter, carbon monoxide, hydrocarbons, organic chemicals, nitrogen oxides, trace minerals and many other compounds.

Particulates in smoke are the greatest concern because they reduce visibility and increase health risks. The amount of particulate released from prescribed burning varies depending on the type of fuel being burned, fuel moisture content, and the rate of fire spread. Smoke dispersal depends primarily on atmospheric stability and wind speed.

Smoke adversely impacts air quality, particularly for two pollutants covered by the Environmental Protection Agency (EPA) National Ambient Air Quality Standards, particulate matter smaller than 2.5 microns (PM2.5) and ozone. Wildland fires release large amounts of PM2.5 and while fires do not release ozone, they do release various nitrogen oxides and volatile organic components that play a role in ozone formation (Waldrop and Goodrick, 2012). The nearest nonattainment area to Felsenthal National Wildlife Refuge is Crittenden County, Arkansas (part of the Memphis TN metropolitan area) for the 8-Hour Ozone standard (http://www.epa.gov/oaqps001/greenbk/ancl.html). This area is approximately 160 miles from Felsenthal NWR and is not likely to be impacted by smoke from prescribed burning conducted on the refuge.

In order to adhere to EPA air quality standards and reduce impact to the environment and the public, the state of Arkansas has implemented the Arkansas Voluntary Smoke Management Guidelines. These guidelines assist the prescribed fire manager to estimate how many tons of wildland fuel may be consumed during a prescribed fire and how much smoke and particulate matter may be produced as a result of the prescribed burning. The amount of wildland fuel that will be allowed to be consumed in an airshed (36 square miles) for any given day is based on the ability of the atmosphere to disperse the resulting smoke, the distance downwind to a smoke sensitive area and the tons of fuel being consumed per burn. If a single prescribed burn or the cumulative emissions from multiple prescribed burns within an airshed will exceed the permissible limits, the Arkansas Forestry Commission will request prescribed burners to either delay their burn or reduce the number of acres to be burned for that day (Arkansas Forestry Commission 2007). All prescribed burning conducted on Felsenthal NWR will comply with Arkansas Voluntary Smoke Management Guidelines.

The use of prescribed fire is common to all management alternatives. The difference among the alternatives lies in the frequency in which prescribed fires would be conducted. Areas burned more frequently will generally have lower fuel loadings than areas burned less frequently. When less fuel is consumed by fire, lower amounts of emissions are produced per burn. By conducting prescribed burns more frequently the amount of emissions per burn is decreased, but the frequency at which emissions are released is increased.

Impacts on Air Quality in Alternative A

Same as Impacts on Air Quality that would not vary by alternative

Impacts on Air Quality in Alternative B

Same as Impacts on Air Quality that would not vary by alternative

Impacts on Air Quality in Alternative C

Same as Impacts on Air Quality that would not vary by alternative

IMPACTS ON SOILS

Impacts on Soils that would not vary by alternative

The refuge has used herbicides in the past and will into the future to meet management objectives under all alternatives, for pre (site preparation) and post-restoration to control vegetation and invasive species. The mobility of an herbicide is a function of how strongly it is absorbed to soil particles and organic matter. Two common herbicides are Triclopyr (Garlon) and Imazapyr (Arsenal) that are used to control hardwood vegetation and invasive species (Chinese tallow) on the refuge. Soil persistence can vary depending on soil moisture and pH.

Before pesticides can be used to eradicate, control or contain pests on the refuge, pesticide use proposals would be prepared and approved in accordance to 7 RM 14. In addition, best management practices will minimize or eliminate effects associated with the use of herbicides that may impact refuge soils.

Prescribed burning is comparatively cheap, causes little soil disturbance, and may enhance the availability of nutrients. However, the chance of fire escape is always a factor; smoke may degrade air quality; if fire is too hot, it may damage soils; and there is often a narrow window when treatments can be applied.

Impacts of forest management activities on soil are possible because of the involvement of heavy equipment and possible clearing of vegetation, but are expected to be negligible as long as forest best management practices are employed. Service Policy 6 RM 4.1 states that the long-term productivity of the soil will not be jeopardized to meet wildlife objectives. In addition the BIDEH policy (601 FW 3) states "We favor management that restores or mimics natural ecosystem process or functions to achieve refuge purposes. Management actions under all alternatives should result in no impairment of the refuge's BIDEH.

Impacts on Soils in Alternative A

Same as Impacts on Soils that would not vary by alternative.

Impacts on Soils in Alternative B

The 1-foot drawdown of the Felsenthal pool would expose 3,500 acres of substrate to sunlight and oxygen which would accelerate aerobic decomposition. The release of these nutrients would increase the primary productivity of the system.

Impacts on Soils in Alternative C

Same as Impacts on Soils in Alternative B, however, the increased frequency may result in diminished benefit over the long term..

IMPACTS ON HYDROLOGY AND WATER QUALITY

Impacts on Hydrology and Water Quality that would not vary by alternative

Properly managed refuge lands tend to improve water quality within the refuge and downstream as vegetated areas reduce runoff and sedimentation, while also absorbing some nitrogen, phosphorous and other pollutants. Unaltered streams provide beneficial impacts to wildlife and water quality by maintaining natural structure and flow and encouraging establishment of native species. The cumulative effects of prescribed fire, silvicultural activities, use of mechanical equipment, and herbicide use may result in a slight decrease in water quality in localized areas of the refuge. Soil disturbance and siltation due to water management activities, silvicultural activities, and prescribed fire are expected to be minor and short in duration. The refuge will use BMPs, streamside management zones, and pesticide use plans to mitigate adverse impacts that could affect water or soil quality and disturbance. Prescribed burning typically does not affect water quality or hydrology unless it is so intense that it consumes the duff and litter layers and exposes soils near streams (Marshall 2008). Generally, a properly planned prescribed burn will not adversely affect water quality in the Coastal Plain (USDA Forest Service, R8-TP 11, 1989)

Impacts on Hydrology and Water Quality in Alternative A

Same as Impacts on Hydrology and Water Quality that would not vary by alternative

Impacts on Hydrology and Water Quality in Alternative B

Elimination of ATV/UTV trails will create a beneficial impact to water quality and hydrology by reducing soil erosion and subsequent sedimentation.

The use of herbicides to control nuisance and invasive aquatic plants may have negative impacts on water quality. The increase in decaying vegetation may increase the biological oxygen demand. This may be further amplified during a drawdown. These impacts would be short-term and temporary.

The 1-foot drawdown of the pool may increase the biological oxygen demand in many of the backwater sloughs resulting in fish kills.

Impacts on Hydrology and Water Quality in Alternative C

Same as Impacts to Hydrology and Water Quality in Alternative B but with increasing frequency with an annual drawdown.

IMPACTS ON VEGETATION

Impacts on Vegetation that would not vary by alternative

Forest thinnings would be used for partial removals of trees to promote the growth of desired species. The remaining trees would be able to better receive sufficient light, moisture, and nutrients to grow. This activity would have significant beneficial impacts on the growth and productivity of desired tree species and wildlife. Selection system harvesting would allow a timber stand to retain its forested appearance in the years immediately following harvest. Disadvantages of selective cutting could be slower long-term growth, allowing undesirable epicormic branching on future crop trees, and holding back valuable shade intolerant species.

The regeneration of many species of trees would require some canopy removal to allow light to the forest floor to stimulate seed germination. Natural regeneration of desirable tree species would be the preferred method of stand replacement following prescribed management operations of any type. The advantages of relying on natural regeneration would include: lower establishment costs, less labor and heavy equipment required, the origin of the seed is usually known, enhanced early root development, and less soil disturbance. The methods of stimulating natural regeneration would vary widely in the amount of overstory that is removed. Therefore, the impacts on wildlife populations would also be varied. The most commonly used strategies to stimulate and enhance natural regeneration would include seed tree methods, strip or patch clear-cuts, shelterwood cuts, and single tree and group selections. The overall benefits regarding regeneration and stand replacement, species composition diversity, forest health, and long-term sustainability of forest habitats would far outweigh any temporary negative impacts of executing these prescriptions.

Unfortunately, natural regeneration is not always a sure thing, and is subject to many natural and anthropogenic variables. When natural regeneration failed, or did not result in the adequate stocking of desirable species, then planting would be required. Some of the

benefits of artificial regeneration would include control of initial spacing and stocking, less chance of seedbed loss, and less need for precommercial thinnings. The initial expense of planting, however, would be far greater than natural regeneration due to the cost of seedlings and potentially a greater amount of site preparation (Wenger 1984). The regeneration of hardwood species differs significantly from pines and is achieved through several means. For most hardwood species the planting of seedlings for regeneration would neither be necessary nor warranted. Unless control measures are taken, the planting of more shade tolerant species such as oaks in clear-cuts or large openings would not be practical since the seedlings would soon be out competed by fast growing sun-loving species such as red maple, sweet gum, and pines, as well as woody shrubs.

Management of problem or undesirable vegetation would be essential for ensuring optimum growth and survival of desired regeneration, whether natural or planted. By definition, when vegetation conflicts with the land management goals it becomes a weed problem. Forest weeds may be grasses, herbs, shrubs, vines, and trees of any species that interfere with the objectives whether they are wildlife habitat, recreation or other uses. Weed control would increase the survivability, growth, and production of desired species, and therefore increase their wildlife benefits. Many of the more successful weed species are of exotic origin and native species are not adapted to compete. Significant occurrences of weed problems often lead to a weed or weed-dominated community replacing the trees removed. The results are brush fields or stands of undesirable species and substantially decreased value.

The primary benefits of chemical control are that they are generally the least expensive, cause the least amount of soil disturbance, and provide control for the longest period of time. Only approved chemicals that are labeled for these specific uses would be considered. Although many chemicals are registered and labeled site preparation and release, the most effective and widely used chemical to control woody weeds is the isopropyl amine salt of imazypar by the trade name “ARSENAL.” Another commonly used chemical, especially in and around areas of open or standing water is glyphosate. An entirely different suite of chemicals may be applied systemically to individual trees in order to kill selected trees and reduce competition, while at the same time leaving the tree standing to provide additional years of shelter and foraging habitat.

It has been proven that those substances, when used in accordance with their labeling, would have little to no impact on non-target fauna and flora. Extreme care would be taken to prevent drift to non-target areas as well as non-Federal lands. The Refuge would continue to implement IPM strategies to reduce the use of chemicals. We would continue to explore new products as they become available in an effort to find equally effective, biologically safe, and less expensive materials to help enhance regeneration and forest conditions. All applications would be performed in accordance with current labeling and Federal, state, and local regulations.

Prescribed burning is an equally effective tool for hardwood midstory and weed control as it is for TSI. Prescribed burning will be used extensively for seedbed preparation, site preparation for planting, and the control of undesirable vegetation. In the Atlantic Coastal Plain, a series of prescribed burns, such as a winter burn followed by three annual summer bums before a harvest cut, has been more effective than discing for control of competing hardwood vegetation after establishment of natural regeneration (Baker and Langdon 1990). Fire can reduce litter depth so that oak seedlings can become established. Fire can also reduce stocking rates of other species, allowing oak species to increase in basal area. Fire

can induce vigorous sprouting from older root stocks, which may be a preferred reproductive technique (Snyder 1992).

A regime of frequent burning over long periods of time creates an open stand. In hardwoods, long-term burning tends to eliminate small understory stems outright and gradually reduces the reaching the forest floor in these open stands will maintain the vigor of oak regeneration. Increasing the light reaching the forest floor in these open stands will maintain the vigor of oak regeneration. Responses of the understory to prescribed burning will vary with frequency and season of burning. Periodic winter burns keep hardwood understories in check, while a series of annual summer burns usually reduces vigor and increases mortality of hardwood root stocks (Baker and Langdon 1990). Dormant-season prescribed burning is often used in hazard fuel reduction practices, and is frequently used on the mid-Atlantic coastal plain. Studies in southeastern forests (Wade and Lunsford 1988) have shown that growing-season fire can be more effective at reducing forest understory and other woody cover. While dormant-season fires top-kill woody plants, many species resprout vigorously following such fires, using stored energy reserves. In contrast, growing-season fires are more likely to damage root collar tissues (Wade and Lunsford 1989), reducing vegetative resprouting. Growing-season fires kill aboveground woody plant organs after plants have mobilized photosynthate reserves, making such plants less competitive.

Fire has been a regular part of the southern forest landscape. The absence of fire since the turn of the century has allowed species that are intolerant to fire to become established and grow to a size where they, because of thicker bark associated with age, can now resist fire (Carter 2000). Prescribed fire is used in managing upland pines as mature pines are relatively fire resistant. Frequent, intense or growing season prescribed fires are used to reduce hardwoods and maintain a open pine savannah favored by red-cockaded woodpeckers.

Impacts on Vegetation in Alternative A

Same as Impacts that would not vary by Alternative.

Impacts on Vegetation in Alternative B

Managing some areas for hardwood/pine would result in fewer acres under pine management. This alternative would see fewer prescribed fires in hardwood/pine areas. However in the upland pine frequency and growing season burns would increase to maintain the open pine habitat.

Green-tree reservoirs (GTRs), shallow-water impoundments in forested areas that are typically flooded through the late fall and early winter, were originally developed in Arkansas during the early 1930s to mitigate the rapid disappearance of waterfowl habitat. Bottomland hardwood trees within the red oak group (Nuttall's, willow, water, and cherrybark oaks) are preferred in GTRs because the small acorns are heavily used by waterfowl. The green-tree reservoir at Felsenthal NWR, located at the confluence of the Ouachita and Saline Rivers in southern Arkansas, was established in 1985 to partially offset the impacts of the U.S. Army Corps of Engineers' Ouachita-Black Rivers Navigation Project. Since completion of the Felsenthal GTR, study plots located within the flooding impact area have been re-measured at approximate 5-year intervals to study any effects of flooding on forest tree survival, growth, regeneration and species composition. Results to date have shown a continued and

dramatic reduction in stem density and vigor (Allen 1992; Allen et al. 1996; Keeland et al. 2002, Keeland et al 2010). Stem density losses have averaged about 16 trees per acre, or approximately 336,000 trees across the seasonally flooded portion of the refuge. Specifically, small diameter trees (< 13 inches dbh) of Nuttall's Oak and willow oak have suffered very high mortality, especially at lower elevations. Realization of the magnitude of the losses as demonstrated by the Felsenthal GTR study resulted in the Corps of Engineers revising the seasonal flooding criteria for GTR permits within the Lower Mississippi Valley. Recent measurements, conducted during 2011, are still being analyzed yet appear to show a continued if not accelerated decline in tree numbers and vigor.

A proposed 1-foot drawdown every three years would stimulant moist soil vegetation. Annuals are desirable where high seed production for waterfowl is the goal. These plants provide habitat, energy, or nutritive requirements for waterfowl and other wildlife. Howard, et al. (2009) found an increase in emergent and woody vegetation cover within the area of exposed soil was accompanied by an increase in cover of waterfowl food species. A drawdown may help with nuisance and invasive vegetation control. Although a drawdown may have no impact on Lotus, a drawdown may provide opportunities to help control Cuban bulrush. Little information is available on drawdowns and the control of Cuban bulrush.

Impacts on Vegetation in Alternative C

Same as Impacts on Vegetation in Alternative B. Plus an annual drawdown would have the possibility of undesirable vegetation develop throughout the Felsenthal pool. Howard, et al (2009) found an increase in woody vegetation due to the 1995 drawdown of the Felsenthal pool. Swamp privet and water elm are two species that may take advantage of annual drawdowns. Controlling undesirable vegetation may require mechanical methods (disking or herbicides) or continuous flooding. Mechanical methods would increase the cost of this management option.

IMPACTS ON FEDERAL AND STATE ENDANGERED SPECIES

Impacts on Federal and State Endangered Species that would not vary by alternative

RCWs require intensely managed pine habitat maintained by silvicultural treatments, frequent fire, and herbicide. Habitat management in the refuge's upland pine areas will be in compliance with standards established in the RCW Recovery Plan, and, therefore, will ultimately benefit this endangered species. However, certain management activities may have short-term negative impacts to individual birds or colonies of birds. For example, silvicultural operations to regenerate suitable habitat within foraging partitions could have short term and unavoidable impacts by temporarily (25-30 years) creating areas of unsuitable RCW habitat. We will conduct silvicultural activities near active RCW clusters outside of the nesting season to avoid disturbance. Prescribed fire operations can negatively impact foraging and roosting/nesting habitat through direct mortality of cavity trees and forage trees. However, prescribed fire will be conducted according to approved burn plans and burn parameters therein. Also, refuge personnel will clear fuels from the base of cavity trees to ensure their protection from fire.

Felsenthal NWR is within the southern range of the Northern long-eared bat, a proposed endangered species. Northern long-eared bats utilize the refuge for summer habitat when roost trees and foraging are important. Northern long-eared bats roost singly or in colonies underneath bark, in cavities, or in crevices of both live and dead trees. This bat is

opportunistic in selecting roosts, using tree species based on suitability to retain bark or provide cavities or crevices. Silvicultural practices can have short term negative impacts on Northern long-eared bats by cutting trees that might be used by bats and displacing bats. However, any silvicultural treatments that improve forest health and retain suitable roost trees will positively affect this species.

Felsenthal is located on the edge of the northern long eared bat habitat range and management activities will be considered not likely to adversely affect the species as a whole.

Impacts on Federal and State Endangered Species in Alternative A

Under this alternative, the refuge would attempt to manage RCW habitat to support 22 active colonies (CCP objective) and/or 34 active colonies (RCW Recovery Plan objectives). If these objectives were attainable, and this RCW population size could be maintained, it could lead to a greater number of RCWs, protect genetic diversity, and help the refuge mission of serving as a support population for RCW recovery. However, these are extremely challenging objectives given the limited number of acres available within each existing RCW partition and a lack of currently suitable or potentially suitable RCW habitat to support additional colonies. The CCP goal of 22 active colonies is based on an assumption that the refuge can supply 9,000 acres of suitable habitat or 409 acres/cluster and was meant to be an intermediate goal (attainable within 15 years) to facilitate the Recovery Plan goal of 34 active clusters. Felsenthal NWR does contain 9,490 acres of upland pine habitat, however, portions of that habitat type exists in relatively small and isolated patches and translocation of RCWs into these areas will lead to small and isolated groups of RCWs with a low probability of long-term survival. Felsenthal NWR's most contiguous RCW habitat exists in Union county within the southwestern portion of the refuge and contains 12 of the 13 active RCW colonies. This area has limited potential for population growth because of the juxtaposition of the existing active colonies, the small partition size of these active colonies, presence of non-RCW habitat, and the fact that 7 of TNCs active colonies have foraging partitions that extend onto Felsenthal NWR. Refuge staff estimates that the refuge contains 6,200 acres of loblolly-dominated RCW habitat. To sustain GQFH for the recovery standard, about 300 acres per foraging partition is required under a 100-year rotation and ideal age class distribution for loblolly pine habitat. Furthermore, we must account for future regeneration actions within foraging partitions and regeneration within small foraging partitions could necessitate "take" of RCW habitat. For the reasons listed above, future growth of the refuge RCW population is problematic and impractical because it will likely lead to failed translocations, waste of valuable resources, negatively impact existing RCWs and their habitat, and could lead to "take" of habitat.

Wildlife favoring non-pine habitats would be impacted by having fewer acres of hardwoods available. Species favoring a diverse, multi-structured mature forest would receive little benefit. Hard mast productivity would remain low, impacting a wide variety of migratory and native wildlife.

Impacts on Federal and State Endangered Species in Alternative B

Under Alternative B, the refuge would manage for a reduced RCW population size of 13-14 active clusters. Portions of the refuge's 9,490 acres of upland pine habitat is unsuitable for RCW use because it is bisected by large amounts of non-RCW habitat and/or exists in

relatively small and isolated patches and translocation of RCWs into these areas will lead to small and isolated groups of RCWs with a low probability of long-term survival. The refuge contains 6,200 acres of relatively contiguous loblolly-dominated RCW habitat and is currently occupied by 13 active clusters. Potential RCW population growth within this 6,200 acres is minimal because of the juxtaposition of existing colonies, the small partition size of these active colonies, the presence of non-RCW habitat within this area, and the fact that 7 of TNCs active colonies have foraging partitions that extend onto Felsenthal NWR. Managing for 13-14 active clusters will allow existing RCW for approximately 300 acre foraging partitions and will facilitate the refuge's ability to meet the GQFH standard for RCWs in loblolly-dominated habitat. The reduced population goal and GQFH standard could lead to increased RCW breeding group size, reproductive success, survival, dispersal, and long-term persistence. Managing for a reduced population size and larger partition size will facilitate future habitat regeneration efforts and avoid situations where habitat would fall below the managed suitability standard and a "take" situation.

The smaller population size of 13-14 active clusters could be more vulnerable to demographic and environmental effects and to extirpation than an RCW population of 30 or more active clusters. Regeneration of pine forests within present partitions to ensure long-term sustainability of habitat for RCWs could temporarily remove suitable and potential foraging and nesting habitat through loss of trees greater than 10 inches dbh.

Impacts on Federal and State Endangered Species in Alternative C

Under Alternative C, the refuge would manage its 6,200 acres of loblolly-dominated upland pines under an even-aged silvicultural approach and a 100-year rotation to support 13-14 active RCW clusters as described in Alternative B. In addition, approximately 500 acres of loblolly-dominated pine forest along Pine Island Road would be managed with an experimental uneven-aged silvicultural approach. The benefit of uneven-aged silviculture to RCW management is that regeneration occurs throughout the forest in gaps created by single trees or small groups of trees. Therefore, regeneration does not necessarily remove foraging or nesting/roosting habitat. Therefore, RCWs can exist with smaller partitions that allow a larger population size. Currently, a single isolated active RCW cluster exists in the proposed experimental uneven-aged RCW management area. Uneven-aged management on these 500 acres could allow expansion of 3 additional active clusters for a total of 4 active clusters in this area and an overall refuge population goal of 18 active clusters. If this experimental uneven-aged management approach proves to be beneficial, then the approach could be applied to portions of the refuge's 6,200 acres to facilitate additional RCW population growth.

Uneven-aged management has clear benefits for RCW population management. However, the RCW Recovery Plan (page 102) lists several negative aspects of this silvicultural approach including: an increase in the number of harvest entries and subsequent habitat disturbance; application of prescribed fire is impractical in loblolly because of mortality to pine regeneration; and increased hardwood regeneration. The inability to use prescribed fire for hardwood control and promotion of grass/herbaceous understories often requires the increased use of herbicides. Uneven-aged pine management is more costly and requires more intensive management than an even-aged approach. While an aggregation of 10 or more active RCW clusters has a high probability of long-term persistence and any aggregate of less than 10 is not likely to persist. Therefore, management actions to promote 3 active RCW clusters in the 500-acre uneven-aged management area will likely create a small group of isolated RCWs with low probability of long term persistence.

IMPACTS ON BIRDS

Impacts on Birds that would not vary by alternative

The purpose of timber stand improvement, or TSI, is to improve the growing conditions of a given stand of timber for future harvesting. There are a variety of techniques employed to accomplish TSI, and the effects on forest interior species differ depending on the methods.

TSI that encourages or enhances understory development should be beneficial for certain forest interior birds, particularly species which nest and/or forage in the shrub layer. Whitcomb et al. (1981) suggested the hooded warbler may profit from modest forest disturbances (i.e. TSI) that lead to increased density of the shrub layer. Other species which may benefit from this include Louisiana waterthrush, prothonotary warbler, worm-eating warbler, and Kentucky warbler.

Usually, the understory is enhanced when a portion of the canopy is thinned. Provided about 70% of the canopy is retained, there should be minimal negative impacts on many of the forest interior specialists. Collins et al. (1982) found 4 forest interior warblers nesting in stands with canopy closures averaging 66 to 78% in Minnesota. James (1976) reported red-eyed vireo (*Vireo olivaceus*)habitat averaging 78% canopy cover and yellow-throated vireo habitat at 62%. In Illinois, Eddleman et al. (1980) found that the percentage of canopy cover always exceeded 55% in Swainson's warbler habitat and most birds were found at sites with at least 75% coverage. Thus, light thinning of the canopy should be tolerated by a wider variety of forest interior species than would intensive thinning.

TSI practices that result in standing dead trees, or snags, will be beneficial for hairy and pileated woodpeckers, prothonotary warbler, and barred owl. The pileated woodpecker requires dead trees 14 inches (35 cm) dbh and greater for nesting (Conner 1978). Evans and Conner (1979) reported the optimum diameter for pileated woodpecker utilization at 20 inches (50 cm). The optimum size of trees used by hairy woodpeckers is between 10 to 14 inches (25-35 cm) dbh (Evans and Conner 1979). Though these birds prefer live trees, they will utilize snags. Standing dead wood not only provides nesting sites for cavity nesters, but also acts as reservoirs for insects on which many forest interior species feed. Snags protruding above the forest canopy should be removed, as they serve as perches for nest predators and brown-headed cowbirds (Robbins 1979).

Regeneration cuts generally involve removing most or all of the timber from an area. Small, unmerchantable trees and snags may be left standing, or clumps of trees and snags may be left uncut. This logging practice temporarily removes forest habitat, but may be tolerated by many forest interior birds depending on the size and shape of the cut, number and type of trees left uncut, and rotation length. Webb et al. (1977) found that clearcutting caused overall population declines in only 1 of 9 forest interior specialists on their study areas in New York, while 3 species increased in numbers.

Large clearcuts over 25 acres (10 ha) are the most detrimental to forest birds initially, but many be beneficial in the long term to those species requiring mature stands, since the older stand will be larger in size (Hooper 1978). Small or narrow clearcuts of 5 to 25 acres (2-10 ha) in larger woods may be tolerated by birds which accept a partially open canopy (Crawford et al. 1981). These include the yellow-throated vireo (*Vireo flavifrons*), black-and-

white warbler, worm-eating warbler, Kentucky warbler, hooded warbler, northern parula, and scarlet tanager. Bird species associated with more open woods, such as the whip-poor-will, may tolerate even larber clearcuts.

Many warbler species are able to inhabitat a clearcut area earlier if small trees are left uncut (DeGraaf 1982). Conner and Adkisson (1975) found hairy woodpeckers and hooded warblers utilizing a 3 year-old clearcut in Virginia when several hardwood trees 3 inches (7cm) dbh and greater were left at the time of cutting. They also found whip-poor-will, worm-eating warbler, and Kentucky warbler in a 7 year-old clearcut and red-eyed vireo, black-and-white warbler, and scarlet tanager in a 12 year-old clearcut where small trees had been left during cutting.

Leaving uncut buffers along streams and roadsides benefits cavity nesters (Connor et al. 1975, Evans and Conner 1979) and other birds which use those habitats. Examples of such species are prothonotary warbler, Swainson's warbler, Louisiana waterthrush, and northern parula. Leaving dead, dying, and decayed trees standing and a 0.25 acre (0.1 ha) clump of trees permanently uncut in each 5 acres (2 ha) of clearcut will greatly benefit the cavity-nesting birds (Conner et al. 1975, Conner 1978, Evans and Conner 1979).

A regeneration cut does not need to grow to maturity before it is inhabited by forest interior birds. Birds such as the scarlet tanager, Kentucky warbler, and black-and-white warbler, which are most abundant in medium-aged stands, may benefit from regenerating mature forests and allowing them to progress through this stage.

Variable retention harvest is a practice that removes forest canopy through thinning and/or group selection. Fewer trees are removed than in regeneration cuts, but harvesting may take place more often. While regeneration cuts generally produce even-aged stands, free thinning tends to produce uneven-aged stands. Free thinning may open the canopy to varying degrees or improve a closed canopy, with the understory vegetation density varying accordingly. This practice is conducive to many forest interior birds.
Free thinning usually produces some openings in the canopy. Provided the remaining canopy is about 70% closed, there should be few detrimental impacts to those species tolerant of partially open canopies. Some canopy opening should actually benefit species such as yellow-throated vireo, black-and-white warbler, northern parula, and scarlet tanager. Whitcomb et al. (1977) recorded a high population of yellow-throated vireos in a selectively logged tract in Maryland.

As the canopy is opened through selective cutting, increased sunlight reaches the forest floor encouraging understory growth. As with certain TSI practices, this may enhance the habitat for species preferring moderate to dense shrub and understory levels. Whitcomb et al. (1977) found a greater number of territorial male hooded warblers and Kentucky warblers in a selectively logged area 4 and 5 years after cutting compared to an undisturbed forest. Conversely, Adams and Barrett (1976) found fewer breeding pairs of Kentucky warblers in a selectively logged forest then in an undisturbed tract. They attributed this to the presence of more spicebush (Lindera Benzoin) in the undisturbed forest, which Kentucky warblers selected to nest in.

Effective management of forest interior breeding bird populations means effective management of forests in tracts large enough so that different successional stages can occur (Anderson and Robbins 1981). Management for these birds and forests can be compatible provided it fits into a regional strategy to maintain the proper mixture of older and

younger stands. Some approaches to forest management may need modifying to achieve forest conditions needed by interior specialists, but these modifications will not drastically alter current forestry management practices. There is no single management strategy that will benefit all species, and as Lynch and Whigham (1984) pointed out almost any conceivable habitat enhancement strategy will have negative impacts on some species. Crawford et al. (1981) reported closed-canopy obligatory species, such as ovenbird (*Seiurus aurocapillus*) and American redstart, would decline with any intermediate or harvest cutting that opens the canopy.

Not all interior specialists will benefit by encouraging development of a moderate to dense understory. The whip-poor-will, Acadian flycatcher, and ovenbird prefer fairly open understories. Crawford et al. (1981) reported a decrease in black-and-white warbler populations with an increase in the density of shrubs 6 to 15 feet (2-5 m) tall. However, species dependent on a closed canopy, such as Acadian flycatcher, ovenbird, and American redstart, may experience declines with selective cutting that opens the canopy. Red-eyed vireo numbers have also reported to decline in selectively logged forests (Adams and Barret 1976, Whitcomb et al. 1977).

Forest interior birds which require an open understory may be negatively impacted by selective harvesting practices. Adams and Barrett (1976) found fewer Acadian flycatchers in a selectively logged woodland, but observed more ovenbirds. In contrast, Whitcomb et al. (1977) found fewer ovenbirds on their selectively logged study area than on their control site, which is the predicted response.

Prescribed burning would be used throughout all appropriate forest cover types and age classes as a form of TSI. When appropriately applied, prescribed burning would benefit most wildlife species, including the endangered red-cockaded woodpecker Northern bobwhites, and certain migratory bird species, by enhancing habitat and reducing hazardous fuel buildup. Prescribed burning in open pine woodlands would aid in creating and maintaining open understory conditions favored by red-cockaded woodpeckers, and promoting habitat diversity and food availability.

Impacts on Birds in Alternative A

Same as Impacts that would not vary by Alternative

Impacts on Birds in Alternative B

With an increase in frequency of prescribed fire and growing season burns, open pine grassland species would increase in density and frequency of occurrence. The West Gulf Coastal Plain/Ouachita Landbird Plan states 11 species should be given consideration in open pine habitats. Three of these species are Bachmann's sparrow, brown-headed nuthatch, and northern bobwhite which are resources of concern for the refuge.

However, several species would not benefit from open pine management. Those species, hooded warbler, wood thrush, Chuck-will's widow, would be reduced under this alternative with the reduction of the hardwood foliage and stratification. However, with many areas being allowed to convert back to historic conditions (hardwood/pine) the impact should be negligible.

Waterfowl, particularly dabbling ducks, often concentrate on wetlands where natural foods are abundant. Foods that attract waterfowl are produced regularly on exposed mudflats after a controlled drawdown. The total energy provided by moist soil vegetation is as high as or higher than that in row crops. In addition to plant foods diverse populations of invertebrates occur with moist soil management benefiting a wide range of wildlife species. The proposed 1-foot drawdown would have beneficial impacts on waterfowl.

A proposed 1- foot drawdown would have positive effects on wading birds and shorebirds. Wading birds would benefit from the concentrated/trapped food supply in shallow water. Migrant shorebirds begin returning by mid-summer. Exposing mudflats and shallow surface water provide ideal habitat for these birds. Invertebrates provide that much needed energy to complete the migration.

Impacts on Birds in Alternative C

Same as Impacts to Birds in Alternative B

IMPACTS ON MAMMALS

Impacts on Mammals that would not vary by alternative

Disturbance to mammals is an unavoidable consequence of many silvicultural, prescribed fires, and other habitat management activities. However, the known and anticipated levels of disturbance from these activities are minimal. Habitat management activities are limited to concentrated areas of the refuge and relatively short in duration. Escape cover and adjacent suitable habitat is available. Individual mammals may be negatively impacted by habitat management activities that alter their habitat, but, in the long term, mammal populations will thrive from active habitat management that promotes a diversity of habitats, healthy forests, and fully-functioning systems.

Impacts on Mammals in Alternative A

Same as Impacts that would not vary by Alternative

Impacts on Mammals in Alternative B

Same as Impacts that would not vary by Alternative

Impacts on Mammals in Alternative C

Same as Impacts that would not vary by Alternative

IMPACTS ON REPTILES AND AMPHIBIANS

Impacts on Reptiles and Amphibians that would not vary by alternative

Disturbance to reptiles and amphibians is an unavoidable consequence of many silvicultural, prescribed fires, and other habitat management activities. However, the known and anticipated levels of disturbance from these activities are minimal. Habitat management activities are limited to concentrated areas of the refuge and relatively short in duration. Escape cover and adjacent suitable habitat is available. Individual reptiles and amphibians

may be negatively impacted by habitat management activities that alter their habitat, but, in the long term, populations of reptiles and amphibians will thrive from active habitat management that promotes a diversity of habitats, healthy forests, and fully-functioning systems.

Impacts on Reptiles and Amphibians in Alternative A

Same as Impacts on Reptiles and Amphibians that would not vary by alternative.

Impacts on Reptiles and Amphibians in Alternative B

Same as Impacts on Reptiles and Amphibians that would not vary by alternative.

Impacts on Reptiles and Amphibians in Alternative C

Same as Impacts on Reptiles and Amphibians that would not vary by alternative.

IMPACTS ON FISHERIES

Impacts on Fisheries that would not vary by alternative

Same as Impacts on Hydrology and Water Quality that would not vary by alternative

Impacts on Fisheries in Alternative A

Same as Impacts on Hydrology and Water Quality that would not vary by alternative.

Impacts on Fisheries in Alternative B

A proposed 1-foot drawdown every three years will likely have both positive and negative effects on fisheries resources. The surface area of the permanent pool will be reduced, thereby concentrating bluegill and other prey fish to allow increased predation by Largemouth Bass and other predators. Increased predation of smaller fish will result in improved condition of Largemouth Bass and other predators and improved size structure of the Bluegill population. Furthermore, predation rates of undesirable fish may increase. Lastly, the drawdown should consolidate sediments and result in improved fish spawning habitat. Potential negative effects of the drawdown to fisheries resources include: increased predation rates on Crappie species and a decrease in nursery habitat for all fish species. However, the decrease in nursery habitat caused by a periodic 1-foot drawdown as described in Alternative B will have little long-term effect on reproductive success of the fisheries resource.

Impacts on Fisheries in Alternative C

Annual drawdowns of the permanent pool will not be beneficial to the fisheries resource. The positive effects of a periodic 1-foot drawdown do not apply to more frequent drawdowns and increased predation at this frequency could cause considerable harm to the fisheries resource. An annual 1-foot drawdown of the permanent pool could have severe consequences on the reproductive success of many fish species.

IMPACTS ON INVERTEBRATES

Impacts on Invertebrates that would not vary by alternative

Same as Impacts on Hydrology and Water Quality that would not vary by alternative

Impacts on Invertebrates in Alternative A

Same as Impacts on Hydrology and Water Quality that would not vary by alternative

Impacts on Invertebrates in Alternative B

Same as Impacts on Hydrology and Water Quality that would not vary by alternative

Impacts on Invertebrates in Alternative C

Same as Impacts on Hydrology and Water Quality that would not vary by alternative

IMPACTS ON PUBLIC USE AND ACCESS

Impacts on Public Use and Access that would not vary by alternative
Portions of the refuge may be temporarily closed to public access for a variety of reasons due to forest management activities or environmental conditions. Advance notice may be provided in the form of posted signs or public notification; however closures may also be abrupt and unannounced. Management activities which may limit public access include but are not limited to timber harvest, prescribed burning, wildfire management, vegetation management, maintenance or improvement to infrastructure. Environmental conditions which may limit public access can include flooding, storm damage, threat of inclement weather, high fire danger, and pest or disease outbreak. Closure to public access will generally be temporary and short in duration. The primary purposes for closure are to protect life, safety, or limit potential resource damage.

Impacts on Public Use and Access in Alternative A

Same as Impacts on Public Use and Access that would not vary by alternative

Impacts on Public Use and Access in Alternative B

Objective 4 of Alternative B addresses water management and waterfowl sanctuary. An important strategy in support of this objective includes the relocation of the waterfowl sanctuary. Implementing a new and relocated waterfowl sanctuary will eliminate public access in this area during the waterfowl hunting season to benefit migrating and wintering waterfowl. This strategy will create a minor negative impact to some refuge users who historically use this area, particularly fishermen, waterfowl hunters, deer hunters, and small game hunters. However, most of the former waterfowl sanctuary will be taken out of sanctuary status; therefore, a substantial area will be available to hunters and other refuge users during the waterfowl season. The relocated sanctuary may necessitate the seasonal closure of one or two boat ramps and this temporary closure will create a minor negative impact. However, between 6 and 7 other boat ramps will be available to support hunting

and fishing activities near the relocated sanctuary and will mitigate the seasonal closure of one or two boat ramps.

Under Alternative B, we propose to reduce the number of ATV/UTV trails on Felsenthal NWR to improve water quality and reduce wildlife disturbance. We will target ATV/UTV trails that are both short in length and therefore unnecessary, and trails that cause severe erosion and sedimentation. These trails will either be eliminated or converted to walking trails. Eliminating certain ATV/UTV trails on the refuge will reduce the many negative impacts to wildlife and the physical environment that accompany off-road vehicle use. The strategy of reducing the number of ATV/UTV trails on the refuge will create and minor negative impact to some refuge users who enjoy accessing the refuge by ATV or UTV. However, the refuge will not eliminate all ATV/UTV trails and users will be able to access portions of the refuge by ATV or UTV. Furthermore, the refuge is readily accessible through public roads, waterways, and by foot. A GIS analysis of public access to the refuge indicates that 62% of the refuge is located within ½ mile of a public road or navigable waterway and 91% of the refuge is within 1 mile of a public road or navigable waterway (not including ATV/UTV access). Those refuge users who prefer to access the refuge by foot and those who enjoy more solitary areas will benefit from the elimination of a portion of the refuge's ATV/UTV trails and this action will be a positive impact.

Refuge users would experience some impact from the 1-foot drawdown accessing the Felsenthal pool via the boat landings. At some of these sites, boaters could experience increased difficulty in launching boats as well as accessing the river through various channels. Several boat launches may be rendered unusable. The impact should be minor as other facilities exist to provide access and the restricted access will be short-term.
Impacts on Public Use and Access in Alternative C

Under Alternative C, we propose to reduce the number of ATV/UTV trails on Felsenthal NWR to improve water quality and reduce wildlife disturbance. We will target ATV/UTV trails that are both short in length and therefore unnecessary, and trails that cause severe erosion and sedimentation. These trails will either be eliminated or converted to walking trails. Eliminating certain ATV/UTV trails on the refuge will reduce the many negative impacts to wildlife and the physical environment that accompany off-road vehicle use. The strategy of reducing the number of ATV/UTV trails on the refuge will create and minor negative impact to some refuge users who enjoy accessing the refuge by ATV or UTV. However, the refuge will not eliminate all ATV/UTV trails and users will be able to access portions of the refuge by ATV or UTV. Furthermore, the refuge is readily accessible through public roads, waterways, and by foot. A GIS analysis of public access to the refuge indicates that 62% of the refuge is located within ½ mile of a public road or navigable waterway and 91% of the refuge is within 1 mile of a public road or navigable waterway (not including ATV/UTV access). Those refuge users who prefer to access the refuge by foot and those who enjoy more solitary areas will benefit from the elimination of a portion of the refuge's ATV/UTV trails and will be a positive impact.

As stated in Alternative B the drawdown of the Felsenthal pool would have recurring minor short-term impacts.

CUMULATIVE IMPACTS

MANAGING AND PROTECTING HABITAT

All of the alternatives would maintain or improve native biological resources on the refuge, in the State of Arkansas, and in the West Gulf Coastal Plain. The combination of our management actions with those of other conservation partners, organizations, and landowners would result in beneficial cumulative impacts on the biological environment by:

- Improving the protection and management of Federal trust species, State listed endangered species, and migratory birds
- Using structured decision-making and enhancing monitoring to improve wildlife management and conservation actions
- Protecting and improving upland and wetland habitats that are declining at the state and regional levels or threatened by development
- Controlling invasive plants and animals
- Controlling nuisance or destructive animals
- Enhancing and restoring biological integrity, diversity, and environmental health of refuge lands

Certain biological resources that we would manage to control, prevent, or eliminate, such as invasive plants, nutria, and feral hogs, are not natural components of our managed wildland areas. We do not consider the loss of these biotic elements to be an adverse impact. However, not controlling invasive and nuisance species would create adverse cumulative impacts to the biological environment.

Controlling exotic and invasive plants may involve the use of chemical herbicides. The selective use of herbicides will be based upon an integrated pest management strategy that incorporates pest ecology, the size and distribution of the population, site-specific conditions, known efficacy under similar site conditions. Best management practices will reduce potential effects to non-target species, sensitive habitats, and quality of surface and groundwater. Herbicide applications will be targeted to control discreet pest populations in localized areas. Combinations of two or more herbicides at labeled rates would not likely result in additive or synergistic adverse effects to non-target fish, wildlife, plants, or their habitats. The Forest Service (2005) found that mixtures of herbicides commonly used in land (forest) management likely would not cause either additive or synergistic effects to non-target species based upon a review of scientific literature regarding toxicological effects and interactions of agricultural chemicals (ATSDR 2004). Moreover, combined herbicides with different modes of action may be used more effectively, likely requiring less retreatment over the long term. Herbicides applied on the refuge would be short-lived, resulting from environmental and microbial breakdown to less or non-hazardous degradation products.

Although all the alternatives either maintain or increase monitoring and controlling invasive plants and animals, we expect infestations to continue to increase and expand to new areas, especially due to increased cumulative impacts from climate change. In general, native habitat management will have considerable cumulative impacts on the biological environment as we expect to increase population numbers of many more ,migrating and wintering waterfowl, bald eagles, forest interior dwelling bird species, and breeding and migrating early successional landbird and waterbird species. Native plant management cumulatively benefits the biological environment by increasing and enhancing healthy soil biota, restoring and enhancing native plant resources, increasing resident wildlife populations of mammals, fish, reptiles, and amphibians, and enhancing invertebrate production to sustain and perpetuate migratory bird resources.

MANAGING EXOTIC OR NUISANCE SPECIES

The refuge will have a zero tolerance policy for exotic species. Preventing establishment of viable populations of invasive animals on the refuge will preserve existing BIDEH.

Beaver are native aquatic rodents that are a natural component of the refuge ecosystem. However, on occasion individual animals or small family groups will damage valuable refuge infrastructure, burrow into dikes/roads or cause flooding conditions on neighboring private land. Beaver damming and flooding of refuge managed habitats may impact the refuge's ability to achieve an optimal management regime for Federal trust resources, particularly migratory birds. Under these circumstances, the refuge may employ lethal removal of specific individuals to lessen damage. Individual animals will be impacted, but the population as a whole will experience no long-term impacts.

CULTURAL RESOURCES

The activities in each alternative have the potential to impact cultural resources, either by direct disturbance during construction of habitat projects or indirectly by exposing artifacts during actions such as managing forestlands and prescribed burning. For compliance with section 106 of the National Historic Preservation Act, the refuge staff will, during the early planning stages of proposed new actions, provide the regional historic preservation officer with a description and location of all projects, activities, routine maintenance and operations that affect ground and structures, details on requests for compatible uses, and the range of alternatives considered. That office will analyze those undertakings for their potential to affect historic and prehistoric sites, and consult with the State historic preservation officer and other parties as appropriate. We will notify the State and local government officials to identify concerns about the impacts of those undertakings.

We expect none of the alternatives to have significant adverse cumulative impacts on cultural resources on the refuge.

RELATIONSHIP BETWEEN SHORT-TERM USES OF THE HUMAN ENVIRONMENT AND THE ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Under all alternatives, our primary aim is to maintain or enhance the long-term productivity and sustainability of natural resources on the refuge, in the State of Arkansas, and in the West Gulf Coastal Plain ecosystem, along with migratory birds, interjurisdictional fish, and other far-ranging wildlife species, across their whole range. Habitat protection and restoration actions across all alternatives may entail short-term negative impacts to ensure the long-term productivity of the refuge. Many of the cyclic management actions in the alternatives, namely, prescribed burning, controlling invasive plants and animals, proactively managing forests, and restoring native plant communities can have dramatic short-term impacts. These include direct mortality of some plants and animals, displacement of species or cessation of certain types of public use.

However, the long-term benefits of those actions generally offset their short-term impacts. Habitat management practices that mimic ecological and sustainable processes optimize the maintenance and enhancement of the biological diversity, integrity, and environmental health of those habitats for the long term. Long-term productivity is especially enhanced

when the ecological and sustainable management actions that are proposed in the preferred alternative would best support and improve links between nutrient cycling, ecological processes and ecosystem function. In summary, we predict that the alternatives would contribute positively to maintaining and enhancing the long-term productivity of the refuge's natural resources, with sustainable beneficial cumulative and long-term benefits to the environment surrounding the refuge with minimal inconvenience or loss of opportunity for the American public.

UNAVOIDABLE ADVERSE EFFECTS

Unavoidable adverse effects are the effects of those actions that could cause harm to the human environment and cannot be avoided, even with mitigation measures. All the alternatives would result in some minor, localized, unavoidable adverse effects. For example, any burning of prescribed fires or control of invasive species would produce minor, short-term, localized adverse effects. However, none of those effects would rise to a significant level. Furthermore, all of those impacts would be mitigated with best management practices, so none of the alternatives would cause significant, unavoidable cumulative impacts.

Forest habitat is also likely to undergo changes in species composition and structure as we create a more natural forest composition representative of the West Gulf Coastal Plain ecosystem, consisting of mixed hardwood oak/pine and upland pine flatwood systems. We do not expect significant adverse consequences from treating invasive plant species, improving current forest stand conditions, or conducting proactive reforestation projects.

As we noted previously, many of the habitat strategies in the alternatives have a certain level of unavoidable adverse effects. Those effects are mitigated to some degree by the use of practices and precautions that safeguard water quality, avoid sensitive or irreplaceable habitats, or time of the actions or include features to avoid or minimize impacts on fish and wildlife. The adverse effects generally are short-term and more than offset by the long-term gains in habitat quality and fish, wildlife, and plant productivity.

CHAPTER VI. CONSULTATION AND COORDINATION WITH OTHERS

PUBLIC INVOLVEMENT SUMMARY

Effective conservation usually begins with effective community involvement. To ensure that our future management of the Refuge considers the issues, concerns, and opportunities expressed by the public, we will use a variety of public involvement techniques in our planning process. Three public meetings will be held in the local area to outline the draft HMP of the refuge. At its completion, the HMP will be reviewed, evaluated, and subsequently updated approximately every 15 years with the CCP in accordance with the Refuge Improvement Act and Service planning policy (602 FWS 1, 3, and 4), and the HMP policy (620 FW1). However, when significant new information becomes available, ecological conditions change, or when we identify the need to do so, the plan will be reviewed sooner. Plan revisions will require NEPA compliance. If minor plan revisions are required and they meet the criteria of a categorical exclusion, then an environmental action statement, in accordance with (550 FW 3.3C) will only be needed. But if the plan requires a major revision, then the HMP process starts anew.

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APPENDIX B. COMPATIBILITY DETERMINATIONS

Compatibility Determination – Felsenthal National Wildlife Refuge – Commercial Forest Management

USE: Commercial Forest Management Activities

REFUGE NAME: Felsenthal National Wildlife Refuge

DATE ESTABLISHED: 1975

ESTABLISHING AND ACQUISITION AUTHORITY:

- 16 U.S.C. 664 (Fish and Wildlife Coordination Act)
- 16 U.S.C. 460k-1 (Refuge Recreation Act)
- 16 U.S.C. 460k-2 (Refuge Recreation Act (16 U.S.C. 460k-460k-4), as amended)

REFUGE PURPOSE(S):

- "shall be administered by him [Secretary of the Interior] directly or in accordance with cooperative agreements ... and in accordance with such rules and regulations for the conservation, maintenance, and management of wildlife, resources thereof, and its habitat thereon" 16 U.S.C. 664 (Fish and Wildlife Coordination Act).

- *"*he Secretary ... may accept and use ... real ... property. Such acceptance may be accomplished under the terms and conditions of restrictive covenants imposed by donors" 16 U.S.C. 460k-2 (Refuge Recreation Act (16 U.S.C. 460k-460k-4), as amended).

- "suitable for (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species" 16 U.S.C. 460k-1 (Refuge Recreation Act).

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

The mission of the Refuge System, as defined by the National Wildlife Refuge System Improvement Act of 1997, is:

"... to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans."

DESCRIPTION OF USE:

(a) What is the use? Is the use a public use priority?

The use is commercial forest management, to include such actions as commercial thinning, salvage, and other silvicultural practices used to improve forest habitat conditions. The use of commercial operators would constitute an economic use. It is not a priority public use of the National Wildlife Refuge System, under the National Refuge System Administration Act of 1966 {16 U.S.C. 668dd-668ee}, as amended by the National Wildlife Refuge System Improvement Act of 1997.

Forest management allows the refuge to maintain and enhance necessary habitat for priority species by promoting plant communities beneficial to these species, manage forest stands by manipulating stand composition in order to produce high quality habitats for trust resources, and manipulate forest stands to provide diverse plant successional stages ranging from regeneration to mature timber, which will support a variety of wildlife species. This will include promoting hard mast species and by assuring that adequate den and snag trees remain in the stands. These techniques may include harvesting under proper climatic conditions and placing buffer strips where necessary to protect water quality or other natural resources. Various silvicultural treatments will be used to accomplish these forest management objectives. These treatments are discussed in more detail in the 1995 Forest Habitat Management Plan and 2015 Habitat Management Plan (HMP). Silvicultural decisions will be based upon the resources of concern and their habitat requirements as it relates to forest management objectives. Silvicultural decisions should consider the age and vigor of the existing stands and the availability of desirable reproduction. When harvesting timber, the promotion of diverse, vigorous stands of timber will benefit trust species. An important factor to consider when making silvicultural decisions is the ability to promote and advance the desired species necessary to maintain a healthy forest structure, which includes multiple forest age and size classes across the landscape.

The use of commercial loggers in an active forest habitat management program can assist land managers in maintaining appropriate forest structure, age, and/or size class distribution on the landscape. These actions will ensure that adequate habitat is always available for endangered species, forest interior breeding birds and other forest–dependent species.

(b) Where would the use be conducted?

This use could be conducted on approximately 50,000 forested acres of Felsenthal National Wildlife Refuge. Areas that are not currently forested but have the potential to be afforested would also fall under this use at some point in time. Future ownership of forested areas and potentially forested areas will also be included in this use.

(c) When would this use be conducted?

Different aspects of forest management will take place at various times throughout the year. Many tasks take place during the management process including but not limited to inventory, planning, timber marking, harvesting, harvest monitoring and various other tasks involved with timber sale administration. The harvesting portion of this process would be

conducted during dry periods of the year. This period is normally between July 15 and November 15, but could occur during other times of the year during acceptable conditions.

(d) How would this use be conducted?

The 1995 Forest Habitat Management Plan (FHMP) and the 2015 Habitat Management Plan (HMP) detail the specifics of Desired Future Conditions (DFC's) of the forests, to provide enhanced habitat for wildlife by increasing the availability of cover and food. The basic goals of these management plans are to:

- Increase the proportion of forest in a multi-canopied condition.
- Increase the proportion of forest that is species diverse.
- Increase the proportion of forest containing larger diameter class trees.

The 2015 HMP adopts the "desired forest conditions" of the publication from the Forest Resource Conservation Working Group (FRCWG) of the Lower Mississippi Valley Joint Venture (LMVJV). These later DFCs are fully described in "Restoration, Management and Monitoring of Forest Resources in the Mississippi Alluvial Valley: Recommendations for Enhancing Wildlife Habitat," edited by R.Wilson, K. Ribbeck, S. King and D. Twedt. The FRCWG table of DFCs has been collaboratively developed to clearly explain favorable habitat conditions for the priority birds and other forest-dependent wildlife. The goal is to achieve desired conditions on 35 -50 percent of the landscape at any point in time on appropriate sites:

- Overstory canopy cover of 60-70 percent
- Mid-story canopy cover of 25 – 40 percent
- Understory canopy cover of 25 – 40 percent
- Dominant trees >2/ac
- Coarse Woody Debris (CWD) of ≥200 ft^3/ac
- Cavity trees (holes <10") of >4 snag stems/ac ≥4" dbh or ≥2 stems/ac ≥20"
- Den trees (holes > 10") of ≥ 2 trees/ac ≥26" dbh or ≥ 8 ft^2 BA ≥ 26" dbh
- Standing dead and/or stressed trees of >6 stems/ac ≥ 10" or ≥ 2 stems/ac ≥ 20"
- Shade intolerant regeneration with sufficient numbers on 30 – 40 percent of area

Each of these efforts complements the other, as the overall goal is to increase structural and species diversity to provide beneficial wildlife habitat. The definition of multi-canopy forest includes a significant presence of a midstory and/ or understory along with overstory. Larger trees would have more cavities, dens and contribute to large size CWD.

The Red-cockaded Woodpecker (RCW), Federally listed as Endangered, is a priority forest management species. The RCW prefers mature, open canopy pine stands with little midstory and a herbaceous understory. Refuge pine stands located near active RCW clusters are managed using the two-aged system with a 100 year rotation. Two-aged stands are created by modified seed tree and irregular shelterwood regeneration methods. Thinning is important to reduce stand density to the desired range.

The 2015 HMP follows the guidelines detailed in the 2003 Red-cockaded Woodpecker (*Picoides borealis*) Recovery Plan, to provide Good Quality Foraging Habitat (GQFH). The parameters of GQFH listed below will be managed for, within the habitat partitions of each active RCW colony.

- There are 45 or more stems/ha (18 or more stems/ac) of pines that are $\geq$ 60 years in age *and* $\geq$ 35 cm (14 in) dbh. Minimum basal area for these pines is 4.6 m^2/ha (20 ft^2/ac). Recommended minimum rotation ages apply to all land managed as foraging habitat.
- Basal area of pines 25.4 – 35 cm (10 – 14 in) dbh is between 0 and 9.2 m^2/ha (0 and 40 ft^2/ac).
- Basal area of pines < 25.4 cm (< 10 in) dbh is below 2.3 m^2/ha (10 ft^2/ac) *and* below 50 stems/ha (20 stems/ac).
- Basal area of all pines $\geq$ 25.4 cm (10 in) dbh is at least 9.2 m^2/ha (40 ft^2/ac). That is, the minimum basal area for pines in categories (a) and (b) above is 9.2 m^2/ha (40 ft^2/ac).
- Groundcovers of native bunchgrass and/or other native, fire-tolerant, fire-dependent herbs total 40 percent or more of ground and midstory plants and are dense enough to carry growing season fire at least once every 5 years.
- No hardwood midstory exists, or if a hardwood midstory is present it is sparse and less than 2.1 m (7 ft) in height.
- Canopy hardwoods are absent or less than 10 percent of the number of canopy trees in longleaf forests and less than 30 percent of the number of canopy trees in loblolly and shortleaf forests. Xeric and sub-xeric oak inclusions that are naturally existing and likely to have been present prior to fire suppression may be retained but are not counted in the total area dedicated to foraging habitat.
- All of this habitat is within 0.8 km (0.5 mi) of the center of the cluster, and preferably, 50 percent or more is within 0.4 km (0.25 mi) of the cluster center.
- Foraging habitat is not separated by more than 61 m (200 ft) of non-foraging areas. Non-foraging areas include (1) any predominantly hardwood forest, (2) pine stands less than 30 years in age, (3) cleared land such as agricultural lands or recently clearcut areas, (4) paved roadways, (5) utility rights of way, and (6) bodies of water.

(e) Why is this being proposed?

To achieve DFCs, manipulation of the forest is essential. Creating gaps in the overstory and midstory canopies provide sunlight penetration to the forest floor to stimulate the growth of vegetation vital as food and cover for wildlife to meet refuge objectives. Also, crowded trees can be thinned to encourage development of habitat characteristics such as large full crowns for perching, nesting and mast production as well as cavities for den sites. Thinnings and canopy gaps are made by removing selected trees that are surplus to the needs of the habitat. Trees to be removed may be girdled (killed), or cut so that their shade is eliminated. Girdling of trees has relatively high costs, while selling the trunks of the trees has a lower cost. Commercial harvests can also be used to remove significant amounts of

offsite species. In this instance, portions or all of the trees located on a site could be removed in an attempt to restore the site to species that would naturally occur there. There are commercial buyers (mills) and operators (loggers) that would pay market value for portions of the trees removed. The objective of obtaining sunshine via canopy gaps and thinning are accomplished with limited negative consequences. In upland pine forests, thinning can improve overall stand health and help prevent outbreaks of forest pests such as southern pine beetles. In areas where active Red-cockaded Woodpecker (RCW) clusters are located forest management is essential in order to provide and maintain Good Quality Foraging Habitat (GQFH) for this endangered species.

Long-term and short term planning is conducted prior to any manipulation of the forest. The current HMP will be completed in 2015 and approved in 2015. The 2015 HMP includes a great deal of information that is not mentioned in this compatibility determination and should be considered an integral part of this compatibility determination. Possible forest management actions to be conducted on the refuge are mentioned in the 2015 HMP. Forest management prescriptions will be prepared at the refuge and undergo a review and approval process through the Regional Office.

The HMP is a 15 year plan during which all areas of the refuge are examined. Inventories of forest management compartments will be conducted throughout these 15 years by sampling portions of compartments. The removal of trees from these compartments could occur as often as every 15 years but will more likely occur on a 20-40 year cycle. In areas managed for RCWs, forest inventories and harvests will be conducted as often as necessary in order to evaluate and maintain GQFH for active RCW partitions. Removal of wood products by heavy equipment will be limited to dry periods to minimize risk of rutting or other adverse effects on the site. Trees to be removed are most often individually selected and marked by refuge staff. Occasionally trees to be removed are designated by guidelines such as remove all of a certain species (nonnative) or removal of smaller trees that are considered less important or overabundant on that particular site.

Commercial activities are permitted activities and are directed under the guidance of a Special Use Permit, which is issued by the Refuge.

AVAILABILITY OF RESOURCES:

Currently refuge staff plan and implement all forest management activities. The refuge has sufficient staff to accomplish these activities with the use of commercial loggers. Additional expenses for equipment maintenance, operating expenses and habitat restoration are funded out of the refuge's budget which includes expense for sale money received by the refuge. Refuge forest management will be carried out to the extent of available resources.

ANTICIPATED IMPACTS OF THE USE:

Commercial harvesting operations would result in short-term disturbances and long-term benefits for forest habitats. Short-term impacts would include disturbance and displacement typical of any noisy heavy equipment operation. Operation of heavy equipment and removal of some vegetation could also result in a short-term increase in soil erosion. This will be minimized by adhering to the Arkansas Forestry Commissions Best Management Practices (BMPs) guidelines. Additionally, wildlife species utilizing undisturbed forest habitat would be

temporarily displaced. As vegetation is disturbed, other wildlife species may also be temporarily displaced. Efforts should be made to use the existing network of roads and trails as much as possible in the harvesting process. These roads and trails should be used and maintained in a way that minimizes adverse effects to wildlife and the ecology of the area, yet remain efficient for accommodating refuge management and public use. Over time any short term impacts would diminish as the effects of increased sunshine quickly results in enhanced diversity and productivity of the habitat. Since so many wildlife species are dependent upon habitat found in disturbed forests, the overall effect of these disturbances is positive. No more than 10% of the refuge should be treated by mechanical timber harvest in any single year. Forest product harvesting could negatively impact some species of wildlife at given points in time; however, these impacts are considered minor and short-term on a landscape level and would not result in impacts that adversely affect the purpose of the refuge or the mission of the Refuge System.

PUBLIC REVIEW AND COMMENT:

This compatibility determination was made available for public review and comment for a 30-day period from XXXXX–XXXXX, 2015 by 1) posting on refuge bulletin board/kiosk, 2) posting on refuge website and social media networks, 3) public media press release.

DETERMINATION (CHECK ONE BELOW):

____ **USE IS NOT COMPATIBLE**

__**X**__ **USE IS COMPATIBLE WITH FOLLOWING STIPULATIONS**

NEPA Compliance for Refuge Use Decision: Place an X in appropriate space.

__ Categorical Exclusion without Environmental Action Statement

___ Categorical Exclusion and Environmental Action Statement

_**X**_ Environmental Assessment and Finding of No Significant Impact

___ Environmental Impact Statement and Record of Decision

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

All management actions will be in accordance with Service and regional policies and guidelines and with approved forest management prescriptions. Refuge staff will monitor all permitted forest management operations to ensure they are in compliance with Special Use Permit conditions. Any special use activity not in compliance will be immediately stopped. Arkansas's Best Management Practices for Forestry will be used as a guide to protect refuge resources.

1. A pre-entry conference between the Refuge Forester or designee and the successful

bidder representative will be required before beginning logging operations to insure understanding of the permit conditions and thus avoid serious conflicts.

2. Except where specifically authorized by a Special Use permit, all regulations governing activities on Felsenthal National Wildlife Refuge in general and specific public use regulations for Felsenthal NWR (including littering, possession and use of firearms, and protection of wildlife) apply.

3. All logging will be within the boundaries specified (see attached map) and coordinated with the Refuge Forester or his designee.

4. Trees larger than 16 inches in diameter (dbh) shall be cut so as to leave a stump not more than 6" above the root collar. Trees less than 16 inches in diameter (dbh) shall be cut so as to leave a stump not more than 6" in height. Stump heights will be measured on the side adjacent to the highest ground. Trees are painted at eye level and at stump; ground
level paint spot must be visible after tree has been cut. All marked trees must be cut. In the event any marked trees are not cut by permittee, refuge personnel will have the trees cut and will withhold from the permittee's performance guarantee a sufficient amount to cover the cost incurred.

5. Logging will not be permitted when the ground is wet and subject to rutting or severe soil compaction. The permittee and his employees will do all in their power to prevent rutting and erosion. Permittee will be required to fill any ruts made as a result of his operation.

6. Only marked or designated trees shall be cut, unless otherwise agreed on by both parties. Utmost care shall be exercised to protect all other trees and vegetation from damage. Additional trees marked by refuge personnel for roads or loading sites will be paid for at bid price. The penalty for excessive skinning or other damage to residual trees will be assessed at $5 per inch of stump diameter. Additional damages may be assessed and merchandising methods adjusted (i.e. skidding lengths) based on the severity of the damage.

7. No unmarked trees will be cut. Penalties will be assessed for cutting unmarked trees at $5.00 per inch of stump diameter up to 22 inches and $10.00 per inch of stump diameter for 22 inch and larger stumps.

8. Trees will be delimbed and topped at the point of felling, unless special conditions are permitted.

9. No loading sites will be permitted within 300 feet of public roads or near ATV trails open to the public. A refuge forester must approve the location of all loading sites and temporary roads.

10. Trees and tops cut shall not be left hanging or supported by any other living or dead tree or brush. Any tree that becomes lodged when cut shall be immediately rendered un-lodged and felled flush to the ground. All tree tops and other logging debris will be removed from roads, roadside ditches, trails, camping areas,

firebreaks, fields, streams, and drainages immediately after felling.

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

12. 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 on an intermittent stream would not be allowed. These areas will be indicated on sale maps.

13. Vehicles and other equipment will be operated in a safe manner at all times. Both refuge personnel and the visiting public use the refuge roads. The speed limit on refuge roads is 25 miles per hour unless posted otherwise.

14. Upon request, any bidder may be required to submit, a current statement demonstrating his financial ability and the ownership or control of necessary equipment to carry out the operation on the basis herein specified. To properly construct and/or maintain roads will
require the use of a crawler tractor and road grader.

15. Permittee and his employees shall not build fires on the refuge. The permittee and his/her employees will be reasonably prudent in preventing and suppressing forest fires. Permittee shall be liable for all fire suppression cost resulting from his operations.

16. The permittee shall protect all known (identified on the ground) archeological sites against disturbance, destruction, or damage during harvesting operations. If, during the course of the harvest activity, the permittee notices illegal excavation or archaeological resources removal activities, this information shall be immediately provided to the Refuge Manager.

17. Should previously unrecorded cultural resources or human remains be discovered on Service land all activities will be halted immediately and the Refuge Manager contacted at once.

18. If, during the course of the harvest activity, the permittee deliberately damages a recorded site, the permittee will be responsible for the resultant site damage assessment and mitigation.

19. The normal operating season on this sale will be July 1 through November 15. Any operations outside the normal season must be approved in advance by the Refuge Forester. For safety reasons and to minimize conflict, the permittee will cease logging operations during refuge deer gun quota hunts.

20. 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.

21. Loggers are required to implement Arkansas Best Management Practices (BMPs) guidelines. Any state and/or federal licenses required for this activity are the responsibility of the permittee.

22. 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.

23. Clean up of oil, hydraulic fluid and other contaminants as a result of the logging operation is the responsibility of the permittee.

24. Any damage to refuge bridges as a result of trucks loaded above the recommended highway load limit will be considered the responsibility of the contractor to repair.

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

26. 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.

27. 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.

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

29. Failure of the permittee to comply with any of these Special Conditions, with the State or Federal law, or special refuge regulations will be sufficient cause for refusal of future Special Use Permits being granted to the permitted party.

30. Maintenance of all roads on Felsenthal used in the logging operation will be the responsibility of the permittee. These roads must be maintained to preharvest condition or to the standards described under this permit.

JUSTIFICATION:

The use of commercial forest contractors and appropriate silivicultural techniques of forest management, will contribute to the purposes, for which the refuge was established, the mission of the Refuge System, the enhancement of biological integrity, diversity and environmental health and to facilitate the ability of the refuge to meet its habitat and wildlife management objectives.

The use will not pose any significant adverse effects on the refuge natural resources, interfere with the public use of the refuge, or cause an undue administrative burden. The use is regulated through a SUP. Commercial forest management on the refuge will not materially interfere with or detract from the mission of the National Wildlife Refuge System or the purposes for which the refuge was established as evidenced by the environmental assessment that shows this use will improve and advance our ability to achieve the goals and objectives set forth under the CCP. This use would be administered in compliance with 50 CFR 29.1.

REERENCES CITED:

LMVJV Forest Resource Conservation Working Group. 2007. Restoration, Management, and Monitoring of Forest Resources in the Mississippi Alluvial Valley: Recommendations for Enhancing Wildlife Habitat. Edited by R. Wilson, K. Ribbeck, S. King, and D. Twedt.

USFWS. 1995. Forest Management Plan and Environmental Assessment. Felsenthal NWR, Crossett, AR.

USFWS. 2015 Habitat Management Plan, Felsenthal NWR, Crossett, AR.

U.S. Fish and Wildlife Service. 2003. Recovery plan for the red-cockaded woodpecker (*Picoides borealis)*: second revision. U.S. Fish and Wildlife Service, Atlanta, GA. 296 pp.

SIGNATURE: REFUGE MANAGER:_____

(Signature and date)

REVIEW: REGIONAL COMPATIBILITY COORDINATOR:_____

(Signature and date)

REVIEW: REFUGE SUPERVISOR:_____

(Signature and date)

CONCURRENCE: REGIONAL CHIEF:_____

(Signature and date)

MANDATORY 10- OR 15-YEAR REEVALUATION DATE:

_____

Compatibility Determination-Felsenthal National Wildlife Refuge- ATV/UTV use on designated trails on Felsenthal NWR

USE: ATV/UTV use

REFUGE NAME: Felsenthal National Wildlife Refuge (NWR)

DATE ESTABLISHED: 1975

ESTABLISHING AND ACQUISITION AUTHORITY:

- 16 U.S.C. 664 (Fish and Wildlife Coordination Act)
- 16 U.S.C. 460k-1 (Refuge Recreation Act)
- 16 U.S.C. 460k-2 (Refuge Recreation Act (16 U.S.C. 460k-460k-4), as amended)

REFUGE PURPOSES:

- "shall be administered by him [Secretary of the Interior] directly or in accordance with cooperative agreements ... and in accordance with such rules and regulations for the conservation, maintenance, and management of wildlife, resources thereof, and its habitat thereon" 16 U.S.C. 664 (Fish and Wildlife Coordination Act)."

- "the Secretary ... may accept and use ... real ... property. Such acceptance may be accomplished under the terms and conditions of restrictive covenants imposed by donors" 16 U.S.C. 460k-2 (Refuge Recreation Act (16 U.S.C. 460k-460k-4), as amended)."

- "suitable for (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species" 16 U.S.C. 460k-1 (Refuge Recreation Act)."

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

The mission of the Refuge System, as defined by the National Wildlife Refuge System Improvement Act of 1997, is:

"... to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans."

DESCRIPTION OF USE:

(a)What is the use? Is the use a priority public use?

This compatibility determination addresses ATV/UTV use by the public. ATV/UTV use is not a priority public use. However, ATV/UTV use can facilitate public involvement in priority public uses such as hunting and trapping. ATV/UTV use is an existing use on Felsenthal NWR.

(b) Where would the use be conducted?

Currently, there are 24 ATV/UTV trails located throughout the refuge which total 61.8 miles of trails. Seven of these trails are open year-round to provide access for fishing and the remaining 17 trails are open only during the refuge hunting season (September – January). We plan to close 8 of these trails (18.3 miles) and convert them to walk-in trails and/or maintenance trails for staff use. The remaining 16 ATV/UTV trails (39.4 miles) are widely distributed across the refuge and facilitate access to remote areas of the refuge (see attached map).

(c) When would the use be conducted?

Most ATV/UTV trails will only be open during the hunting season (September – January), however, 7 trails will be open year-round to allow access to remote fishing locations. ATV/UTV use will be allowed day and night and ATV/UTV use is expected to occur on a daily basis during the hunting season. The most intense periods of use coincide with the refuge's 5-day muzzle loader deer hunt and the 4-day modern gun deer hunt.

(d) How would the use be conducted?

ATV/UTV use will be restricted to the above-mentioned designated ATV/UTV trails and ATV/UTV use is restricted to wildlife-dependent activities. An exception is in place that allows mobility-impaired hunters to travel up to 100 yards from a road, campground, or ATV/UTV trail to hunt and to retrieve game with a valid mobility-impaired access permit. Designated ATV/UTV trails will be marked with yellow or blue paint. Those refuge users who use an ATV or UTV must comply with engine size, width, and tire size restrictions as defined in the Felsenthal NWR Public Use Brochure. ATV/UTV use by the public is allowed without a Special Use Permit.

(e) Why is this use being proposed?

ATV/UTV use is a common and historic activity on Felsenthal NWR that facilitates public access in support of wildlife-dependent activities. ATVs and UTVs are primarily used to facilitate hunting activities on Felsenthal NWR. In fact, a primary justification for allowing ATV/UTV use on the refuge has been to disburse hunters to balance deer harvest and prevent hunter crowding.

Refuge staff recently completed an evaluation of Felsenthal's trail system and concluded that many of the trails were out of compliance with Executive Order (E.O.) 11644, E.O. 11989 and Refuge Manual 8 RM 7. These policies require that refuge managers close ATV/UTV trails that cause adverse effects on soil, vegetation, wildlife, or wildlife habitat. The scientific literature is replete with descriptions of the adverse effects of ATV/UTV use to the physical environment and to wildlife (Berry et al. 1996; Stokowski and LaPointe 2000; Buckley 2003; Cumulative and Universal: ATV Impacts on the Landscape and Wildlife 2011; Switalski and Jones 2012). In terms of the physical environment, science supports the fact that ATV/UTV use can negatively affect soil and hydrologic function through soil compaction, increased erosion, and stream sediment deposition. These effects can impact water quality, vegetative composition and structure, and wildlife habitat, particularly in wetland habitats (Aust 1994). Negative effects on wildlife by ATV/UTV use include alterations in animal behavior, habitat fragmentation, habitat loss, and direct and indirect mortality. These negative impacts are known to affect fish, mussels, amphibians, reptiles, birds and mammals. The impacts of ATV/UTV use on the physical environment and wildlife are cumulative, universal, and can be achieved by low intensity traffic over short a period of time.

The closure of 18.3 miles of ATV/UTV trails on Felsenthal NWR is required to curtail the negative effects as described above. Most of the trails that are targeted for closure to ATV/UTV use are short in length (ATV/UTV use is unnecessary), or near existing roads or waterways, and with hydric conditions that are prone to rutting and subsequent soil erosion. In fact, by using GIS to buffer existing roads on Felsenthal NWR (not including ATV trails), we find that 62% of the refuge acreage is within 1/2 mile of an existing road and 91% is within 1 mile of existing roads (see attached map). The remaining 39.4 miles of ATV/UTV trials will serve to provide refuge users access to remote areas. The remaining trails will be evaluated further to prevent negative impacts to habitats and wildlife.

AVAILABILITY OF RESOURCES:

Sufficient staff and maintenance funding within our base budget is available to meet annual maintenance requirements. Reducing the number of ATV/UTV trails on the refuge will alleviate much of the current trail maintenance burden. Furthermore, we are proposing to remove the trails that are most difficult to maintain due to hydric soils and flood-prone conditions.

ANTICIPATED IMPACTS OF THE USE:

<u>Known Direct and Indirect Effects</u>
ATV/UTV use on Felsenthal NWR can have positive and negative effects. ATV/UTV use can safely facilitate existing wildlife-dependent priority public uses such as hunting and fishing. In fact one of the purposes of Felsenthal NWR is to recognize the importance of non-consumptive activities, other recreational activities, and wildlife-related public use. However, ATV/UTV use can have negative effects on the physical environment and wildlife populations and this fact conflicts with the NWRS mission and the refuge purpose of conserving wetlands, other habitats, migratory birds and other wildlife.

ATV/UTV use can have negative effects on the physical environment and to wildlife in a variety of ways. All-terrain vehicle use affects soil and hydrologic function primarily through

rutting, soil compaction, soil erosion, removal of the forest litter layer, and increased stream sediment deposition (Meadows et al. 2008; Ouren et al. 2007). Soil compaction and the removal of the forest litter layer can reduce vegetation growth (Webb et al. 1978) and is a primary factor in accelerated erosion rates (Megahan 1990). Changes in plant species composition can occur as a result of invasive species being propagated by ATV trails that act as conduits for human-caused invasion by exotic species (Greenberg et al. 1997; Ouren et al. 2007). In contrast, one of the cornerstones of conservation ecology is the fundamental belief that roadless habitats serve as refuges for native species diversity (Soule´ and Terborgh 1999).

Hydraulic conductivity is a measure of potential water flow through the soil profile and has implications for erosion potential. Declining hydraulic conductivity equates to less infiltration and more runoff. Compaction resulting from ATV travel was proven to reduce hydraulic conductivity 8% at a Montana study site, 59% on a Louisiana study site, and 51% at a Washington study site (Meadows et al. 2008).

Sediment delivery to streams through increased erosion can result from ATV travel (Misak et al. 2002). Increased sediment loading decreases water quality, fish habitat quantity and quality, and fish reproductive success (Newcombe and MacDonald 1991). The increase in runoff and sediment transport can be substantial. Meadows et al. (2008) compared the effects of ATV traffic across seven sites on diverse landscapes including the Wenatchee National Forest in Washington State and Land Between the Lakes in Kentucky and Tennessee. Sediment loads resulting from ATV trails increased by 56% and 625%, respectively, when compared to adjacent undisturbed sites. Ricker et al. (2008) reported increases in suspended stream sediments resulting from ATV trail surface runoff in a paired watershed study in Stafford County, Virginia. Suspended stream sediments increased approximately 94 times downstream of an ATV trail crossing relative to sediment concentrations above the ATV trail crossing.

ATV travel can have a profound effect on all forms of wildlife. Concerns about the effect of off-highway travel on wildlife include: direct mortality (Bury et al. 1977; Bury et al. 2002), habitat fragmentation (Ouren et al. 2007; Robinson et al. 1995) and reductions in habitat patch size (Reed et al. 1996; Forman et al. 2003), increases in the edge: interior habitat ratio (reductions in animal populations at the edge of forest habitats referred to as the “edge effect”), and alteration of animal behavior (Canfield et al. 1999; Cole et al. 1997; Geist 1978; Hershey 2011; Murcia 1995; Naylor et al. 2009; Nicholson et al. 1997; Rowland et al. 2000). Although direct mortality of ungulates resulting from collisions with ATV’s is low, mortality of several species of reptiles have been documented due to off-highway travel (Brooks 1999; Grant 2005).

Sedimentation caused by road runoff or ATV/UTV activity can seriously degrade fish habitat. Burkhead and Jelks (2001) point out that “Excessive sedimentation of rivers and creeks has been linked to increasing levels of imperilment in the diverse fish fauna of the southeastern United States.” They explain that sedimentation leads to increased predation on fish eggs by sediment-dwelling invertebrates, increased vulnerability of adult fish to predators, reduced reproductive success, physiological stresses, gill damage, slower feeding rates and consequent weight loss, impeded ability to detect prey, decreased prey availability, increased parasitism and simplification of community structure.

In 2015 Service employees conducted a survey of freshwater mussel beds in the Felsenthal NWR’s 10.8-mile section of the Saline River and identified 13 mussel beds and 31 species

of mussels (Davidson 2015). Two federally protected species: Winged Mapleleaf (*Quadrula fragosa*) and Pink Mucket (*Lampsilis orbiculata*), were collected within the study area. Among the management implications listed in the final report were recommendations to reduce sediment runoff, improve and/or sustain the quality and quantity of vegetative cover in riparian areas, decrease siltation, and subsequently improve habitat quality for mussels. Posey (1997) documented freshwater mussel beds and species composition within the 33.4-mile portion of the Ouachita River between Felsenthal NWR and the Arkansas-Louisiana line. Posey's findings consisted of 20 major beds and 4 minor beds and 27 freshwater mussel species.

Forest interior songbirds and wading birds appear to be the avian groups most affected by roads and off-road vehicle (ORV) activities. Populations of both are decreasing, and the influences of roads and trails are contributing to these losses (Wilcove 1985; Robbins et al. 1989; Sauer and Droege 1992; Peterjohn et al. 1995). A variety of wetland loss and degradation processes are contributing to the decline of wading birds such as the wood stork, snowy egret, white ibis and little blue heron. These are species for which Felsenthal NWR was established to protect.

Forest-interior bird species have often been the focus of forest fragmentation issues. Within fragmented forest habitats, forest birds are subjected to: increased competition with other species (Kerpez and Smith 1990), increased parasitism from brown-headed cowbirds (Robinson and Wilcove 1994), increased likelihood of predation (Andren and Angelstram 1988; Marzluff and Restani 1999), greater disturbance from human activities (Knight and Gutzwiller 1995), and increased isolation and inhibition of dispersal (Doak et al. 1992; Matthyssen and Currie 1996). Forest interior migratory bird species tend to be vulnerable to predation and parasitism because they often have open cup nest structures, poorly developed defense mechanisms, nest close to the ground and typically only produce a single, relatively small clutch each breeding season (Dobkin 1992; Rich et al. 1994). Reduced nest success due to nest predation and/or brood parasitism can ultimately result in widespread reproductive failure and have subsequent impacts at the population level for numerous bird species. Road and trail corridors are relatively permanent features on the landscape, and can result in forest fragmentation by creating permanent openings in the forest canopy. Because road and trail corridors remain in the same location for many years, they can become learned features used by multiple generations of predatory and/or parasitic species (Askins 1994). Brown-headed cowbirds show a distinct preference for edge habitats due to the combination of breeding and foraging opportunities available along or near edges. Other common nest predators include: Blue Jay, American Crow, Common Grackle, squirrels, raccoon, and rat snakes.

It appears that corridor width can influence bird species composition and associated nest predation and parasitism rates along roadways and trails. Studies that specifically addressed the fragmentation impacts of road corridors on bird species (Rich et al. 1994; Askins 1994) generally reported that narrow (8-10 m, 26-33 ft) road corridors had few notable impacts on nesting bird species, whereas wider corridors, particularly where shoulders were maintained with mowing, had more notable effects associated with nest predation and brood parasitism.

Numerous studies of the relationship between ecosystem integrity and road density have concluded that a road density of one mile per square mile is an ecologically acceptable road

density standard (Forman and Hersperger 1996). Road and trail densities at or below one mile per square mile can help curtail negative effects such as habitat fragmentation, wildlife disturbance, soil loss and hydrological concerns. Currently, Felsenthal NWR supports a combined road and trail density of approximately 1.2 miles per one square mile of terrestrial habitat. The reduction of 18.3 miles of ATV/UTV trails will bring the combined road and trail density to 0.90 miles per square mile of terrestrial habitat. If all ATV/UTV trails were removed from Felsenthal NWR, the road density would be 0.40 miles per square mile of terrestrial habitat.

Future Effects

Like other outdoor pursuits, ORV use has risen dramatically (Hammitt and Cole 1987). In 1960, so few people used ORVs they were not even addressed in a nationwide survey on outdoor recreation (USDA Forest Service 2008). However, ORV use is now recognized as one of the fastest growing outdoor activities in the country (USDA Forest Service 2008). The National Survey on Recreation and the Environment conducted from 2005-2007 estimated that almost 43 million U.S citizens ≥16 years of age participate in ORV recreation. Just under 19 %, or 14.4 million of the South's 77 million people over 16, were ORV participants during the survey period (USDA Forest Service 2008). Therefore, we can expect that the frequency and magnitude of ATV/UTV use will increase. Likewise, the impacts of ATV/UTV use will increase unless properly managed and mitigated.

Cumulative Effects

Many of the impacts of trails and roads go unrecognized because they are cumulative and/or develop slowly over time and cannot be detected by casual observation or the focused short-term studies favored by research-funding programs (Noss 1996; Findlay and Bourdages 2000). Therefore, we can expect that the adverse effects of ATV/UTV use on the physical environment and on wildlife are cumulative.

Mitigation

ATV/UTV use is a popular and historic activity on Felsenthal NWR that facilitates public access in support of wildlife-dependent activities. Meanwhile, this use clearly creates negative impacts to the physical environment and to wildlife. However, the Service can strike a balance between the desire to support wildlife-dependent recreation and the mission to conserve wildlife and their habitats through mitigation measures. An important mitigation measure will be to reduce the overall number and mileage of ATV/UTV trails on the refuge as proposed above. This mitigation measure will bring the refuge just below the recommended one linear mile of road/trail per square mile of habitat threshold. This measure will considerably reduce all potential negative impacts to the physical environment and to wildlife. Finally, ATV/UTV use will be restricted to wildlife dependent activities and recreational riding will not be allowed.

PUBLIC REVIEW AND COMMENT:

This compatibility determination will be made available for public review and comment for a 30-day period by 1) posting on refuge bulletin board/kiosk, 2) posting on refuge website and social media networks, 3) public media press release.

DETERMINATION (CHECK ONE BELOW):

____ **USE IS NOT COMPATIBLE**

_X__ USE IS COMPATIBLE WITH FOLLOWING STIPULATIONS

NEPA Compliance for Refuge Use Decision: Place an X in appropriate space.

___ Categorical Exclusion without Environmental Action Statement

___ Categorical Exclusion and Environmental Action Statement

_X__ Environmental Assessment and Finding of No Significant Impact

___ Environmental Impact Statement and Record of Decision

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

ATV/UTV use on designated trails can facilitate public access in support of wildlife-dependent activities on Felsenthal NWR, primarily hunting and fishing. For ATV/UTV use to be compatible users will:

- Only operate on designated trails.
- Only utilize ATV/UTVs for wildlife-dependent recreational uses.
- Adhere to refuge special regulations in the refuge brochure.
- Individuals with a State-issued mobility-impaired permit may apply for a mobility-impaired access permit to gain special access due to disabilities.
- Closure of 18.3 miles of trail

JUSTIFICATION:

Our analysis demonstrates that 62% of the refuge is located within 1/2 mile of a public road and 91% within 1 mile of refuge public roads. This analysis did not include ATV/UTV trails, hiking trails, or maintenance/logging roads. The removal of 18.3 miles of ATV/UTV trail will restore lost or severely degraded elements of biological integrity, diversity, and environmental health at the refuge. The closure of 18.3 miles of trail will reduce habitat fragmentation, improve water quality, and may reduce the spread of invasive species. This reduction is supported by the Service's BIDEH policy (601 FW 3), Executive Orders 11644 and 11989, and 8 RM 7.

This compatibility determination is a re-evaluation of an existing use (ATV/UTV use) that can facilitate wildlife-dependent recreation, particularly hunting and fishing. After fully considering the impacts of this activity, as described in the anticipated impacts section, it is our judgment that ATV/UTV use with the proposed reductions (see map), as described above, does not materially interfere with or detract from the purposes for which the refuge was established or the mission of the National Wildlife Refuge System. Off-road vehicle access is not recognized as a priority public use of the Refuge System, and future use will be re-evaluated if conditions under which the use is permitted change significantly or if there is significant new information regarding the effects of the use.

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SIGNATURE:

REFUGE MANAGER:_____

(Signature and date)

REVIEW: REGIONAL COMPATIBILITY COORDINATOR:_____

(Signature and date)

REVIEW: REFUGE SUPERVISOR:_____

(Signature and date)

CONCURRENCE: REGIONAL CHIEF:_____

(Signature and date)

MANDATORY 10- OR 15-YEAR REEVALUATION DATE:

_____

APPENDIX C. COMMERICAL FOREST HARVEST CONDITIONS AND PROCEDURES

FELSENTHAL NATIONAL WILDLIFE REFUGE
CROSSETT, ARKANSAS

CONDITIONS APPLICABLE TO TIMBER HARVEST PERMIT: Sale: #

7.0 THE COMMERCIAL SALE OF TIMBER

7.1 Execution of Timber Harvest

7.1.1 Cruising and Marking Timber

Entry of forest management compartments in the uplands will be determined each year according to the habitat needs determined by Red-cockaded Woodpecker (RCW) habitat inventories conducted by refuge staff. The timing of entry will be based directly on habitat needs while considering various other factors such as recruitment cluster locations and translocation opportunities. Entries may encompass portions of multiple management compartments as the entry is driven by RCW colony locations. The portions of bottomland hardwood habitat located in management compartments with upland habitat will be managed along with the upland habitat entry as deemed necessary by the refuge forester. This will ensure not only a viable amount of product in order to conduct a commercial sale but also the most logical use of access with the least amount of habitat disturbance possible. The entry schedule in the bottomlands will be set by refuge staff according to habitat needs based on forestry personnel reconnaissance cruises, keeping in mind last dates of entry and locations of previous treatments spatially on the refuge. Upon entry to a compartment a habitat cruise will be conducted. The cruise may be conducted using fixed plot or point sampling techniques. The following data will be collected during each management compartment cruise:

Upland RCW Habitat:

1. Basal Area of Pines < 10” dbh
2. TPA of Pines < 10” dbh
3. Basal Area of Pines 10” - 14” dbh
4. Basal Area of Pines > 14”
5. TPA of Pines > 14”
6. Basal Area of Hardwoods ≤ 12” dbh
7. Basal Area of Hardwoods ≥ 14” dbh
8. % hardwood canopy
9. % Ground Cover (Herbaceous/Woody)

Upland Mixed Pine Hardwoods and Upland Hardwoods:

1. Timber volumes including basal area for sawtimber and pulpwood
2. Species composition of woody vegetation (6” dbh and above)

3. Tree ages

4. Canopy Conditions
5. Number and sizes of den, cavity, and cull trees per acre
6. Tree and shrub species regeneration
7. Species composition of each canopy layer (overstory, midstory, understory, and ground cover)

Bottomlands:

1. Timber volumes including basal area for sawtimber and pulpwood
2. Species composition of woody vegetation (6” dbh and above)
3. Tree ages
4. Canopy conditions
5. Presence of vines, Spanish moss, and switchcane
6. Herbaceous ground cover
7. Number and sizes 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 compartments will be expressed in 2-inch diameter classes for both sawtimber and pulpwood. Doyle volume tables will be used to determine pine and hardwood volumes for sawtimber products.

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, stocking, age, condition, and basal area.

5. Wildlife habitat parameters including woody plant composition of overstory and understory; number of cavity and den trees; presence of vines; number of dead snags; and presence of woody debris.

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 explaining 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 compartment, 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 compartment prescription designates how much timber volume, canopy cover 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 compartment 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. In certain situations the operator select method of harvest can be utilized in order to meet habitat objectives. An example of a situation where this method could be used would be first thinnings of pine regeneration areas where timber marking would be very labor intensive and would not necessarily produce a better quality result.

Timber marking is very subjective and varies from one timber marker to another. Though the management compartment 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. The refuge forester will be responsible for staying informed as to the details of the local markets surrounding the refuge in order to satisfy these conditions.

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 that are located in upland burn units will be mowed as needed in order to be used as access / escape routes during prescribe burning. Temporary roads not located in burn units 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, a subset of treatment areas will be monitored at 1, 5, 10 and 15 years post-harvest. This monitoring will evaluate vegetative response, and help refuge staff, determine if the desired results of the compartment prescription have been met or if changes need to be made to forest management prescriptions.

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 satellite imagery. 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.

Refuge forest management activities will follow Arkansas Forestry Commission Best Management Practice Guidelines. To ensure the refuge is in compliance with the Forestry Best Management Practices (FBMP) manual regulations 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 generally restricted to the summer and early fall, which are usually the driest times of the year, to reduce soil compaction and erosion potential. However, if dry weather persists and it is agreeable between the refuge forester and the refuge manager logging can be authorized to take place outside of the normal time period. 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. There are 212 cultural resources on record for Felsenthal NWR of which 190 are prehistoric sites, 10 historic sites and 12 are sites with both prehistoric and historic components. All known cultural resources are on record with the Office of the State Archeologist. Details and locations of these sites can be found in the 1985 Historic Preservation Associates Reports kept on file at the refuge office.

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. All new road construction will avoid any known archeological or historic sites identified in the 1985 cultural resource survey.

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 group cuts, patchcuts or loader sets. The patchcuts, 1/2-7 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 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, age, 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 inventory. 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 advice 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 Felsenthal 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 schedule to stop or slow the outbreak.

7.1.9 Threatened and Endangered Species

The refuge potentially has eight species currently listed as threatened or endangered. An Intra-service Section 7 Consultation will be conducted for any timber operation that may negatively affect these species.

7.2 Administration of Sales

7.2.1 Conditions Applicable to Timber Harvesting Permits

31. A pre-entry conference between the Refuge Forester or designee and the successful bidder representative will be required before beginning logging operations to insure understanding of the permit conditions and thus avoid serious conflicts.

32. Except where specifically authorized by a Special Use permit, all regulations governing activities on Felsenthal National Wildlife Refuge in general and specific public use regulations for Felsenthal NWR (including littering, possession and use of firearms, and protection of wildlife) apply.

33. All logging will be within the boundaries specified (see attached map) and coordinated with the Refuge Forester or his designee.

34. Trees larger than 16 inches in diameter (dbh) shall be cut so as to leave a stump not more than 6” above the root collar. Trees less than 16 inches in diameter (dbh) shall be cut so as to leave a stump not more than 6” in height. Stump heights will be measured on the side adjacent to the highest ground. Trees are painted at eye level and at stump; ground
level paint spot must be visible after tree has been cut. All marked trees must be cut. In the event any marked trees are not cut by permittee, refuge personnel will have the trees cut and will withhold from the permittee’s performance guarantee a sufficient amount to cover the cost incurred.

35. Logging will not be permitted when the ground is wet and subject to rutting or severe soil compaction. The permittee and his employees will do all in their power to prevent rutting and erosion. Permittee will be required to fill any ruts made as a result of his operation.

36. Only marked or designated trees shall be cut, unless otherwise agreed on by both parties. Utmost care shall be exercised to protect all other trees and vegetation from

damage. Additional trees marked by refuge personnel for roads or loading sites will be paid for at bid price. The penalty for excessive skinning or other damage to residual trees will be assessed at $5 per inch of stump diameter. Additional damages may be assessed and merchandising methods adjusted (i.e. skidding lengths) based on the severity of the damage.

37. No unmarked trees will be cut. Penalties will be assessed for cutting unmarked trees at $5.00 per inch of stump diameter up to 22 inches and $10.00 per inch of stump diameter for 22 inch and larger stumps.

38. Trees will be delimbed and topped at the point of felling, unless special conditions are permitted.

39. No loading sites will be permitted within 300 feet of public roads or near ATV trails open to the public. A refuge forester must approve the location of all loading sites and temporary roads.

40. Trees and tops cut shall not be left hanging or supported by any other living or dead tree or brush. Any tree that becomes lodged when cut shall be immediately rendered un-lodged and felled flush to the ground. All tree tops and other logging debris will be removed from roads, roadside ditches, trails, camping areas, firebreaks, fields, streams, and drainages immediately after felling.

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

42. 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 on an intermittent stream would not be allowed. These areas will be indicated on sale maps.

43. Vehicles and other equipment will be operated in a safe manner at all times. Both refuge personnel and the visiting public use the refuge roads. The speed limit on refuge roads is 25 miles per hour unless posted otherwise.

44. Upon request, any bidder may be required to submit, a current statement demonstrating his financial ability and the ownership or control of necessary equipment to carry out the operation on the basis herein specified. To properly construct and/or maintain roads will
require the use of a crawler tractor and road grader.

45. Permittee and his employees shall not build fires on the refuge. The permittee and his/her employees will be reasonably prudent in preventing and suppressing forest fires. Permittee shall be liable for all fire suppression cost resulting from his operations.

46. The permittee shall protect all known (identified on the ground) archeological sites against disturbance, destruction, or damage during harvesting operations. If, during the course of the harvest activity, the permittee notices illegal excavation or archaeological resources removal activities, this information shall be immediately provided to the Refuge Manager.

47. Should previously unrecorded cultural resources or human remains be discovered on Service land all activities will be halted immediately and the Refuge Manager contacted at once.

48. If, during the course of the harvest activity, the permittee deliberately damages a recorded site, the permittee will be responsible for the resultant site damage assessment and mitigation.

49. The permittee is required to furnish to Felsenthal NWR, prior to commencement of harvesting activities, (XX) cases of BLUE, tree marking paint in one gallon containers. Cost of these items should be reflected in the timber sale bid quote.

50. The permittee is required to furnish XXX tons of rock / fill materials delivered on site as needed or prior to the expiration of the sale if needed. Cost of these items should be reflected in the timber sale bid quote. This material will be used exclusively to improve the access routes that function as timber haul routes/ATV trails. Receipts for this material will be provided to the refuge Forester.

51. The normal operating season on this sale will be July 1 through November 15. Any operations outside the normal season must be approved in advance by the Refuge Forester. For safety reasons and to minimize conflict, the permittee **will cease** logging operations during refuge deer gun quota hunts.

52. 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.

53. Loggers are required to implement Arkansas Best Management Practices (BMPs) guidelines. Any state and/or federal licenses required for this activity are the responsibility of the permittee.

54. 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.

55. Clean up of oil, hydraulic fluid and other contaminants as a result of the logging operation is the responsibility of the permittee.

56. 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.

57. 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.

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

59. Failure of the permittee to comply with any of these Special Conditions, with the State or Federal law, or special refuge regulations will be sufficient cause for refusal of future Special Use Permits being granted to the permitted party.

60. Any damage to refuge bridges as a result of trucks loaded above the recommended highway load limit will be considered the responsibility of the contractor to repair.

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

62. Maintenance of all roads on Felsenthal used in the logging operation will be the responsibility of the permittee. These roads must be maintained to preharvest condition or to the standards described under this permit.

General constraints and specifications for haul route improvement are as follows:

- Use the old travel way as much as possible to minimize stump and rootwad removal and refilling.

- Maintain a maximum 20-foot wide road bed.

- If necessary place "B" stone in drainages to facilitate crossing but at a level that will not impede water flow.

- If necessary place pit-run gravel as needed to firm up the road bed and in conjunction with culvert placement.

- If necessary, disc and grade to fill in ruts after completion of the sale or by November 15 of each year – whichever comes first.

- V-ditch and crown haul roads (no blading out of haul roads). Also, utilize lead-off ditches for drainage where appropriate.

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, special use permits, management unit timber volume tables, order of entry plan, non-commercial treatments and wildlife information gathered by management unit.

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 inventory tally sheets, volume estimates, maps, bid invitation, Special Use Permits, payment records, correspondence with permittee, sale compliance inspection notes, copies of deposit checks, etc. In the case of consumer scale sales (pay as cut) sales, records of exact tons of each product removed from the sale area will be included in the sale folder.

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 Felsenthal NWR CCP, Felsenthal 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 high 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 information.
2. Estimated volumes for lump sum sales or stock and stand tables for consumer scale sales (pay as cut) sales.
3. A bid form, which the bidder fills out, signs, and returns to the refuge.
4. Maps giving general sales location information and detailing all sales units.
5. General conditions applicable to harvest of forest products.
6. Special conditions applicable to the timber sale.
7. Certificate of Independent Price Determination.
8. Equal Employment Opportunity Clause (Form 3-176).
9. 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 $20,000 in the form of a cashier's check 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

In the case of lump sum sales the successful bidder (hereafter referred to as the permittee) will have ten (10) days after receipt of the harvesting permit to make total payment or in the event of a consumer scale sale, (pay as cut) the performance guarantee will be considered as prepayment for the first operating period and after each subsequent operating period, payment will be made to the government in the amount indicated by actual scale tickets for that period. In no case will harvesting operations begin prior to payment. The purpose of an advance payment is to encourage the permittee to begin harvesting operations as quickly as possible and is department policy. Performance bond and lump sum payments will be made in the form of cashier's check payable to U.S. Fish and Wildlife Service. Weekly payments for pay as cut sales will be in the form of a cashiers/company check payable to U.S. Fish and Wildlife Service.

In some cases, such as salvage sales, where speed is essential and volumes are difficult to determine, timber products may be sold by mill scale. That is, the products will be sold according to the volume of products delivered to a mill, as scaled by that mill. In mill scale sales, payment will be made according to the units scaled at a negotiated price per unit. Payments will be made on a time schedule specified on the Special Use Permit. All payments will be accompanied by mill scale tickets or other documentation confirming the volume of forest products removed from the refuge.

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 U.S.C. 668dd-ee)

   In administering the National Wildlife Refuge System, the Secretary is authorized to take the following actions:……..(3) Acquire lands or interests therein by exchange (a) for acquired lands or public lands, or for interests in acquired or public lands, under her jurisdiction which she finds to be suitable for disposition, or (b) **for the right to remove, in accordance with such terms and conditions as he may prescribe, products so exchanged either shall be approximately equal, or if they are not approximately equal the values shall be equalized by the payment of cash to the grantor or to the Secretary as the circumstances require.**

2. Lands acquired must be located within the approved refuge acquisition boundary. No preliminary proposal or any other studies are required. The merits of the acquisition are a judgment call by the refuge manager.

3. Forest Management plans must be followed, and no deviation from planned schedules should be considered. No additional timber harvest will be considered for the sole purpose of acquiring land. It is critical that all normal prerequisites for implementing a timber sale on a refuge be adhered to (approved Habitat Management Plan, adherence to order of entry schedule contained in this plan, approved treatment prescription, implementation of normal timber sale permit special conditions).

4. In exchange for refuge timber or other refuge products, another party or intermediary working on the Service's behalf, must acquire the land identified for acquisition by the refuge. The Service can work directly with the landowner to exchange refuge timber for lands. Negotiations with the landowner will be undertaken by Realty.

5. The Service receives compensation for the timber when the partner conveys the subject property to the United States. The government's interest in the timber **must** be secured by either transfer of the title to the land or by other means such as an irrevocable letter of credit for the entire timber sale amount from a financial institution prior to timber removal.

6. The value of the property to be acquired, and the timber exchanged should be of approximately equal value. Any significant difference will be reconciled, either by adjusting the amount of timber cut (reducing sale area or using other planned sales – would not result in any increase in harvest just to buy the land), removal of other refuge products, or by a payment to the Service for the difference.

7. Realty will be responsible for the 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 normally be paid from Realty funds.

8. A formal agreement will be developed between the government and any partner involved in a timber for land exchange that provides all details and specifies both the timber value and the land acreage/value. This agreement must be reviewed by the Regional Solicitor and should be referenced in a Special Use Permit issued for forest product removal. The Regional Chief of Realty signs this agreement after it has been signed by the partner.

9. The Regional Chief of Refuges will sign all Special Use Permits for forest project removal involved in timber-for-land agreements. If exchange involved, should be approved by Regional Chief of Refuges.

10. Refuge staff should plan on a minimum of six month timeline for the completion of this process.

11. Appraisals in accordance with the Office of Valuation Services (OVS) standards for the identified tracts of land should be completed prior to implementing agreements. Realty will be provided with a list of tracts needing appraisals by September when these tracts will be potentially involved in a timber for land exchange the following year.

METHODS

Certain parameters need to be set in order to establish guidance with respect to timber for land exchanges. A few of the utilized methods are summarized below. In all cases, a formal
Agreement will be developed between the government and any party involved in a timber for land exchange.

1) Method (A) – timber for land exchange is based upon appraised value of land and timber. Land is acquired or already owned by the timber company. A lump sum method of sale (sawlog timber sales with each tree marked for cutting tallied for volume) is used. Land(s) to be acquired by the timber company must be appraised by the Service through OVS. The Service must disclose the approved appraised value to the landowner when the Service completes the appraisal. Terms of the Special Use Permit for the sale of the timber are determined by direct negotiations using appraised value of land versus timber. The Special Use Permit for removal refuge forest product becomes a “timber deed” for a specified value of forest products. Timber value is established by refuge staff and documentation of value determination retained in sales folders. Standard refuge sales administration processes are required and must be adhered to.

2) Method (B) – The Service can identify the property and have it appraised. A Purchase agreement is obtained by the Service and then the timber sale is made to the high bidder who is required to purchase the property as a condition of sale. Purchase agreement can/will be assigned to timber sale contractor.

(A) The information concerning a proposed land transaction as part of the sale must be specified in both the timber sale bid invitation and the Special Use Permit. The specific tract is not identified until after the bid opening in order to eliminate possible conflicts.

(B) Value of timber is determined by the following methods:

(1) Lump Sum by Competitive Bidding Process

(2) Consumer Scale (pay as you cut) with value established by:

(a) Bid price per of wood (i.e., $/ton of scaled wood)

(b) Value determination by the Service (i.e., performed by Administrative Forester and staff)

(c) Direct negotiation utilizing timber appraisal to establish range of value for refuge timber. Refuge would normally set a minimum price based upon fair market value prior to entering negotiations.

3) Method (C) – The Service can utilize a third party partner (i.e., real estate company, consultant forester, non-profits such as TNC, TCF, etc.) as an intermediary.

(A) Third party buys property – Service or third party can do the appraisal through OVS.

(B) Timber is exchanged directly to third party – Timber values are determined by the Service (either by station forestry staff or competitive bids).

(C) Third party that owns/buys land can/will assign contract for harvest (via Special Use Permit) of Government timber to a timber company utilizing all conditions for harvest normally used by that station. Refuge staff normally oversees harvest operations. Refuge must secure government's interest in the timber either by irrevocable letter of credit from a bank or other form of security equal to the value of the timber. Service determines value of timber.

4) The Service can deal directly with existing landowner.

(A) Landowner owns land within approved acquisition boundary. Service initiates an appraisal of the property. The Service enters into an Agreement for the Exchange of Timber for Land with the landowner. Usual special conditions that regulate harvest activities on the refuge are imposed as part of the agreement.
(B) The landowner exchanges a Warranty Deed to the Service for equal value of timber. Value/Volume of timber to be harvested is either:
(1) Lump Sum
(2) Consumer Scale (pay as you cut)
(C) Logging can be performed by landowner or his assignee (i.e., logging contractor or timber company.

1. A pre-entry conference between the Refuge Forester (or designee) and the successful bidder representative will be required before beginning logging operations to insure understanding of the permit conditions and thus avoid serious conflicts.

2. Except where specifically authorized by a Special Use permit, all regulations governing activities on Felsenthal National Wildlife Refuge in general and specific public use regulations for Felsenthal NWR (including littering, possession and use of firearms, and protection of wildlife) apply.

3. All logging will be within the boundaries specified (see attached map) and coordinated with the Refuge Forester or his designee.

4. Trees larger than 16 inches in diameter (dbh) shall be cut so as to leave a stump not more than 6" above the root collar. Trees less than 16 inches in diameter (dbh) shall be cut so as to leave a stump not more than 6" in height. Stump heights will be measured on the side adjacent to the highest ground. Trees are painted at eye level and at stump; ground
level paint spot must be visible after tree has been cut. All marked trees must be cut. In the event any marked trees are not cut by permittee, refuge personnel will have the trees cut and will withhold from the permittee's performance guarantee a sufficient amount to cover the cost incurred.

5. Logging will not be permitted when the ground is wet and subject to rutting or severe soil compaction. The permittee and his employees will do all in their power to prevent rutting and erosion. Permittee will be required to fill any ruts made as a result of his operation.

6. Only marked or designated trees shall be cut, unless otherwise agreed on by both parties. Utmost care shall be exercised to protect all other trees and vegetation from damage. Additional trees marked by refuge personnel for roads or loading sites will be paid for at bid price. The penalty for excessive skinning or other damage to residual trees will be assessed at $5 per inch of stump diameter. Additional damages may be assessed and merchandising methods adjusted (i.e. skidding lengths) based on the severity of the damage.

7. No unmarked trees will be cut. Penalties will be assessed for cutting unmarked trees at $5.00 per inch of stump diameter up to 22 inches and $10.00 per inch of stump diameter for 22 inch and larger stumps.

8. Trees will be delimbed and topped at the point of felling, unless special conditions are permitted.

9. No loading sites will be permitted within 300 feet of public roads or near ATV trails open to the public. A refuge forester must approve the location of all loading sites and temporary roads.

10. Trees and tops cut shall not be left hanging or supported by any other living or dead tree or brush. Any tree that becomes lodged when cut shall be immediately rendered unlodged and felled flush to the ground. All tree tops and other logging

debris will be removed from roads, roadside ditches, trails, camping areas, firebreaks, fields, streams, and drainages immediately after felling.

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

12. 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 on an intermittent stream would not be allowed. These areas will be indicated on sale maps.

13. Vehicles and other equipment will be operated in a safe manner at all times. Both refuge personnel and the visiting public use the refuge roads. The speed limit on refuge roads is 25 miles per hour unless posted otherwise.

14. Upon request, any bidder may be required to submit, a current statement demonstrating his financial ability and the ownership or control of necessary equipment to carry out the operation on the basis herein specified. To properly construct and/or maintain roads will require the use of a crawler tractor and road grader.

15. Permittee and his employees shall not build fires on the refuge. The permittee and his/her employees will be reasonably prudent in preventing and suppressing forest fires. Permittee shall be liable for all fire suppression cost resulting from his operations.

16. The permittee shall protect all known (identified on the ground) archeological sites against disturbance, destruction, or damage during harvesting operations. If, during the course of the harvest activity, the permittee notices illegal excavation or archaeological resources removal activities, this information shall be immediately provided to the Refuge Manager.

17. Should previously unrecorded cultural resources or human remains be discovered on Service land all activities will be halted immediately and the Refuge Manager contacted at once.

18. If, during the course of the harvest activity, the permittee deliberately damages a recorded site, the permittee will be responsible for the resultant site damage assessment and mitigation.

19. The permittee is required to furnish to Felsenthal NWR, prior to commencement of harvesting activities, (XX) cases of BLUE, tree marking paint in one gallon containers. Cost of these items should be reflected in the timber sale bid quote.

20. The permittee is required to furnish XXX tons of rock / fill materials delivered on site as needed or prior to the expiration of the sale. Cost of these items should be reflected in the timber sale bid quote. This material will be used exclusively to improve the access routes that function as timber haul routes/ATV trails. Receipts for this material will be provided to the refuge Forester.

21. The normal operating season on this sale will be July 1 through November 15. Any

operations outside the normal season must be approved in advance by the Refuge Forester. For safety reasons and to minimize conflict, the permittee **will cease** logging operations during refuge deer gun quota hunts.

22. 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.

23. Loggers are required to implement Arkansas Best Management Practices (BMPs) guidelines. All license required for this activity, both state and federal are the responsibility of the permittee.

24. 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.

25. Clean up of oil, hydraulic fluid and other contaminants as a result of the logging operation is the responsibility of the permittee.

26. 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.

27. 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.

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

29. Failure of the permittee to comply with any of these Special Conditions, with the State or Federal law, or special refuge regulations will be sufficient cause for refusal of future Special Use Permits being granted to the permitted party.

30. Any damage to refuge bridges as a result of trucks loaded above the recommended highway load limit will be considered the responsibility of the contractor to repair.

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

32. Maintenance of all roads on Felsenthal used in the logging operation will be the responsibility of the permittee. These roads must be maintained to preharvest condition or to the standards described under this permit.

General constraints and specifications for haul route improvement are as follows:

- Use the old travel way as much as possible to minimize stump and rootwad removal and refilling.

- Maintain a maximum 20-foot wide road bed.

- If necessary place “B” stone in drainages to facilitate crossing but at a level that will not impede water flow.

  If necessary place pit-run gravel as needed to firm up the road bed and in conjunction with culvert placement.

- If necessary, disc and grade to fill in ruts after completion of the sale or by November 15 of each year – whichever comes first.

- V-ditch and crown haul roads (no blading out of haul roads). Also, utilize lead-off ditches for drainage where appropriate.

7.4 Exhibit 2: Bid Form

BID FORM

Felsenthal 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 $xx,xxx 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

NATIONAL WILDLIFE REFUGE TIMBER SALE

FORMAL BID INVITATION

Sale Number XXXXX Compartment XX Product Multiple

Formal sealed bids will be received in the office of the Refuge Manager of the Felsenthal National Wildlife Refuge (NWR), P.O. Box 1157 Crossett, AR 71635, until **1:00 p.m., July X, 20XX**. Formal sealed bids will be opened at this time. This bid includes the sale of pine sawtimber, pine pulpwood , hardwood pulpwood, and a small amount of hardwood sawtimber. These products are contained in areas of trees marked in blue to harvest and trees marked in orange to be retained (see attached map) in Compartment XX of Felsenthal NWR, located in XXX County, AR. The boundaries to the sale unit are XXXXX.

This sale is a consumer scale sale or "pay as you cut" sale. Payment will be based on certified weight scale tickets with a copy provided to this office with payment. All bids will be by the ton on each individual product class: pine sawtimber, pine pulpwood, hardwood sawtimber and hardwood pulpwood. The successful bidder will be determined by the highest total value of the sale based on the sum of the value of the four product classes. (Determined by the Fish and Wildlife Services estimated tonnage per product class, times the bid price.) The bidder is responsible for determining volumes from which to base his/her bid.

All bids must be securely sealed in a suitable envelope and plainly marked "Timber Bid, X-XX-XX" on the outside of the envelope.

The sale area is located on approximately XXX acres and consists of 2 harvest strategies. The sale unit consists of upland pine and hardwood stems marked at eye level and at the stump with blue paint. **All merchantable trees marked with blue paint are to be cut and removed. All pre-merchantable stems marked with blue paint are to be cut and left at the point of felling.** This unit contains 2 regeneration areas, each one being approximately 20 acres in size. The boundaries to the regeneration areas are marked with yellow paint facing inside the area. **The trees inside the regeneration areas marked with orange paint are to be retained**. All unmarked trees inside the yellow boundary are to be cut and removed. All stems that are designated to be cut that are below merchantable size, should be cut and left at the point of felling. Stems marked with orange or yellow paint are not to be cut.

A show me trip will be available upon request. Please contact the refuge forester at 870-XXX-XXXX to schedule a trip. The sale location is shown on the attached map. Additional information may be obtained at the Refuge Office. With this bid invitation "in hand", an ATV can be used to examine the sale area until July XX, 20XX after notification of Felsenthal NWR office (870-364-3167). **Questions concerning this sale should be directed to the refuge forester at 870-XXX-XXXX (cell).**
Operations must be completed in the most expeditious time possible. The sale will expire on December 31, 20XX. (At the discretion of the Refuge Manager, an extension may be granted for extended wet weather or other uncontrollable circumstances.)

Each bidder will submit with his bid, a bid guarantee in the amount of <u>$500.00</u> payable to the U.S. FISH AND WILDLIFE SERVICE IN THE FORM OF A CERTIFIED CHECK. The deposits of the unsuccessful bidders will be returned after a determination has been made regarding the bidder who will be awarded the permit.

The bid guarantee of the successful bidder will be retained by the Government and applied to the PERFORMANCE GUARANTEE which will be **$XX,000.00** to cover any damages or claims the Government may have against the permittee as a result of this operation under the terms and conditions of the permit-agreement and to serve as a perpetual advanced payment for timber.

Payment of the performance guarantee will be in the form of a CERTIFIED CHECK due within ten (10) days of purchaser's receipt of the timber sale permit. Upon satisfactory completion of the timber operation, the performance guarantee will be returned.

Timber will be paid for every week by CERTIFIED CHECK. The value of the timber will be based on actual scale tickets provided with the payments. Weather and logging conditions permitting, START HARVEST OPERATIONS WITHIN THIRTY (30) DAYS of the bid opening.

A copy of applicable special harvesting conditions and map is attached to this bid invitation.

A sample copy of the permit agreement is available from the refuge manager at the Felsenthal NWR office located at 5531 Hwy. 82 West, Crossett, AR 71635.

The right to reject any or all bids hereunder is reserved.

Item 1: Pine Sawtimber $_____per ton
Item 2: Pine Pulpwood $_____per ton
Item 3: Hardwood Sawtimber $_____per ton
Item 4: Hardwood Pulpwood $_____per ton

_____ _____
Submitted by (Company or Organization) Name of Bidder

_____ _____
Address Signature

_____ _____
City, State, Zip Date

_____ _____
Accepted by: Administrative Forester, South Arkansas Refuges Complex Date

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.

APPENDIX D. INTRA-SERVICE SECTION 7 CONSULTATION

REGION 4 INTRA-SERVICE SECTION 7 BIOLOGICAL EVALUATION FORM

Originating Person: Alan Whited
Telephone Number: (870) 364-3167 E-Mail: William_Whited@fws.gov
Date: 08/31/15

PROJECT NAME (Grant Title/Number): Felsenthal NWR-Habitat Management Plan

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

II. State/Agency: Arkansas/U.S. Fish and Wildlife Service

III. Station Name: Felsenthal National Wildlife Refuge

IV. Description of Proposed Action (attach additional pages as needed):

Implement management actions identified in the Felsenthal NWR Habitat Management Plan (HMP).

V. Pertinent Species and Habitat:

A. Include species/habitat occurrence map:

Complete the following table:

SPECIES/CRITICAL HABITAT	STATUS[1]
Red-cockaded Woodpecker *Picoides borealis*	E
Pondberry *Lindera mellisifolia*	E
Pink Mucket (pearly mussel) *Lampsilis abrupta*	E
Winged Mapleleaf Mussel *Quadrula fragosa*	E

SPECIES/CRITICAL HABITAT	STATUS[1]
Rabbitsfoot Mussel *Quadrula cylindrical cylindrical*	T
Northern Long-Eared Bat *Myotis septentrionalis*	T

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

VI. Location (attach map):

A. Ecoregion Number and Name: Number 29, Lower Mississippi River

B. County and State: Ashley, Bradley and Union Counties, Arkansas

C. Section, township, and range (or latitude and longitude):
N 33.14808 / W 092.05760

Distance (miles) and direction to nearest town:
Felsenthal NWR is located in southeast Arkansas, and approximately 8-miles west of Crossett, Arkansas.

E. Species/habitat occurrence:

Red-cockaded Woodpecker (RCW) (*Picoides borealis*): 13 known colonies are known to occur on the refuge and occur in suitable habitat across the refuge. RCWs prefer the open, park-like timber stands where it drills nesting cavities in mature pine trees.

Pondberry (*Lindera mellisifolia*): Recent surveys failed to find pondberry within Felsenthal NWR, however, the plant does occur within Arkansas Natural Heritage Commission's Coffee Prairie Natural Area. Coffee Prairie is just south of the Felsenthal NWR boundary and is within the refuge's acquisition boundary.

Pink Mucket (pearly mussel) (*Lampsilis abrupta*): Known to occur on the refuge in the Saline River.

Winged Mapleleaf Mussel (*Quadrula fragosa*): Known to occur on the refuge in the Saline River.

Rabbitsfoot Mussel (*Quadrula cylindrical cylindrical*): Known to occur on the refuge in the Saline River.

Northern Long-Eared Bat (*Myotis septentrionalis*): Suitable summer habitat (e.g. trees with a DBH of > 4" with exfoliating bark, hollow, etc.) for the northern long-eared bat does occur on the refuge; however, this bat species is not known to occur in any of the counties within Felsenthal NWR (USFW Arkansas Ecological Services-Revised Endangered Species Inventory 6/12/15).

VII. Determination of Effects:

A. Explanation of effects of the action on species and critical habitats in item V. B (attach additional pages as needed):

SPECIES/ CRITICAL HABITAT	IMPACTS TO SPECIES/CRITICAL HABITAT
Red-cockaded Woodpecker *Picoides borealis*	No impacts expected. No critical habitat designated.
Pondberry *Lindera mellisifolia*	No impacts expected. No critical habitat designated.
Pink Mucket (pearly mussel) *Lampsilis abrupta*	No impacts expected. No critical habitat designated.
Winged Mapleleaf Mussel *Quadrula fragosa*	No impacts expected. No critical habitat designated.
Rabbitsfoot Mussel *Quadrula cylindrical cylindrical*	No impacts expected. No critical habitat designated.
Northern Long-Eared Bat *Myotis septentrionalis*	No impacts expected. No critical habitat designated.

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

SPECIES/ CRITICAL HABITAT	ACTIONS TO MITIGATE/MINIMIZE IMPACTS
Red-cockaded Woodpecker *Picoides borealis*	Manage known colonies as described in the RCW Recovery Plan and the Felsenthal HMP; continually monitor for new colonies.
Pondberry *Lindera mellisifolia*	Conduct periodic surveys in suitable habitat; document and notify refuge staff and partnering agencies and NGO's; and avoid if found to occur.

SPECIES/ CRITICAL HABITAT	ACTIONS TO MITIGATE/MINIMIZE IMPACTS
Pink Mucket (pearly mussel) *Lampsilis abrupta*	No mitigation actions required.
Winged Mapleleaf Mussel *Quadrula fragosa*	No mitigation actions required.
Rabbitsfoot Mussel *Quadrula cylindrical cylindrical*	No mitigation actions required.
Northern Long-Eared Bat *Myotis septentrionalis*	No mitigation actions required.

II. Effect Determination and Response Requested:

SPECIES/ CRITICAL HABITAT	DETERMINATION[1]			RESPONSE[1] REQUESTED
Red-cockaded Woodpecker *Picoides borealis*		X		Concurrence
Pondberry *Lindera mellisifolia*		X		Concurrence
Pink Mucket (pearly mussel) *Lampsilis abrupta*		X		Concurrence
Winged Mapleleaf Mussel *Quadrula fragosa*		X		Concurrence
Rabbitsfoot Mussel *Quadrula cylindrical cylindrical*		X		Concurrence
Northern Long-Eared Bat *Myotis septentrionalis*		X		Concurrence

[1]DETERMINATION/RESPONSE REQUESTED:

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

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

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

_____ _____
Signature (originating station) **Date**

Project Leader
Title

IX. Reviewing Ecological Services Office Evaluation:

A. Concurrence _____ Nonconcurrence _____

B. Formal consultation required _____

C. Conference required _____

D. Informal conference required _____

E. Remarks (attach additional pages as needed):

_____ _____
Signature **date**

_____ _____
Title **office**