VOLUME II

HABITAT MANAGEMENT PLAN, INTEGRATED PEST MANAGEMENT PLAN, AND VISITOR SERVICES PLAN FOR

SAM D. HAMILTON NOXUBEE

NATIONAL WILDLIFE REFUGE

Oktibbeha, Noxubee, and Winston Counties, Mississippi

Southeast Region

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Habitat Management Plan

Sam D. Hamilton Noxubee

National Wildlife Refuge

Oktibbeha, Noxubee, and Winston Counties, Mississippi

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I. INTRODUCTION

SCOPE AND RATIONALE

Established in 1940, Noxubee NWR was renamed Sam D. Hamilton Noxubee National Wildlife Refuge (hereinafter referred to as the Sam D. Hamilton Noxubee NWR or the refuge) by Public Law 112-279 on February 14, 2012. The statutory authority for conducting habitat management planning on national wildlife refuges is derived from the National Wildlife Refuge System Administration Act of 1966 (Administration Act), as amended by the National Wildlife Refuge Improvement Act of 1997 (Improvement Act), 16 U.S.C. 668dd - 668ee. Section 4(a) (3) of the Improvement Act states: "With respect to the System, it is the policy of the United States that each refuge shall be managed to fulfill the mission of the System, as well as the specific purposes for which that refuge was established …" and Section 4(a) (4) states: "In administering the System, the Secretary shall monitor the status and trends of fish, wildlife, and plants in each refuge." The Improvement Act provides the Service the authority to establish policies, regulations, and guidelines governing habitat management planning within the System (Service Manual 620 FW 1).

Management of Sam D. Hamilton Noxubee NWR is currently guided by the establishing purposes developed in 1940. Specific step-down management plans are used to implement the establishing purposes. Service policies 602 and 620 FW 1 require the preparation of a Comprehensive Conservation Plan (CCP) for all national wildlife refuges. The CCP describes the desired future conditions of a refuge or planning unit and provides long-range guidance and management direction to achieve the purpose(s) of the refuge; helps fulfill the mission of the System; maintains and, where appropriate, restores the biological integrity, diversity, and environmental health of each refuge and the National Wildlife Refuge System; helps achieve the goals of the National Wilderness Preservation System, if appropriate; and meets other mandates. The wildlife and habitat management goals and objectives contained in the Habitat Management Plan are a reflection of the information and recommendations derived from the goals, objectives, and strategies related to habitat management activities discussed in the Sam D. Hamilton Noxubee NWR CCP (2014).

The vision for the refuge is:

Sam D. Hamilton Noxubee National Wildlife Refuge is a key puzzle piece within an interconnecting landscape otherwise dominated by small cities, rural communities, and lands devoted to agriculture and commercial forestry. The refuge includes pine forests, bottomland and upland hardwood forests, cypress swamps, and wetlands surrounding the historic Noxubee River whose channel and floodwaters support migratory bird species and a host of native flora and fauna. The refuge promises to conserve and manage its natural diversity by restoring and protecting historic habitats and wildlife while working with partners, listening to the American public, and promoting awareness. In the future, habitat

management and public use program objectives will no longer be viewed through a lens of simply the next 15 years, but as one step in a continuing restoration process covering the next 100 years. Management of the refuge's habitats will be designed to support resources of concern and species of complimentary need. Refuge management will recognize the position of the refuge within the surrounding landscape and target those unique ecological roles it can fulfill within that landscape. New programs will be developed to provide users with a better understanding and appreciation of natural and cultural resources.

A Habitat Management Plan (HMP) is a step-down management plan of the refuge CCP. HMPs comply with all applicable laws, regulations, and policies governing the management of the National Wildlife Refuge System (Refuge System). The lifespan of an HMP is 15 years and parallels that of refuge CCPs. HMPs are reviewed every 5 years, utilizing peer review recommendations, as appropriate, in the HMP revision process or when initiating refuge CCPs.

LEGAL MANDATES

"The mission of the National Wildlife 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" (National Wildlife Refuge System Improvement Act of 1997). The U.S. Fish and Wildlife Service (Service) is the agency that administers the Refuge System. Currently, over 540 national wildlife refuges exist encompassing more than 100 million acres of lands. The refuge is administered under the Refuge System and therefore, is part of a larger national landscape conservation plan set forth by the Service. This refuge is an extremely important component for the conservation and management of fish, wildlife, and plant resources within the Refuge System.

Sam D. Hamilton Noxubee NWR was established on June 14, 1940, by Executive Order 8444 under the authority of 16 U.S.C. Sec. 715 (Migratory Bird Conservation Act). The refuge's stated purpose was "…for use as a refuge and breeding ground for migratory birds and other wildlife…" 16 U.S.C. Sec. 715 (Migratory Bird Conservation Act).

In conjunction with the primary establishing purposes, the refuge will provide an area for the **"…** conservation, management, and restoration of the fish, wildlife, and plant resources and their habitats for the benefit of present and future generations of Americans" 16 U.S.C., 668(a)(2) (National Wildlife Refuge System Administration Act) as well as "…for the development, advancement, management, conservation, and protection of fish and wildlife resources…" 16 U.S.C., 742(b)(1) (Fish and Wildlife Act of 1956). The passage of the Endangered Species Act (ESA) in 1973 (as amended) required the refuge to support recovery actions for federally listed threatened and endangered species.

Section 106 of the National Historic Preservation Act of 1966, as amended, and Section 14 of the Archaeological Resources Protection Act also applies to national wildlife refuges. It requires the Service to evaluate the effects of any of its actions on cultural resources [e.g., historical, architectural, and archaeological that are listed or eligible for listing in the National Register of Historic Places (NRHP)]. The Service, like other federal agencies, is legally mandated to inventory, assess, and protect cultural resources located on those lands that the agency owns, manages, or controls. The Service's cultural resource policy is delineated in 614 FW 1-5 and 126 FW 1-3. In the Service's Southeast Region, the cultural resource review and compliance process is initiated by contacting the Regional Historic Preservation Officer/Regional Archaeologist (RHPO/RA). The RHPO/RA would determine whether the proposed undertaking has the potential to impact cultural resources, identify the "area of potential effect," determine the appropriate level of scientific investigation necessary to ensure legal compliance, and initiate consultation with the pertinent State Historic Preservation Office (SHPO) and federally recognized tribes.

Several themes recur in the above-mentioned laws, their promulgating regulations, and more recent executive orders. They include: (1) each agency is to systematically inventory the historic properties on their holdings and to scientifically assess each property's eligibility for the NRHP; (2) federal agencies are to consider the impacts to cultural resources during the agencies' management activities and seek to avoid or mitigate adverse impacts; (3) the protection of cultural resources from looting and vandalism are to be accomplished through a mix of informed management, law enforcement efforts, and public education; and (4) the increasing role of consultation with groups, such as Native American tribes, in addressing how a project or management activity may impact specific archaeological sites and landscapes deemed important to those groups.

Other legislation that applies to national wildlife refuges, and specifically to the refuge is the Wilderness Act of 1964 (16 U.S.C. 1131-1136, 78 Stat. 890). Public Law 88-577, approved September 3, 1964, directed the Secretary of the Interior, within 10 years, to review every roadless area of 5,000 or more acres and every roadless island (regardless of size) within national wildlife refuges and national parks and to recommend to the President the suitability of each such area or island for inclusion in the National Wilderness Preservation System, with final decisions made by Congress. The Wilderness Act provides criteria for determining suitability and establishes restrictions on activities that can be undertaken on a designated area. It authorizes the acceptance of gifts, bequests, and contributions in furtherance of the purposes of the Wilderness Act and requires an annual report at the opening of each session of Congress on the status of the wilderness system.

NATIONAL AND INTERNATIONAL CONSERVATION PLANS AND INITIATIVES

As described within the refuge's comprehensive conservation plan, there is a large amount of conservation and protection information that defines the role of the refuge at local, national, international, and ecosystem levels. This HMP supports, among others, the Partners-in-Flight Plan, the North American Waterfowl Management Plan, the Western Hemisphere Shorebird Reserve Network, and the National Wetlands Priority Conservation Plan.

North American Waterfowl Management Plan (USFWS 2012)

The refuge contributes directly to the protection and enhancement of resident migrating and wintering waterfowl habitat, which is a key goal under the plan.

Partners in Flight North American Landbird Conservation Plan (PIF 2004)

Examples of PIF's priority neotropical migratory birds on the refuge include cerulean warblers (*Dendroica cerulean*) in the mixed pine/hardwood habitats and rusty blackbirds (*Euphagus carolinus*) overwintering in the bottomland hardwoods (http://www.blm.gov/wildlife/pl_04sum.htm).

North American Bird Conservation Initiative (NABCI)

The refuge works under the direction of the Service leadership on the committee to further bird conservation. In particular, the refuge participates in a number of national surveying and monitoring activities to facilitate integrated bird conservation (http://www.nabci-us.org/plans.htm).

United States Shorebird Conservation Plan (Brown et al. 2001)

Given that Sam D. Hamilton Noxubee NWR is an interior, predominantly forested landscape, little habitat is readily available to support regional shorebird efforts along the coastal plain. However, the refuge does intermittently provide shallow water and mudflat areas in spring and summer that are utilized by migratory shorebirds.

Southeast United States Regional Waterbird Conservation Plan (Hunter et al. 2006)

The refuge attempts to place additional conservation measures on waterbirds excluded from the North American Waterfowl Management Plan and the U. S. Shorebird Conservation Plan. Wood storks are a common summer resident, little blue herons and white ibis breed within rookeries on Bluff Lake. According to the refuge's 2012 roost count, there were 22,119 cattle egrets; 747 little blue, 147 great blue herons; 287 great egrets; and 241 white ibis. Excessive population levels of double-crested cormorants (*Phalacrocorax aurtis*) and cattle egrets (*Bubulcus ibis*) are of concern. Cormorants typically are winter residents, utilizing the refuge's lakes for food and roosting habitat.

Northern Bobwhite Conservation Initiative (Palmer et al. 2011)

This non-migratory gamebird is found throughout much of the refuge in areas managed to support the endangered red-cockaded woodpecker (*Picoides borealis*) as well as other areas. Northern bobwhites have been shown to respond positively to management for red-cockaded woodpeckers on the refuge, which supports NBCI recovery goals (Fuller 1994).

East Gulf Coastal Plain Joint Venture Plan (EGCPJV 2008)

The refuge provides significant habitat in support of the major initiatives under this plan. The plan supports an open pine habitat which is beneficial to Bachman's sparrow and other similar guild species.

Red-cockaded Woodpecker Recovery Plan (USFWS 2003)

Within the Red-cockaded Woodpecker Recovery Plan, the refuge has been identified as a support population. Though not essential to recovery of the species, the existence of smaller populations distributed across the ecological range of the bird is important.

Wood Stork Recovery Plan (USFWS 1996)

Though no stork breeding occurs in Mississippi, the refuge serves as an important location for a portion of the population to summer. The refuge provides roosting and foraging habitat for these birds throughout the summer months through water level fluctuation (either natural or human manipulated) in the refuge's lakes, wetlands, streams, and ditches.

Lower Mississippi Alluvial Valley Joint Venture "Restoration, Management, and Monitoring of Forest Resources in the Mississippi Alluvial Valley: Recommendations for Enhancing Wildlife (LMVJV 2007)"

The Desired Forest Conditions is an outline designed to provide suitable habitat for foraging and cover within all dimensions of the forest and provide a desirable blend of regeneration, maturity, and senescence of forest trees that will address the habitat needs of priority wildlife species, with an emphasis on migratory birds.

Strategic Habitat Conservation – Gulf Coastal Plains and Ozark Landscape Conservation Cooperative (USFWS 2006) (GCPO 2013)

The refuge will work within the context of the defined landscape conservation cooperative to support conservation efforts that meet the purpose of the refuge and mission of the Service (USFWS 2010b).

Mississippi Comprehensive Wildlife Conservation Strategy (MS CWCS 2005)

The MS CWCS was developed in compliance with this congressional mandate and serves as Mississippi's blueprint for fish and wildlife conservation statewide for the next half century. The CWCS is a broad set of conservation strategies for wildlife and fish species and their key habitats in greatest need of conservation which are managed by the State of Mississippi. The State of Mississippi also identifies species of greatest conservation need associated with each habitat.

The North American Wild Turkey Management Plan (National Wild Turkey Federation 2010)

The Mississippi State Chapter's priorities fall into five categories: Habitat Enhancement, Hunter Access, Wild Turkey Research, Education and Outreach. The Mississippi Chapter of the National Wild Turkey Federation has contributed a Super Fund Project of $25,000 over 5 years to enhance wild turkey habitat with prescribed burning, herbicide, and field restoration. This project will benefit wild turkey and northern bobwhite quail by creating useful foraging/brooding areas. These treatments would also be beneficial for many other species of interest, including the endangered red-cockaded woodpeckers, Bachman's sparrows, and brown headed nuthatches.

II. BACKGROUND, INVENTORY, AND DESCRIPTION OF HABITAT

LOCATION

GEOGRAPHIC CONTEXT

Sam D. Hamilton Noxubee NWR is located within three counties (Noxubee, Oktibbeha, and Winston) in east-central Mississippi, approximately 17 miles south-southwest of Starkville and approximately 120 miles north-northeast of Jackson, the capital city of Mississippi (Figure 1). Primary access to the refuge is by either Oktoc Road from Starkville, by Highway 25 via Loakfoma Road and Brooksville-Louisville Road from Louisville, or by Lynn Creek Road from Brookville.

ECOSYSTEM CONTEXT

Eastern Gulf Coastal Plain

Sam D. Hamilton Noxubee NWR is managed within the Service's biological physiographic region referred to as the Eastern Gulf Coastal Plain (EGCP) (Figure 2). A broad descriptor of the EGCP is flat to rolling topography, broken by numerous streams and river bottoms. Uplands are dominated by pine, originally longleaf and slash in the south and shortleaf mixed with hardwoods in the north. These are fire-maintained systems that give way to loblolly pines and hardwoods in damper areas and bottomland hardwood forests in extensive lowland drainages.

Within the EGCP, biological diversity, including bottomland hardwood forests and open pine forests, has been altered from historic conditions. This has resulted in degradation of the rich composition that once supported diverse communities. Forest structure and quality are influenced by site conditions and fire, as well as past land management practices. Hardwoods can dominate pine in many stands depending on soil moisture, soil type, aspect, and past disturbance. Historically, pine forests were widely dominant on the EGCP. The elimination of open pine habitats has decimated some associated wildlife species throughout the ecoregion. Species most adversely affected are fire-sensitive or dependent on special habitat requirements.

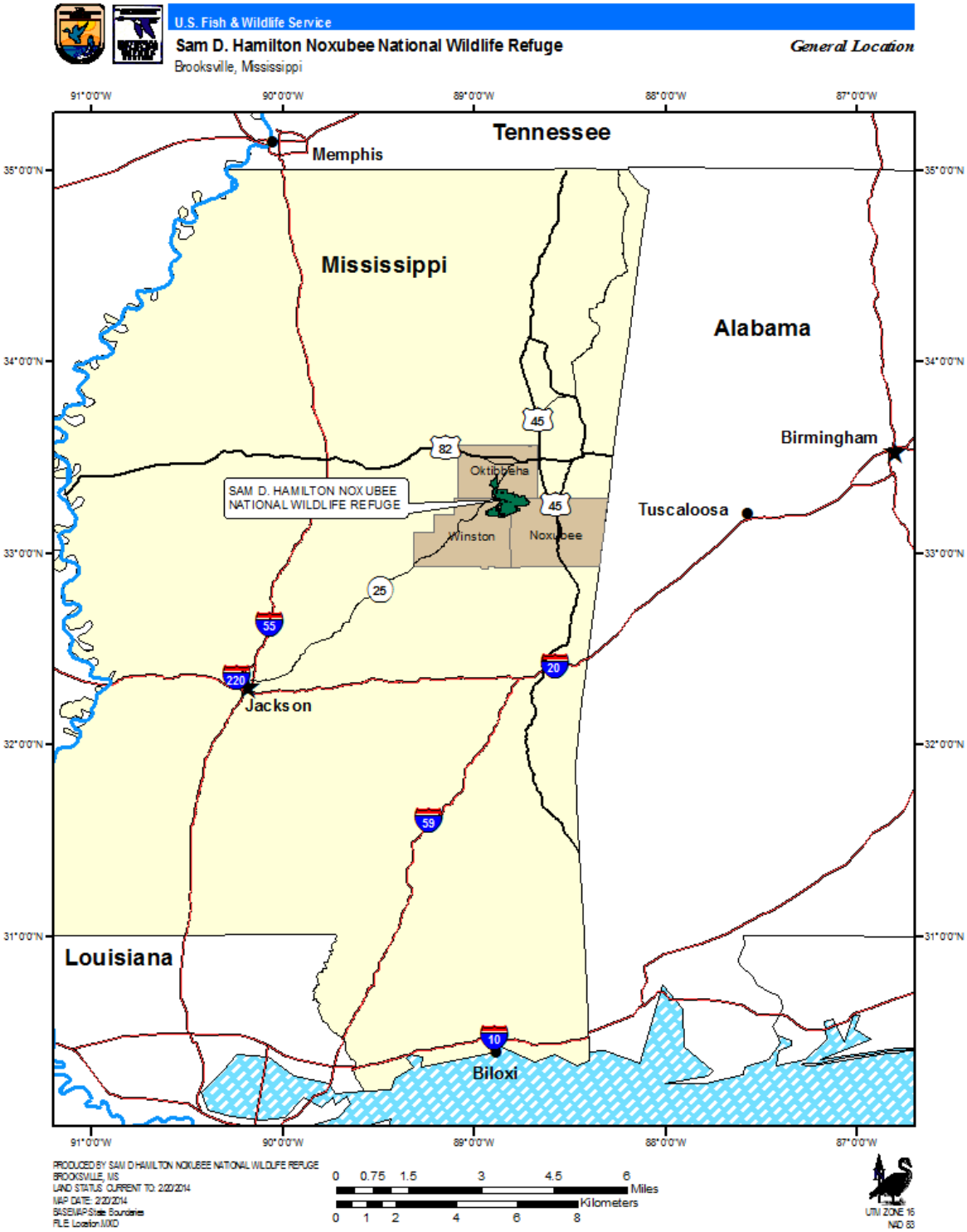


Figure 1. Location of Sam D. Hamilton NWR, Mississippi.

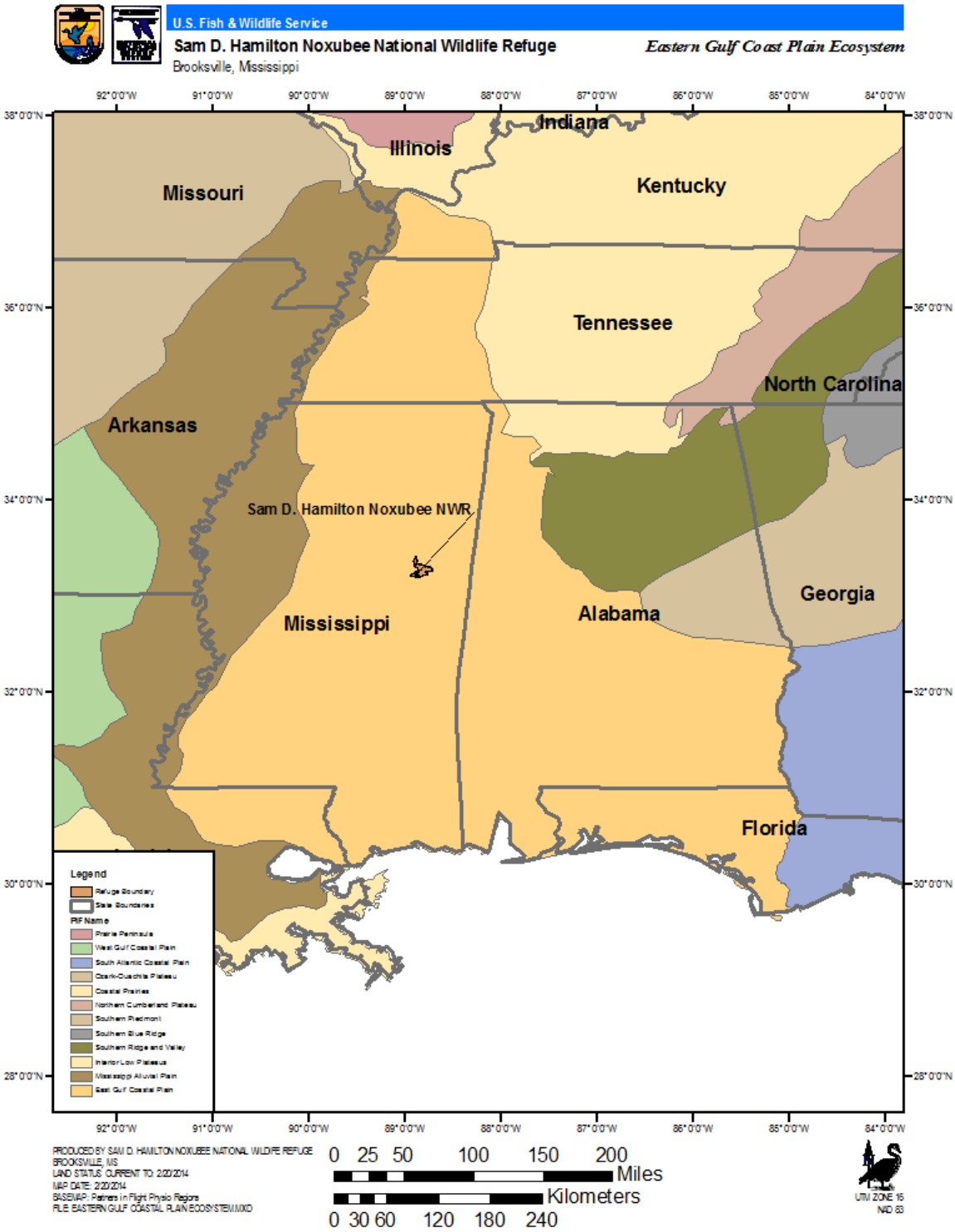


Figure 2. Location of Sam D. Hamilton Noxubee NWR within the Eastern Gulf Coastal Plain.

PHYSICAL OR GEOGRAPHIC SETTING

Sam D. Hamilton Noxubee NWR lies in the central section of the 60-million-acre EGCP. The refuge is situated in three Mississippi counties (northeastern Winston, southern Oktibbeha, and northwestern Noxubee) in the northeast portion of Mississippi. The Noxubee River, a tributary of the Tombigbee River, flows through the central portion of the refuge from west to east. Other streams flowing through the refuge include Cypress, Jones, Oktoc, Loakfoma, Lynn, Little Yellow, Yellow, Chinchahoma, and Dry creeks. The Tombigbee National Forest borders a portion of the southwest corner of the refuge. Mississippi State University owns the John Starr Memorial Forest, which borders the refuge on the north and west sides. Private forest industry lands border the refuge on the southern side. The State of Mississippi owns three 16th section lands that either are true in-holdings or adjoin the refuge on the east and north sides. Private landowners border the remaining boundary of the refuge.

Black Belt Prairie Feature: Historically, a portion of land extending from the Tennessee border in an inverted arc through Mississippi into eastern Alabama supported native prairie. This area is known as the black belt prairie region. It is a crescent-shaped region that covers approximately 8,700 square miles and extends from McNairy County, Tennessee, south across east central Mississippi and east to Russell County, Alabama. Today, the Black Belt Prairie has been listed as one of the critically endangered ecosystems in the United States with less than 1 percent still remaining. This makes it the most degraded habitat type in Mississippi. Very small isolate remnant patches (less than 100 acres) remain in the northeastern part of the state (Jones et al. 2007; Mississippi Museum of Natural Science 2005), in cemeteries, 16th section lands, and on Tombigbee and Bienville National Forests (Wildlife Mississippi). Currently, the refuge has 85 acres being managed as a demonstration area for this habitat type. The demonstration area is the only location where a calcareous clay prairie-like soil exists on the refuge.

Hydrologic Context: The refuge is located in the Tombigbee Basin Drainage (Figure 3) and entirely within one 8-digit Hydrologic Unit (HUC-8). This particular HUC-8 (03160108) is defined as the “Noxubee” unit and expands across portions of east central Mississippi and into areas of west central Alabama. It includes a total drainage area of over 364,000 ha within 3,600 km^2. Additionally, the “Noxubee” unit (03160108) is identified as being a watershed priority by the Fish and Wildlife Service Fisheries Program Watershed Priority Tool and assigned a criteria score of 39.1 and ranked 79th out of all 401 units in the Southeast Region (USFWS unpublished data). Streams existing upon the refuge are tributaries of the Tombigbee River. The series of locks and dams along the Tombigbee River has created many isolated tributaries. Some tributaries of the Tombigbee River that flow through the refuge include Noxubee River, Chinchahoma, Talking Warrior, Cypress, Jones, Oktoc, Loakfoma, Lynn, Little Yellow, and Dry creeks. Approximately 80 miles of streams crisscross the refuge (Mississippi Museum of Natural Science 2005). The

refuge's topography influences many of these streams with low land areas forming extensive areas of bottomland subject to seasonal flooding (Figure 4).

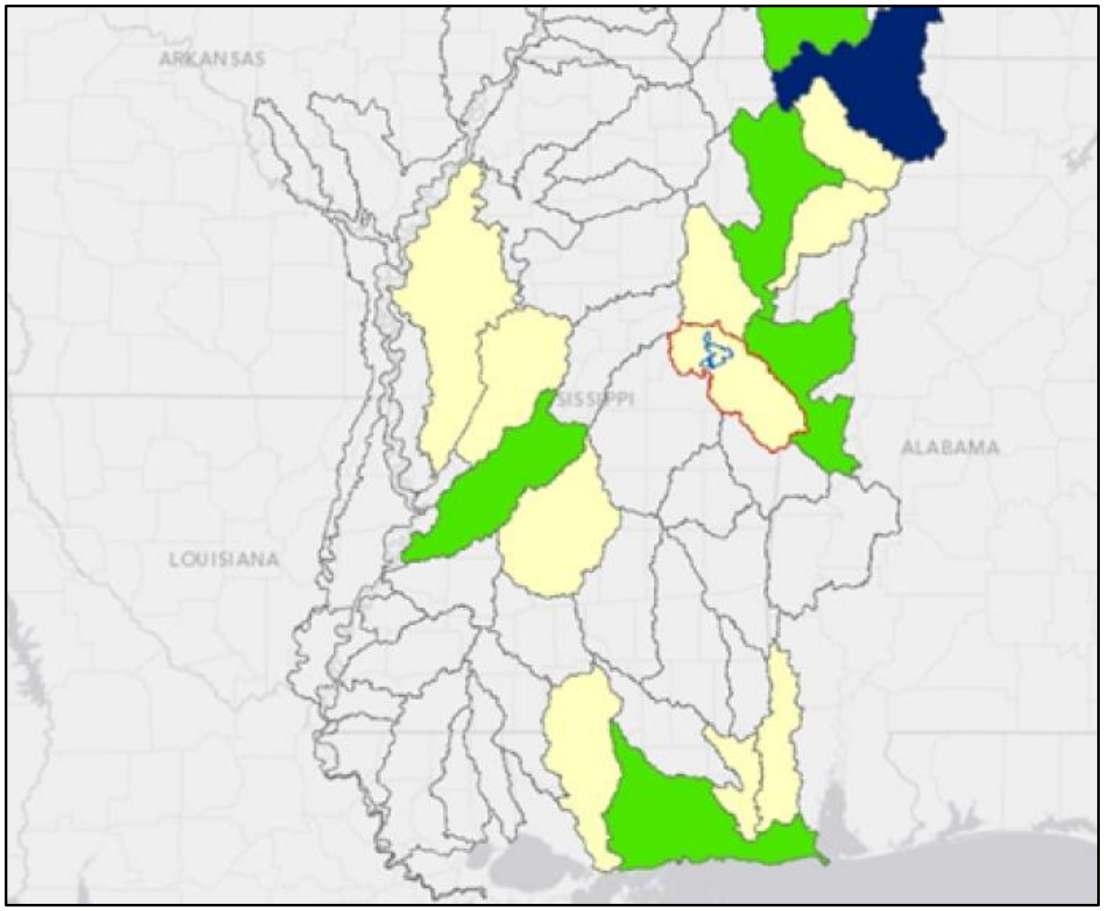


Figure 3. Tombigbee basin drainage.

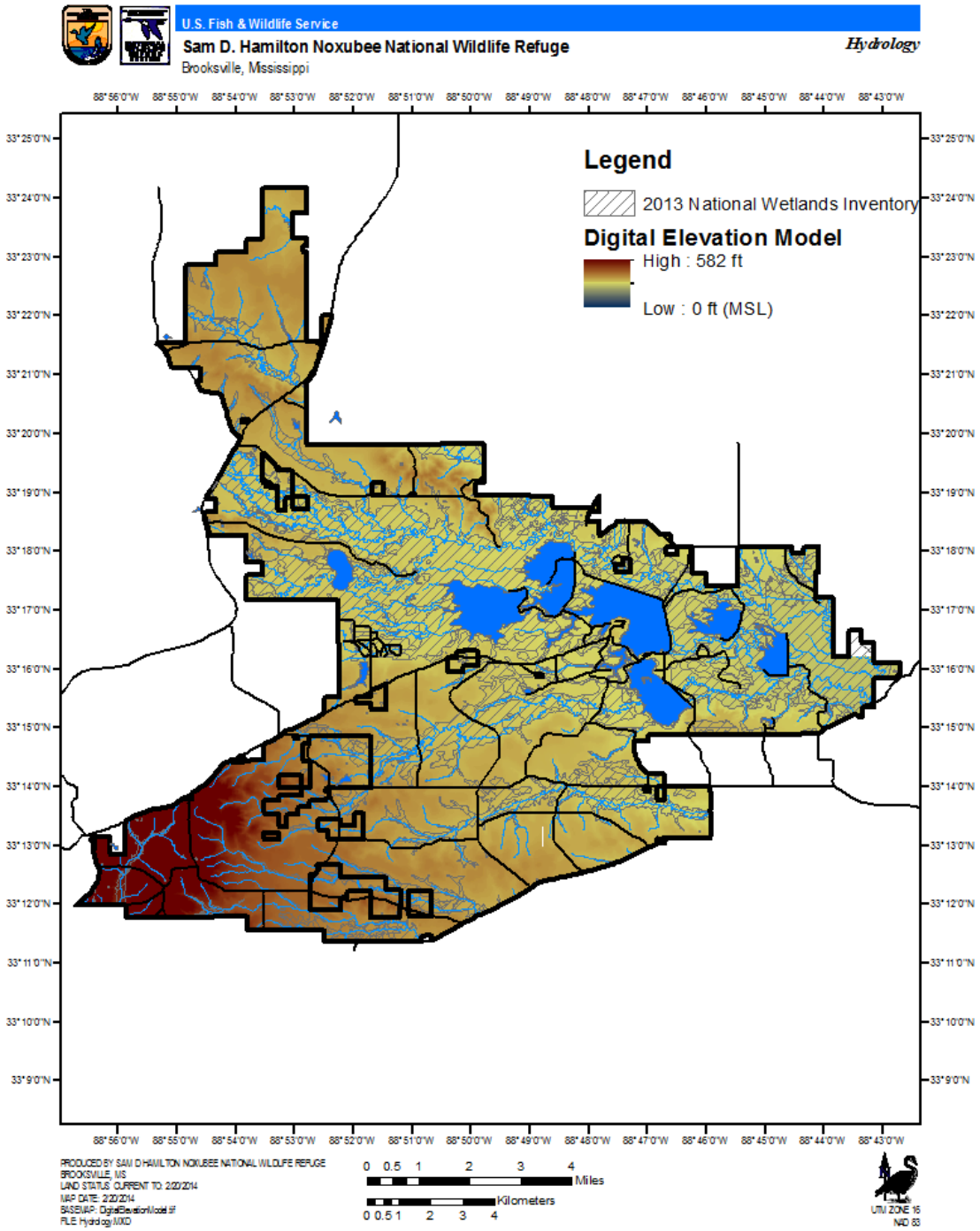


Figure 4. Hydrology Sam D. Hamilton Noxubee NWR, Mississippi.

SOILS

The refuge lies within the coastal plain physical division and typically has soils that are acidic and poorly drained clays, silt loam, silty clay loam, and loam from the upper coastal plains (Miller 1967). Areas of the refuge exhibit deep, somewhat poorly drained soils on slightly elevated flood plains and a small but distinct area of moderately well drained to poorly drained silty soils with slopes ranging from 0 to 8 percent. Soil associations on the refuge are as follows (Figure 5):

- Stough-Freest-Vimville: Upland soil on nearly level and gently sloping, somewhat poorly drained, moderately well drained, and poorly drained, loamy soils; on stream terraces and uplands
- Falkner-Longview-Savannah: Upland soil on nearly level to sloping, somewhat poorly drained, silty soils and moderately well drained, loamy soils; on uplands and stream terraces
- Kipling-Savannah-Oktibbeha: Somewhat poorly drained to moderately well drained soils that have dominantly a clayey subsoil that developed from chalk, and moderately well drained soils that have a loamy subsoil and a fragipan
- Leeper-Marietta-Catalpa: Nearly level, somewhat poorly drained and moderately well drained, clayey soils; on flood plains
- Longview-Falkner-Prentiss: Somewhat poorly drained and moderately well drained soils that have a loamy to clayey subsoil
- Mantachie-Mathiston-Ochlockonee: Somewhat poorly drained to well-drained, acid soils that have loamy to silt sub-soil.
- Mathiston-Urbo: Somewhat poorly drained, acid soils that have a loamy to clayey subsoil
- Smithdale-Ruston-Ora: gently sloping to steep, loamy to silty soils; on uplands
- Stough-Prentiss-Myatt: Poorly drained to moderately well drained soils that have dominantly a loamy subsoil
- Urbo-Mantachie-Quitman: Deep, somewhat poorly drained soils on nearly level flood plains that are fine, mixed, acid, and thermic Aerie Haplaquepts
- Wilcox-Falkner: Somewhat poorly drained, nearly level to sloping soils that have clayey and silty subsoils

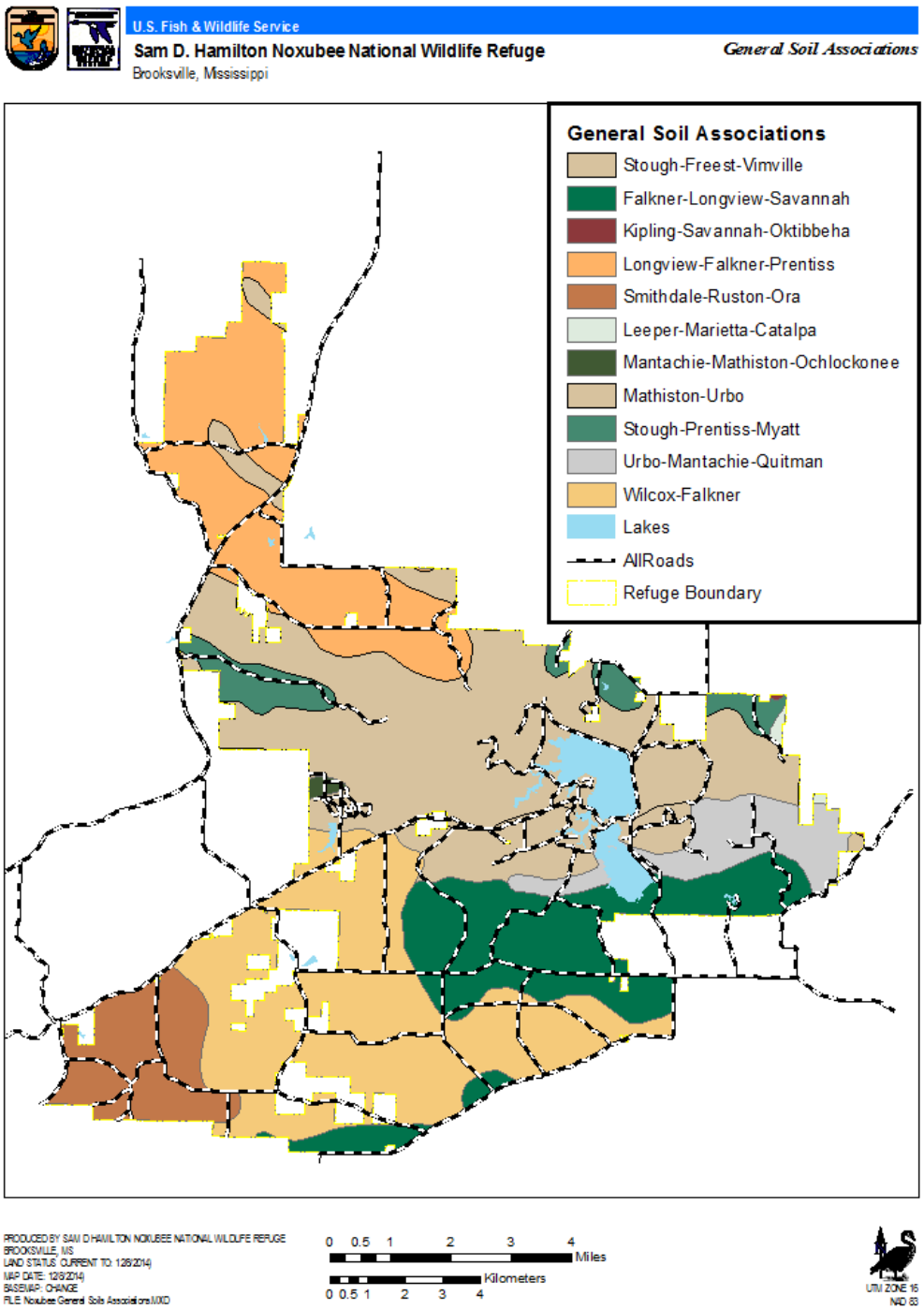


Figure 5. Soils of Sam D. Hamilton Noxubee NWR, Mississippi.

HISTORIC HABITAT CONDITIONS

Although relatively small in size, individual refuges contribute to biological integrity, diversity, and environmental health at landscape scales, especially when they support populations and habitats that have been lost at an ecosystem, national, or international scale. In keeping with the Biological Integrity Diversity and Environmental Health Policy (601 FW 3), biological integrity of the refuge was evaluated by examining the extent to which forest composition, structure, and function have been altered from historic conditions. This assessment included comparison of current to available historical forest data.

Northeastern Mississippi was comprised of forests, savannas, and streams prior to 1830, when these lands were opened to settlement by citizens of the United States and the refuge's later establishment. At the time of the Treaty of Dancing Rabbit Creek and prior to large scale settlement by Americans, the EGCP ecoregion was covered with upland pine, upland hardwood, and bottomland hardwood forests, cane breaks, savannas, and grasslands/prairies, creating a diverse complex ecosystem. The upland forests were either hardwood forests or were a mixture of both hardwoods and pines, depending on the frequency of fire. Upland pine forests consisted of loblolly (*Pinus taeda*), shortleaf (*Pinus echinata*), and longleaf (*Pinus palustris*) pines in the overstory and were burned every one to two years. In areas frequently burned, the forest stands were open and park-like with grasses being the primary ground cover. The more hilly regions within the central and northern portions of the EGCP were predominately hardwoods with shortleaf pine on the ridges (Fickle 2001).

Evidence indicates that by the sixteenth century (1700s), the Native Americans had already impacted Mississippi's landscape through the use of fire. The indigenous people used fire to enhance their food supplies through modification of forest composition and creation of grasslands and agricultural fields (Williams 2001). They practiced intensive agriculture (i.e., growing corn, beans, and squash) near their settlements, and periodically moved their villages as the soil fertility declined. The Native American populations began to decline as the European explorers exposed the Native Americans to diseases for which they had no immunity. In 1798, the United States Congress created the Mississippi Territory.

Evidence of early Euro-American settlements is also abundant on the refuge, including roads, cemeteries, churches, schools, mill sites, cisterns, a World War II practice bombing range, and one diversion canal dating back to the late 1800s and early 1900s. Dating from 1821, Old Robinson Road is the remnant of an original public highway from Jackson to Columbus, Mississippi.

Much like other areas settled since 1830, the land area within the present refuge boundary was intensively farmed and over-grazed by cattle. By the 1930s, the swift settlement and poor farming practices were creating lands depleted of top soil and suffering from erosion (Hickman 1962). The Federal Government acquired much of the land that would later become the refuge under the authorities of the Rural Resettlement Administration through Title II of the National Industrial Recovery Act (NIRA) (1933), Emergency Appropriation Act of (1935), and Title III of the Bankhead-Jones Farm Tenant Act (1937). Of the more than 100,000 acres acquired by the Federal Government, 25 percent of the acres were in cultivated fields and the remaining acres abandoned agricultural lands in various stages of succession. Much of the newly acquired land suffered from severe erosion. While managed by the Department of Agriculture, the CCC completed construction of Bluff Lake, several water control levees, access roads and bridges, and initial erosion control structures. With the formation of the Fish and Wildlife Service in 1940, approximately 45,000 acres of this land was used to establish the Noxubee National Wildlife Refuge under Executive Order 8444 on June 14, 1940. This order reserved these lands as a refuge and breeding ground for migratory birds and other wildlife.

The refuge's initial goals were to rehabilitate the land and create more wildlife habitat through planting trees to reduce soil erosion. Each year from the time of establishment until the early 1950s, the refuge planted thousands of acres in loblolly pine. Further alterations of the land were conducted. These alterations included the construction of ephemeral pools, Loakfoma Lake, levees, water control structures, and greentree reservoirs (GTRs). Roads and bridges were created and in some areas streams altered. Bald cypress forests were cleared to create open water features.

The new lakes, water control structures, and altered streams provided the option of flooding over 2,500 acres for migratory waterfowl, as well as creating aquatic habitats for fish. Over the years, the refuge has been restocked with numerous wildlife species. Those species documented that have been stocked include the white-tailed deer (*Odocoileus virginianus*), beaver, turkey, Canada goose *(Branta canadensis),* paddle fish *(Polyodon spathula),* and American alligator (*Alligator mississippiensis*). Although the refuge is more than 75 years old, restoration of the land continues today. The early habitat restoration efforts and the refuge's later management have produced a forest that does not fully represent the forest that existed prior to Euro-American settlement.

Currently, the majority of the refuge, 94 percent, consists of forested habitats. Timber harvest has been part of the refuge's management since its first establishment. The 1953 estimate of the amount of timber on the property was placed at 158,000 board feet (International ¼" Rule) of pine and hardwood sawtimber. By 1993, estimates of the amount of timber were placed at 531,000 board feet of pine and hardwood sawtimber. The total volume of timber has continued to increase with overall timber growth, as measured by continuous forest inventories, estimated at 1 percent annually.

A recent analysis to determine historic habitat conditions used General Land Office (GLO) records from 1830 to model the historic forests of the refuge (LANDFIRE 2008). Witness

trees and surveyor's notes were analyzed and it was determined that historical forests were dominated by post oak (*Quercus stellata*), pine (*Pinus* spp.), hickory (*Carya* spp.), and red and white oaks (*Quercus* spp.). Surveyor's notes listed much of the survey area as being open woods, predominantly associated with higher elevations and upland slopes. Lower areas and stream channels were described as having thick understory with bushes, briers, and canes (Schauwecker et al. 2011). The bottomland forests were comprised of various hardwoods such as red and white oaks, sweetgum (*Liquidambar styraciflua*), American bald cypress (*Taxodium distichum*), sugarberry (*Celtis laevigata*), red maple (*Acer rubrum*), hickories, American sycamore (*Platanus occidentalis*), boxelder (*Acer negundo*), elm (*Ulmus* spp.), and ash (*Fraxinus* spp.). It also included loblolly pine, longleaf pine and shortleaf pine, mixed with post oak, hickory, and white oak (*Quercus alba*). Openings created by fire, winds, North American beaver (*Castor canadensis*), or other events were scattered across the landscape (Fickle 2001). Figure 6 depicts historic land cover from the LANDFIRE model report produced by USFWS 2013 (Appendix C).

Historic forest habitats for lands within the current refuge boundary supported a variety of habitat types. Upland hardwood forests consisted of approximately 704 acres (2 percent) of white oak, post oak, southern red oak (*Quercus falcata*), and loblolly pine interspersed with oaks, hickories, black gum (*Nyssa sylvatica*), and sweetgum. The refuge also supported a mixed shortleaf-loblolly pine forest over approximately 21,304 acres (44 percent) of the refuge. The historic forest conditions analysis also indicated approximately 19,306 acres (40 percent) of bottomland hardwoods were within the refuge consisting of water oak (*Quercus nigra*), willow oak (*Quercus phellos*), cherrybark oak (*Quercus pagoda*), overcup oak (*Quercus lyrata*), American beech (*Fagus grandifolia*), blackgum, and sweetgum. The fourth major habitat type consisted of nearly pure stands of American bald cypress, which constituted approximately 6,904 acres (14 percent) interspersed throughout the bottomland hardwood forests.

CURRENT HABITAT

Although the majority of the refuge, 94 percent, consists of forested habitat, differences exist within the amounts and distribution of the forest types when compared to the historic forests (Figure 7). Today, hardwood forests are over-represented by 7,312 acres; pine forests are only slightly under-represented by 331 acres; bottomland hardwood forests are under-represented by approximately 3,727 acres; and, bald cypress forests are the most under-represented forest type by approximately 5,775 acres. New non-forested lands consisting of lakes, developed lands, rights-of-way, and roads that exist today did not exist historically.

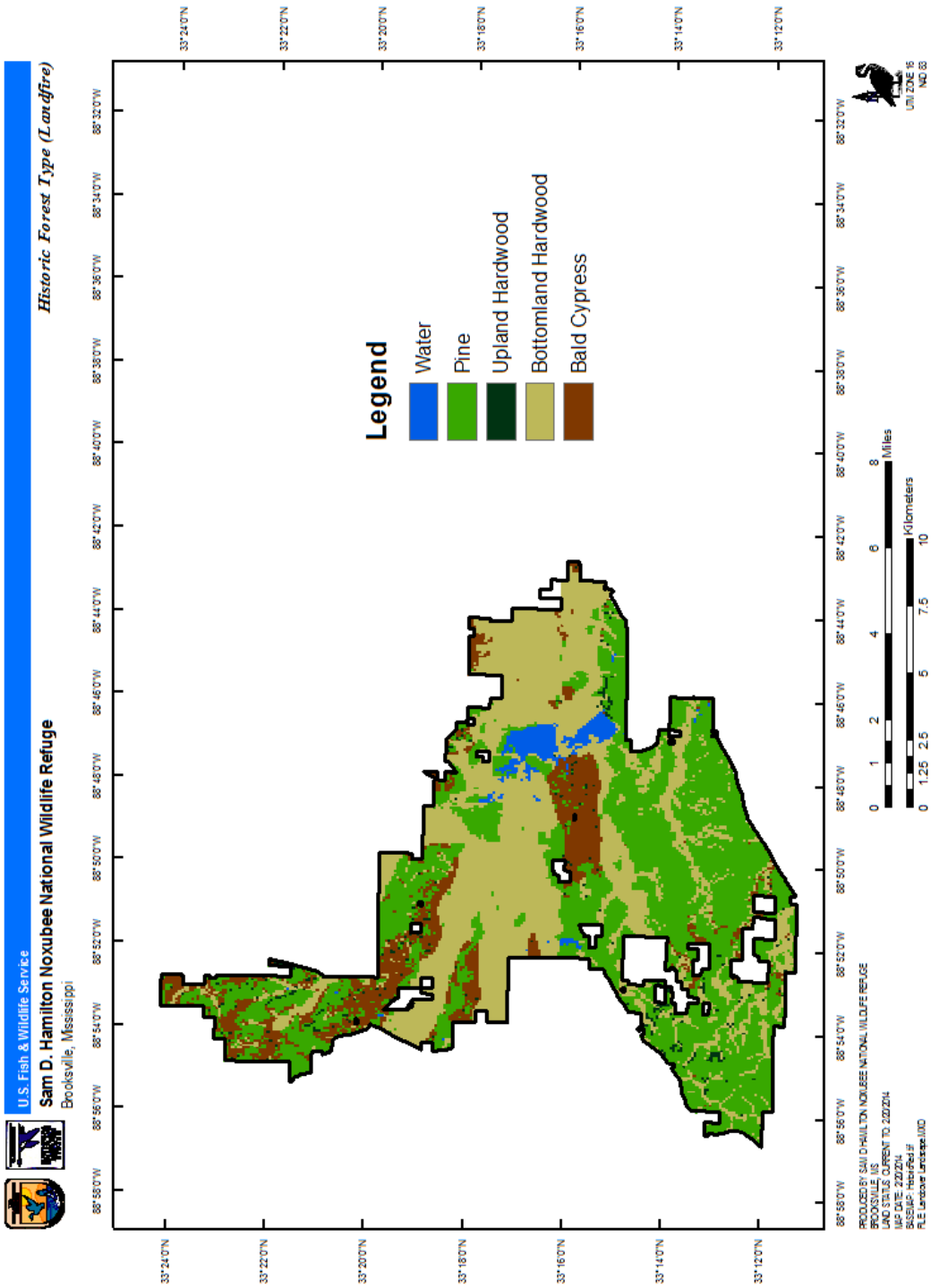


Figure 6. Historic forest types as modeled in LANDFIRE on Sam D. Hamilton Noxubee NWR, Mississippi.

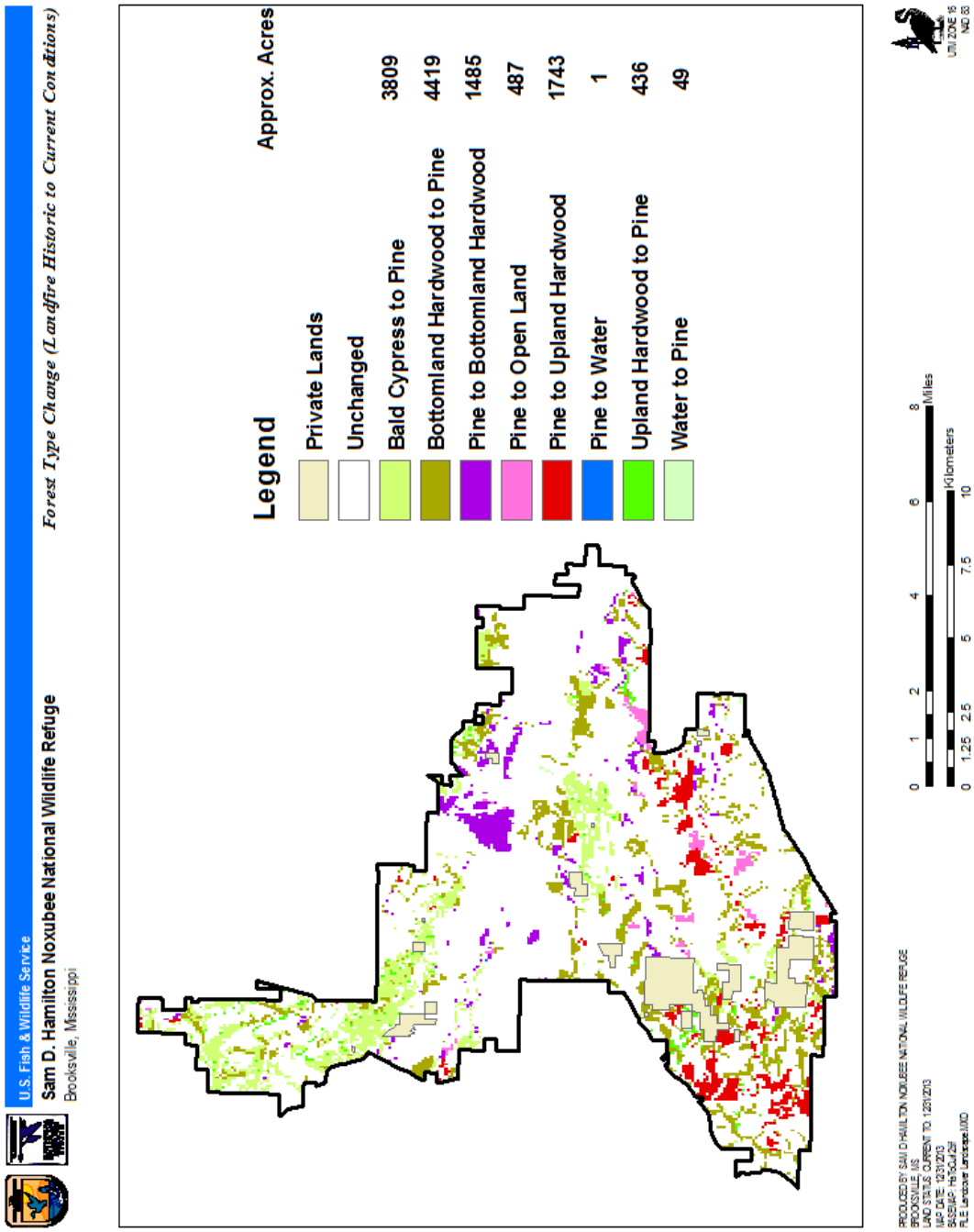


Figure 7. Historic forest types to current conditions as modeled in LANDFIRE on Sam D. Hamilton Noxubee NWR, Mississippi.

HABITAT DESCRIPTIONS

Upland Hardwood Forests

The historically upland hardwood forest type is found on gentle to moderate slopes. It consists of mixed oak, oak-pine, and mixed hardwood communities. Two SAF forest cover types have been identified on the refuge with this historic community type.

The first cover type is mainly an upland xeric site association in which the species compositions change depending upon elevations. The oaks dominate the stand with hickories comprising a smaller component. Other tree species occurring are yellow poplar (*Liriodendron tulipifera*), blackgum, red maple, ash, elm, sweetgum, shortleaf pine, and loblolly pine. Dogwood (*Cornus* spp.), sassafras (*Sassafras albidum*), serviceberries (*Amelanchier* spp.), redbud (*Cercis canadensis*), hophornbean (*Ostrya virginiana*), American beech, witch-hazel (*Hamamelis* spp.), sparkleberry (*Vaccinium arboreum*), wild grapes (*Vitis* spp.), greenbriers (*Smilax* spp.), and poison-ivy (*Toxicodendron radicans*) are found in the midstory and understory. Common herbaceous species are mayapple (*Podophyllum peltatum*), trillium (*Trillium* spp.), wild ginger (*Alpinia* spp.), bellworts (*Uvulvaria* spp.), asters (*Aster* spp.), and goldenrod (*Solidago* spp.). The type is a subclimax or climax depending upon the geographic location and site index (SAF Cover Type 52).

The second cover type, a mixture of loblolly pine and hardwoods, dominated no more than 20 percent of the overstory. The loblolly pine-hardwood cover type occurs on sites ranging from coastal swamps to xeric sites. The hardwood components consist of a mixture of sweetgum, water oak, cherrybark oak, swamp chestnut oak (*Quercus michauxii*), ash, yellow poplar, elm, red maple, and hickories. Shrubs and midstory trees include wax myrtle (*Morella cerifera*), American beautyberry (*Callicarpa americana*), possumhaw (*Ilex decidua*), sparkleberry, dogwood, and hawthorns (*Crataegus* spp.). Common vines include blackberries (*Rubus* spp.), greenbriers, grapes, and honeysuckle (*Lonicera japonica*). This cover type develops toward a hardwood climax (Mississippi Museum of Natural Science 2005) (SAF Cover Type 82).

Pine Forests

The historic pine community type occurred on upland hills and flats. Stands of pines form a dominant cover type for the refuge. On the refuge, two SAF forest cover types exist in this historic community type.

One cover type is comprised of a loblolly, longleaf and shortleaf pine majority, although the proportion of each species varies. It occurs in moist, even poorly drained soils and can also grow on dry, shallow eroded soils at higher elevations. Species associated with the loblolly, longleaf and shortleaf pine cover type include southern red oak, white oak, persimmon (*Diospyros virginiana*), blackgum, hickories, and flowering dogwood (*Cornus florida*). With a lack of fire management, hardwoods species are common in the midstory.

Panicums (*Panicum* spp.), sedges (*Carex* spp.), and little bluestem (*Schizachyrium scoparium*) are common undergrowth, if the stand has been managed by prescribed fire. This cover type is transient and will convert to an upland oak climax without disturbance (SAF Cover Type 80).

The other cover type is composed of either pure stands or a mixture in which loblolly pine comprises the majority of the overstory. It occurs on a variety of soils from well drained upland soils to somewhat poorly drained flatwood soils. The loblolly pine cover type is widespread and therefore associated with many species. The most common associated species include sweetgum, water oak, willow oak, cherrybark oak, red maple, hickories, and blackgum. The associated species are also common in the midstory. Dense, young stands support sparse herbaceous vegetation, but as the stand opens up, bluestems, panicums, and sedges appear. This cover type tends to be successionally temporary unless a fire regime is present (Mississippi Museum of Natural Science 2005) (SAF Cover Type 81).

Most of the refuge's pine forests are reaching maturity, and regeneration is a concern for the sustainability of future habitat for the red-cockaded woodpecker (RCW). This habitat has had silvicultural management in the past to promote RCW habitat and regeneration, but has proven to be not sustainable for current and future RCW habitat, thus leading to more landscape-scale approach to forest management to improve RCW habitat.

Bottomland Hardwood Forests

The historic bottomland hardwood forest habitats are found on small drainage ways, floodplains, stream terraces, levees, low moist-soil plains, and the lower slopes and high terraces of minor rivers and streams throughout the refuge. On the refuge, one SAF forest cover type is represented.

The sweetgum-willow oak SAF forest cover type is associated with alluvial floodplains of rivers in the southern United States. Species composition in this cover type is determined by soils. On well drained first bottom ridges and terrace flats with silty clay soils, sweetgum will dominate the stand. Oaks will dominate on clay soils. Willow oak and water oak will be found on the first bottom ridges with better drainage. Nuttall oak (*Quercus texana*) occur on the first bottom flats. Other species associated with this cover type are sugarberry, ash, elm, overcup oak, hickory, Eastern cottonwood (*Populus deltoides*), persimmon, red maple, and rarely bald cypress. The associate species also are the dominant midstory species. The herbaceous layer can include greenbrier, poison-ivy, redvine (*Brunnichia ovata*), mayapple, jack-in-the-pulpit (*Arisaema triphyllum*), netted chainfern (*Woodwardia areolata*), and jumpseed (*Polygonum virginianum*) (Mississippi Museum of Natural Science 2005) (SAF Cover Type 92).

Bald Cypress - Gum Swamp Forests

Historically, bald cypress occurred in areas with frequent prolonged flooding along streams. Its major associates are water tupelo and blackgum. Minor associates include black willow (*Salix nigra*), cottonwood, ash, water hickory (*Carya aquatica*), and overcup oak. The midstory may include buttonbush (*Cephalanthus occidentalis*), eastern swampprivet (*Forestiera acuminate),* acuminate (*Forestiera acuminate*), and Virginia sweetspire (*Itea virginica*). The ground cover will contain species such as whitegrass (*Leersia virginica*), waterwillow (*Justicia americana*), swamp sedge (*Carex joorii*), and opposite-leaf spotflower (*Acmella oppositifolia*), depending upon the amount of shade (Mississippi Museum of Natural Science 2005). On the refuge, there is one SAF Forest Cover Type (Type 101).

Fields

Fields are not a historic community type for the refuge. Since the refuge's establishment, remaining fields have been managed to produce a variety of vegetation types and have been planted with grain crops such as sorghum, wheat, or lespedeza to provide food for wildlife species such as waterfowl and quail. More recently these fields have been left fallow to provide a more natural plant community of native forbs and grasses, many of which have value as food or cover for wildlife. Old fields or fallow lands contain a variety of annual and perennial plants, including purpletop tridens (*Tridens flavus*), velvet panicum (*Dichanthelium scoparium*), bristlegrass (*Setaria* spp.), bahiagrass (*Paspalum notatum*), Johnsongrass (*Sorghum halepense*), bluegrass (*Poa* spp.), Bermuda grass (*Cynodon dactylon*), cheatgrass (*Bromus tectorum*), cattail sedge (*Carex typhina*), little barley (*Hordeum pusillum*), little bentgrass (*Agrostis* spp.), bittercress (*Cardamine* spp.), butterweed (*Packera glabella*), bedstraw (*Galium* spp.), buttercup (*Ranunculus* spp.), chervil (*Chaerophyllum* spp.), chickweed (*Stellaria*, *Holosteum*, and *Cerastium* spp.), clover (*Trifolium* spp.), cornsalad (*Valerianella* spp.), corn speedwell (*Veronica arvensis*), crowpoison (*Nothoscordum bivalve*), dwarfdandelion (*Krigia* spp.), fleabane (*Erigeron* spp.), forget-me-not (*Myosotis verna*), garlic (*Allium* spp.), lyre-leaf sage (*Salvia lyrata*), plantain (*Arnoglossum* spp.), medic (*Medicago lupulina*), and toadflax (*Linaria* and *Nuttallanthus* spp.).

Prairie Demonstration Area (Morgan Hill)

Today, the black belt prairie has been listed as one of the critically endangered ecosystems in the United States with less than 1 percent still remaining. Very small isolate remnant patches (less than 100 acres) remain in the northeastern part of the state (Jones et al. 2007; Mississippi Museum of Natural Science 2005), in cemeteries, 16th section lands, and on Tombigbee and Bienville National Forests (Wildlife Mississippi). This prairie community is considered critically imperiled in the state.

Prairie is not an historical community type and the refuge has non-prairie soils being managed as a demonstration area for the black belt prairie habitat type. Native prairie species, including little bluestem, Cherokee sedge (*Carex cherokeensis*), yellow Indian grass (*Sorghastrum nutans*), prairie coneflower (*Ratibida pinnata*), false foxglove (*Agalinis* and *Aureolaria* spp.) and a variety of asters, have been planted at this site.

Douglas Bluff

While the refuge has defined major habitat classifications and associated vegetation, there exist several clearly identifiable microhabitats that contain specialized and often uncommon or rare plant communities. One such prominent plant community is located along Douglas Bluff. This north facing slope runs along the edge of Oktoc Creek, which promotes a stable moisture regime. In 1976, Dr. Ray Watson, Mississippi State University, Department of Biological Sciences, identified 85 plant species with fairly narrow habitat distribution or collectively uncommon locally on the bluff. Some of these species included Pachysandra (*Pachysandra procumbens*), early Saxifrage (*Saxifraga virginiensis*), and bloodroot (*Sanguinaria candensis*). Trillium and other herbaceous plants are isolated along the ridge line. Several woody plants including American chestnut (*Castanea dentata*), bladdernut (*Staphylea trifolia*), Allegheny chinkapin (*Castanea pumila*), and fringetree (*Chionanthus virginicus*) can also be found as associates along the bluff.

Aquatic Habitats

The dynamic nature of the flooding regime from the Noxubee River, lesser creeks, and associated wetland habitats provide a renewable fishery resource on the refuge. The creeks, sloughs, and lakes support a diverse warm water fishery, including largemouth bass (*Micropterus salmoides*), spotted bass (*M. punctulatus*), black crappie (*Pomoxis nigromaculatus*), white crappie (*P. annularis*), bream (*Lepomis* spp.), channel catfish (*Ictalurus punctatus*), and blue catfish (*I. furcatus*). Nongame fish such as common carp (*Cyprinus carpio*), freshwater drum (*Aplodinotus grunniens*), and bigmouth buffalo (*Ictiobus cyprinellus*) are also found in refuge waters. When flooding occurs in the spring, the backwater areas provide excellent nurseries for juvenile fish. These waters also provide essential habitat for a host of reptile and amphibian species.

Man-made Lakes

Three man-made lakes exist on the refuge. Bluff (609 acres) and Loakfoma (453 acres) lakes have water control structures that allow the refuge to actively manage water levels. The refuge's man-made lakes are waterfowl habitat and enjoyed by recreationalists. The marshy shores and shallow waters provide excellent wildlife habitat for a variety of species. The Loakfoma Lake bottom was recently contoured using heavy equipment to provide increased waterfowl and fisheries habitats. The Ross Branch Reservoir (34 acres) provides water to flood moist-soil impoundments through gravity flow.

Streams

A wide variety of wildlife is dependent upon streams for their survival, including mussels, fishes, amphibians, and reptiles. Riparian zone habitats created by streams sustain the most dynamic collection of wildlife. Healthy riparian zones stabilize the stream banks, and provide organic input and woody structure into stream channels.

Moist-soil Impoundments

Moist-soil impoundments are man-made impoundments managed for native grasses, sedges, and other wildlife beneficial plants. The Jones Creek moist-soil area is subdivided into 11 small impoundments. Each impoundment contains individual water control structures but water from Ross Branch Reservoir must flow through upper impoundments to reach lower ones.

Greentree Reservoirs

Four GTRs exist on the refuge and total approximately 1,359 acres. GTR-4 (620 acres) and GTR-3 (547 acres) are positioned in series with Jones Creek feeding them. GTR-1 (131 acres) and GTR-2 (214 acres) are located in series with waters from Bluff Lake feeding them. Levees and individual water control structures are used to block existing streams flowing through these units.

HABITAT INFLUENCES

Prescribed Fire and Wildfires

Wildfires are documented occurring within refuge boundaries but are very infrequent possibly due to the consistent use of prescribed fire. Up to 6,000 acres of forested habitat have been treated with prescribed fire yearly. The majority of this burning is accomplished in pine habitats and to a lesser extent in pine/hardwood habitats. Prescribed fire in combination with herbicides is a valuable tool that primarily retards succession in the midstory and understory vegetation as it eliminates shrubs and small trees, allowing increased growth of grasses and herbaceous plants. Additional benefits of prescribed fire include reducing the risk and catastrophic effect of wildfire, as well as functioning to recycle nutrients locked up in woody vegetation.

Exotic, Invasive, and Nuisance Species

Invasive and nuisance species occur throughout the refuge including terrestrial and aquatic systems. The four animal species with the highest potential to damage habitat on the refuge and yet remain controllable are the beaver, southern pine beetles (*Dendroctonus spp.)*, white-tailed deer, and feral hogs (*Sus scrofa*). Beaver and white-tailed deer are native species with control measures already in place. Beaver are managed on an individual dam by dam basis. Beaver and dams specifically cause damage to the biological resources and real property as a result of unwanted flooding of

areas during the growing season, by clogging of water control structures, and burrowing into levees, are removed by staff. White-tailed deer populations are controlled using public hunts. The southern pine beetle, a pest species that can quickly kill pine trees under the right environmental conditions, is of most concern within pine forest having high basal areas and closed canopies. Feral hogs are a newly documented invasive species to occur on the refuge and may quickly become a problem within the eastern and southern management units of the refuge. Hogs are known to consume and destroy a variety of native flora and fauna. Amphibians, reptiles, ground and low nesting birds are susceptible to loss due to these feral animals.

The number of invasive plant species of concern on the refuge is currently less than ten. This includes cogongrass (*Imperata cylindrica*), Japanese stiltgrass (Microstegium vimineum), Chinese privet (*Ligustrum sinense*), alligatorweed (*Alternanthera philoxeroides*), hydrilla (*Hydrilla verticillata*), Argentine Ant (*Linepithema humile)* and Johnsongrass (*Sorghum halepense*). Other exotic plant species may be present on the refuge but not yet documented.

Proposed Wilderness Area

In December 1974, a Wilderness Review was completed resulting in a 1,200-acre proposed wilderness within the National Wilderness Preservation System at the refuge (Figure 8). The proposed wilderness is bounded by the Noxubee River on the west and north, Oktoc Creek on the south, Bluff Lake on the southeast, and Bluff Lake Road on the east. Currently, the proposed wilderness area is managed as a wilderness using the guidance in the refuge manual 6 RM 8, Wilderness Area Management.

HABITAT CHANGES FROM HISTORIC TO CURRENT CONDITION

Data presented by Hansen et al. (2013) show that the Mississippi landscape, beyond the borders of the refuge, is dominated by forested habitats subject to repeated conversion. These maps show the refuge as a notable patch of ‘Forest Extant’ inset within areas predominantly identified as ‘Both (forest) Loss and Gain,’ indicating rotational forests which are periodically cleared and regrown(Figure 9). Comparison of current to historic habitat conditions reveals today’s refuge as having approximately 1,391 acres of open water and 1,170 acres of fields and other open areas that previously did not exist. In addition, the refuge’s quantity of forest types differs from that found historically. Today’s refuge possesses an additional 2,494 acres and 5,076 acres of upland hardwood and pine forests, respectively. In contrast, the refuge possesses 3,511 acres and 6,620 acres less of bottomland hardwood and bald cypress forest, respectively.

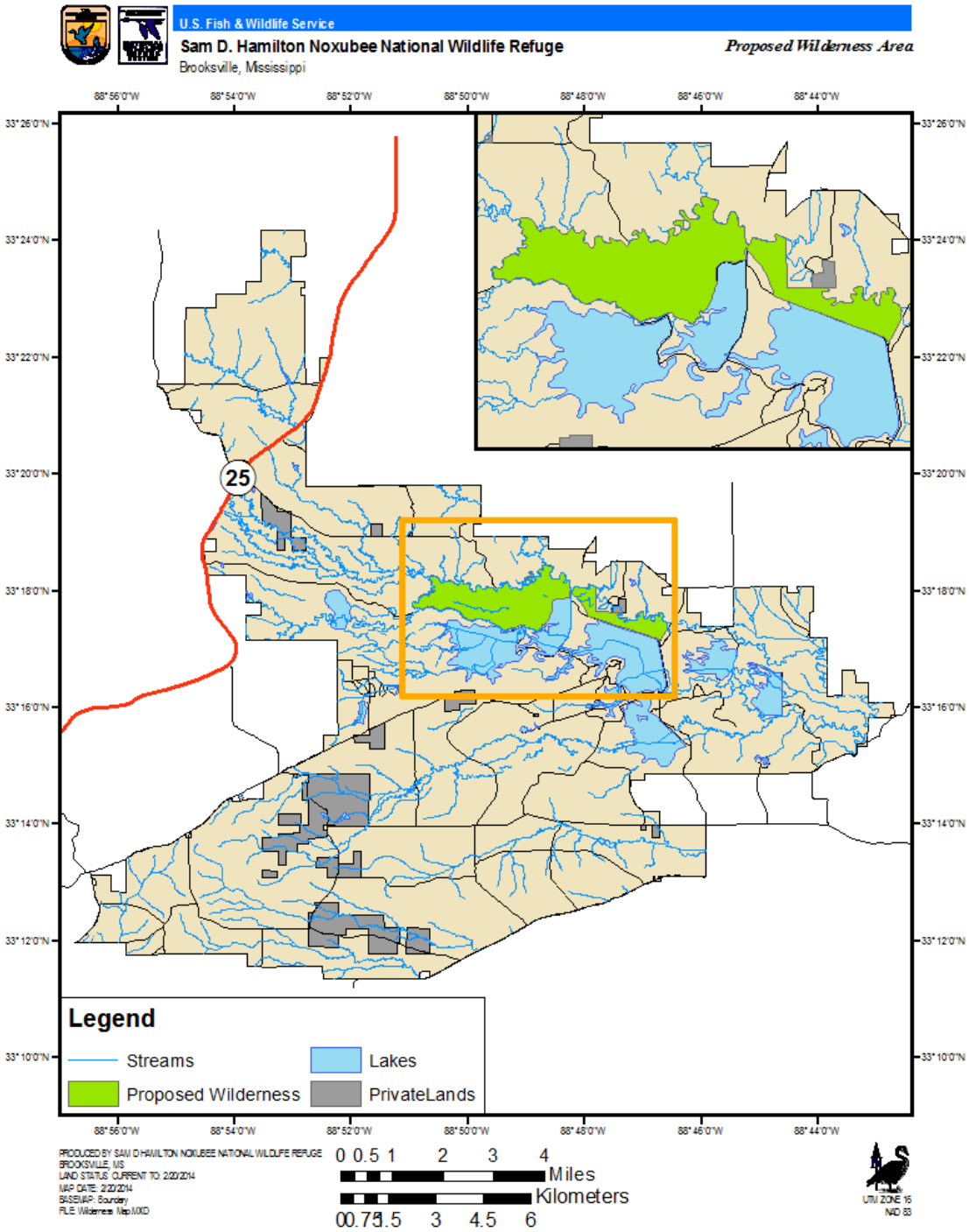


Figure 8. Location of proposed wilderness, Sam D. Hamilton Noxubee NWR, Mississippi.

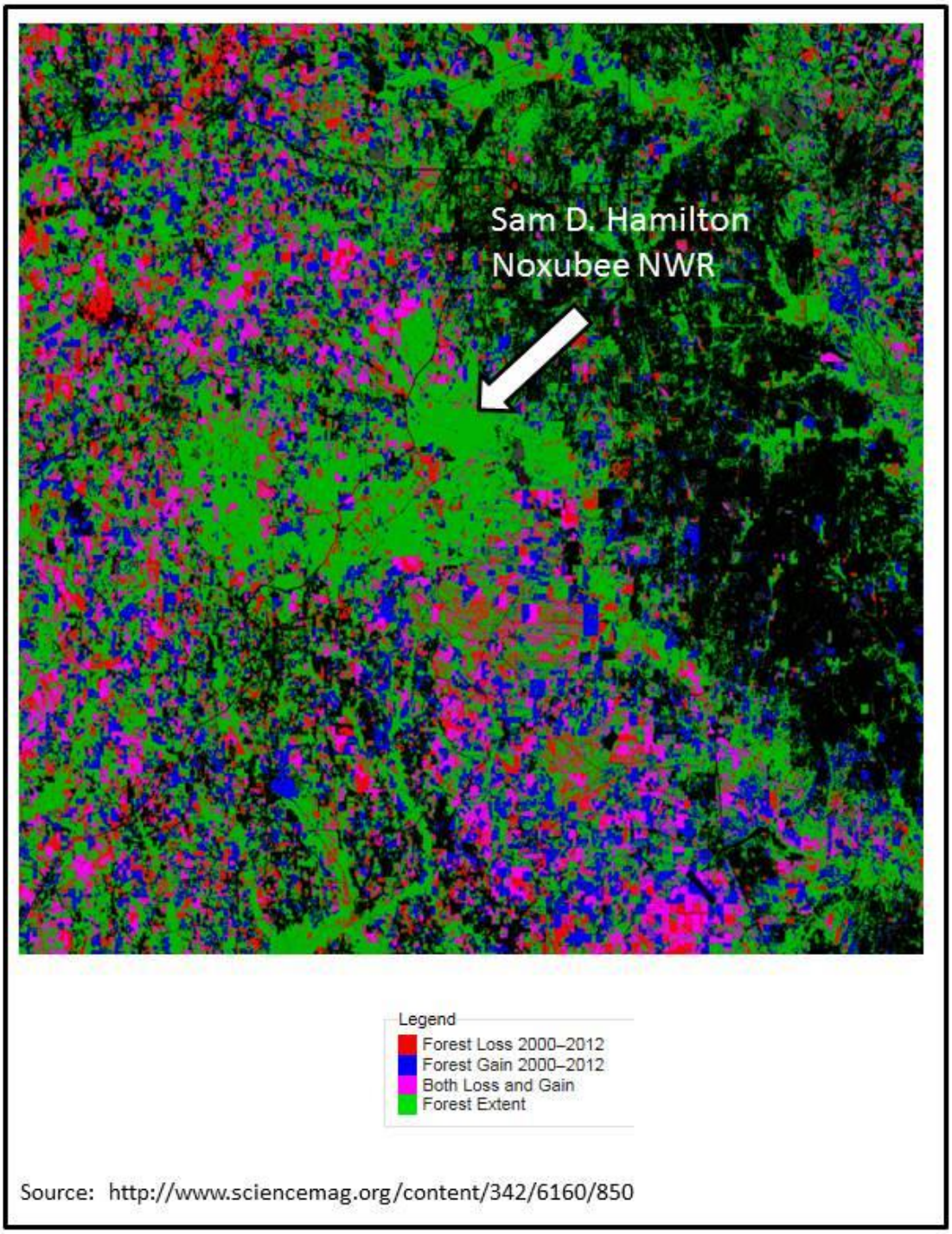


Figure 9. High-resolution map of forest Cover Change 2000-2012 (Hansen et al. 2013).

CHANGES ASSOCIATED WITH GLOBAL CLIMATE CHANGE

The potential for rapid and lasting climate warming poses a significant challenge for fish and wildlife conservation. Although Mississippi's climate is already highly variable with hot summers and cool to cold winters, current predictions suggest the state's climate will be subjected to 34 more days of summer weather over 90 degrees Fahrenheit within the next 15 years. Species' abundance and distribution are dynamic, relative to a variety of factors, including climate. As the climate changes, the abundance and distribution of wildlife and fish will also change. Climate warming will be a particular challenge for threatened, endangered, and other "at risk" species (USFWS 2008a).

A changing climate will force change in the stewardship of the Refuge System. Potential challenges posed by a changing climate might include the following:

- Changing fire regimes;
- Changing patterns of precipitation;
- Changing access to water resources;
- Altered hydrology in rivers and wetlands;
- Increased frequency of extreme weather events;
- Changes in plant community types;
- Changing abundance and distribution of fish, wildlife, and plant species; and
- Changes in the timing (phenology) of synchronized, interdependent phenomena, so that they no longer coincide.

Climactic changes will likely amplify current management challenges involving habitat fragmentation, urbanization, invasive species, disease, parasites, and water management. Highly specialized or endemic species are likely to be most susceptible to the additional stresses of changing climate.

Some climate change models have predicted that within the Mississippi pine forests, decreases in growing season rainfall and overall average rainfall are likely to occur (McNulty 1996). In addition, both growing season and average annual temperatures are predicted to increase. Because of this, many pine species, including loblolly pine, which is the dominant pine species on the refuge, could become at risk due to instances of drought and increases in air temperatures that exceed the range for optimal photosynthesis. Another factor to consider is the possibility of an increase in prevalence of the southern pine beetle, which responds positively to warm winter temperatures (Gan 2004). Because the refuge manages a vast amount of pine acreage for RCWs, this information is important to consider in our future management practices. Longleaf pine (*Pinus palustris*) once covered vast tracts of land in the southeastern United States. It has been suggested that integrating loblolly and other pine species with this historical pine species can alleviate some effects of global climate change, since this species is drought and insect resistant, long-lived, and survives surface fire conditions at all life stages (NWF 2009). By

thus improving ecosystem resilience, we can better ensure the habitat needs of our species of concern are provided.

Waterfowl is a priority species of management concern at the refuge, and the increasing potential for drought in the southeast may reduce water supply at the refuge. Because water is the most critical component of moist-soil management, decisions that benefit wintering waterfowl and help to reduce shortages of this resource are crucial.

Many species of reptiles have temperature-dependent sex determination, meaning that the air temperature at the time of egg incubation determines the sex of the offspring. With warmer temperatures predicted, shifts in population demographics of reptiles on the refuge, including turtles and alligators, may be possible (Ferguson and Joanen 1982, Janzen 1994).

MANAGEMENT UNIT DESCRIPTIONS

The refuge has 18 management units designated whose boundares reflect historic forest types (Figure 10). Table 1 describes each management unit's total acres, current cover type, acres by cover type, percent cover type, historic forest type, and forest treatment history. In addition, the current habitat conditions and constraints on habitat management are further described for each unit in association with the management prescriptions.

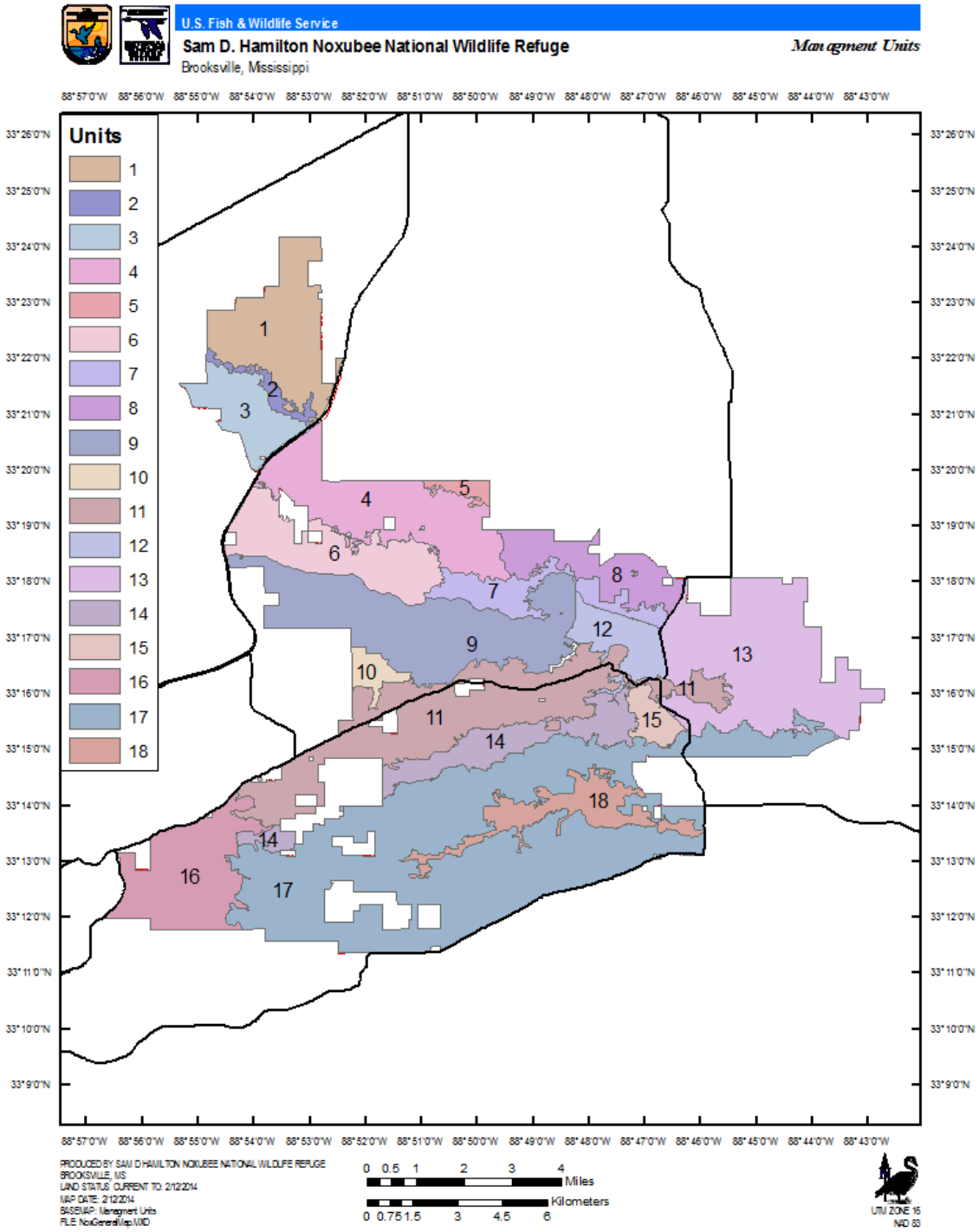


Figure 10. Management units, Sam D. Hamilton Noxubee National Wildlife Refuge, Mississippi.

Table 1. Habitat Management Units, Sam D. Hamilton Noxubee NWR, Mississippi

Management Unit	Total Acres	Current Cover Type	Acres by Cover Type	Cover Type %	Historic Condition (Landfire)	Forest Habitat Treatment History (Total Acres)
1 Craig Pond Unit	2,714	Pine	2,050	76	Bald Cypress-Red Cedar, Mixed Pine Species	19 Acre Pine Seedtree 1994 86 Acre Pine Seedtree 1996 61 Acre Pine Seedtree 1997 37 Acre Pine Seedtree 2011 75 Acre Pine Thinned 2013
		Pine/Hardwood	450	17		
		Upland Hardwoods	60	2		
		Mixed Species	46	2		
		Bottomland Hardwoods	101	4		
2 Chinchahoma Creek Unit	290	Bottomland Hardwoods	290	100	Bald Cypress-Red Cedar, American Sycamore-Sugarberry-Pine	No Known Treatments
3 Ennis Road Unit	1,272	Pine	835	66	Loblolly Pine- Willow Oak,	14 Acre Pine Seedtree 2011 19 Acre Pine

Management Unit	Total Acres	Current Cover Type	Acres by Cover Type	Cover Type %	Historic Condition (Landfire)	Forest Habitat Treatment History (Total Acres)
		Pine Hardwood	437	34	Bald Cypress-Red Cedar, American Sycamore-Sugarberry-Pine	Seedtree 2001
4 Cedar Grove North Unit	3,338	Pine	2,234	67	Bald Cypress-Red Cedar Loblolly Pine- Willow Oak American Sycamore- Sugarberry-Pine Shortleaf Pine-Oaks	27 Acre Pine Seedtree 1989 20 Acre Pine Seedtree 1989 29 Acre Pine Seedtree 1991 26 Acre Pine Seedtree 199122 Acre Pine Seedtree 1997 28 Acre Pine Seedtree 1998 19 Acre Pine Seedtree 1998 16 Acre Pine Thinning 2001 26 Acre Pine Seedtree 2002 21 Acre Pine Seedtree 2002 60 Acre Pine
		Pine/Hardwoods	921	28		
		Bottomland Hardwoods	115	3		
		Upland Hardwoods	68	2		

Management Unit	Total Acres	Current Cover Type	Acres by Cover Type	Cover Type %	Historic Condition (Landfire)	Forest Habitat Treatment History (Total Acres)
						Seedtree 2005 32 Acre Pine Seedtree 2005 1015 Acre Salvage 2006
5 Chinchahoma Creek East Unit	220	Upland Hardwoods	205	93	Willow Oak-Water Oak-American Elm Loblolly Pine- Willow Oak	No Known Past Treatment
		Bottomland Hardwoods	15	7		
6 *Keaton Tower* North Unit	2,370	Bottomland Hardwoods	2,016	85	Loblolly Pine- Willow Oak Willow Oak-Water Oak-American Elm Bald Cypress-Red Cedar	123 Acre Hardwood Regen 1990 59 Acre Hardwood Regen 1991 115 Acre Regen Pine 1995 80 Acre Hardwood Regen 2003 222 Acre Storm Salvage 2006
		Pine	293	12		
		Upland Hardwoods	45	2		
		Field	20	1		

Management Unit	Total Acres	Current Cover Type	Acres by Cover Type	Cover Type %	Historic Condition (Landfire)	Forest Habitat Treatment History (Total Acres)
7 Wilderness Area Unit	1,152	Bottomland Hardwoods	1,143	99	Willow Oak-Water Oak-American Elm Loblolly Pine- Willow Oak American Sycamore-Sugarberry-Pine	1 Acre mix-pine 2006 5 Acre Storm Salvage 2010
		Pine Hardwood	9	1		
8 Beattie Camp Unit	1,590	Bottomland Hardwoods	1,010	64	Willow Oak-Water Oak-American Elm Loblolly Pine- Willow Oak White Oak- Post Oak Shortleaf Pine- Oak American Sycamore-Sugarberry-Pine Post Oak -Eastern Red Cedar	152 Acre Hardwood Regen 1981
		Pine	462	29		
		Pine Hardwood	52	3		

Management Unit	Total Acres	Current Cover Type	Acres by Cover Type	Cover Type %	Historic Condition (Landfire)	Forest Habitat Treatment History (Total Acres)
		Beaver Pond	58	4		
		Water	8	1		
9 Oktoc Creek Unit	4,728	Bottomland Hardwoods	3,960	84	Willow Oak-Water Oak Loblolly Pine- Willow Oak American Sycamore-Sugarberry Open Water	159 Acre Hardwood Regen 1976 9 Acre Salvage 2006 19 Acre Salvage 2007
		Pine	577	12		
		Pine Hardwood	80	2		
		Moist Soil	75	2		
		Field	28	1		

Management Unit	Total Acres	Current Cover Type	Acres by Cover Type	Cover Type %	Historic Condition (Landfire)	Forest Habitat Treatment History (Total Acres)
		Upland Hardwoods	7	<1		
		Water	1	<1		
10 Prisock Field's Unit	338	Moist Soil	201	59	Willow Oak-Water Oak-American Elm Loblolly Pine- Willow Oak American Sycamore-Sugarberry-Pine Post Oak -Eastern Red Cedar	32 Acre Pine Natural Regen 1990 14 Acre Hardwood Natural Regen 2007
		Pine	71	21		
		Field	36	11		

Management Unit	Total Acres	Current Cover Type	Acres by Cover Type	Cover Type %	Historic Condition (Landfire)	Forest Habitat Treatment History (Total Acres)
		Bottomland Hardwoods	30	9		
11 Bluff Lake Road Unit	5,190	Pine	3,535	68	Shortleaf Pine- Oak Loblolly Pine-Willow Oak Bald Cypress-Red Maple Post Oak-Eastern Redcedar Shortleaf Pine-Oaks American Sycamore-Sugarberry-Pine Beech-Cherrybark Oak-Tulip Tree	37 Acre Pine Seed Tree 1988 119 Acre Pine Seed Tree 1990 81 Acre Pine Seed Tree 1991 5 Acre Regen of Old Field 1994 8 Acre Regen of Old Field 1996 25 Acre Pine Seed Tree 1999 47 Acre of Planted Pine 2000 88 Acre Pine Thinning 2002 22 Acre Pine Seed Tree 2002 9 Acre Natural
		Pine Hardwood	751	14		
		Upland Hardwoods	475	9		
		Bottomland Hardwoods	237	5		
		Field	135	3		

Management Unit	Total Acres	Current Cover Type	Acres by Cover Type	Cover Type %	Historic Condition (Landfire)	Forest Habitat Treatment History (Total Acres)
		Water	38	1	Open Water Willow Oak-Water Oak-American Elm	Pine Regen 2003 18 Acre Pine Seedtree 2003 43 Acre Tornado Salvage 2003 6 Acre Tornado Salvage 2004 50 Acre Pine Seed Tree 2004 16 Acre Pine Thinning 2004 21 Acre Pine Seedtree 2005 71 Acre Pine Seed Tree 2007 19 Acre Pine Thinning 2007 7 Acre Pine Seed Tree 2008 27 Acre Pine Seed Tree 2009 18 Acre Pine Regen 2001
		Moist Soil	19	<1		
12 Bluff Lake Unit	1,040	Water/Cypress	869	84	Loblolly Pine-Willow Oak American Sycamore-	No Known Past Treatment

Management Unit	Total Acres	Current Cover Type	Acres by Cover Type	Cover Type %	Historic Condition (Landfire)	Forest Habitat Treatment History (Total Acres)
		Bottomland Hardwood	159	15	Sugarberry-Pine Open Water Willow Oak-Water Oak-American Elm	
		Field	12	1		
13 Noxubee Bottoms Unit	4,890	Bottomland Hardwood	4,420	90	Willow Oak-Water Oak-American Elm American Sycamore-Sugarberry-Pine Loblolly Pine-Willow Oak Bald Cypress-Red Maple	36 Acre Pine Regen 1982 41 Acre BH Regen 1985 66 Acre Pine Regen 1996 27 Acre Pine Thinning 2001 11 Acre Pine Regen 2001 132 Acre Tornado Salvage 2003 45 Acre Hardwood Thinning 2007 25 Acre Hardwood Thinning 2010
		Pine	263	5		
		Field	96	2		
		Pine Hardwood	86	2		
		Right-of-Way	20	1		
		Beaver Slash	5	<1		
14 Loakfoma Creek Unit	1,872	Bottomland	1,439	77	American Sycamore-Sugarberry-Pine	13 Acre Hardwood Salvage 13 Acre Hardwood

Management Unit	Total Acres	Current Cover Type	Acres by Cover Type	Cover Type %	Historic Condition (Landfire)	Forest Habitat Treatment History (Total Acres)
		Hardwood			Bald Cypress-Red Cedar Post Oak-Eastern Redcedar Shortleaf Pine- Oak Loblolly Pine-Willow Oak	Rgen 1996
		Pine	123	7		
		Upland Hardwoods	81	4		
		Pine Hardwood	68	4		
15 Loakfoma Lake Unit	466	Water	431	92	Open Water, Willow Oak-Water Oak-American Elm American Sycamore-Sugarberry-Pine	No Known Past Treatment
		Bottomland Hardwood	35	8		

Management Unit	Total Acres	Current Cover Type	Acres by Cover Type	Cover Type %	Historic Condition (Landfire)	Forest Habitat Treatment History (Total Acres)
16 Bevill's Hill Unit	2,682	Pine	1,502	56	Shortleaf Pine- Oak American Sycamore-Sugarberry-Pine Beech- Cherrybark Oak, Loblolly Pine-Willow Oak, Longleaf Pine	31 Acre Pine Seed Tree 1988 23 Acre Pine Seed Tree 1991 31 Acre Pine Seed Tree 1992 24 Acre Pine Seed Tree 1993 49 Acre Pine Seed Tree 1996 19 Acre Pine Seed Tree 1999 45 Acre Pine Seed Tree 2006
		Upland Hardwoods	898	33		
		Pine Hardwood	278	10		
		Dirt Pit	4	1		
17 Section Line Road Unit	12,400	Pine	9,246	62	Loblolly Pine-Willow Oak	40 Acre Pine Seed Tree 1980 21 Acre Pine Seed

Management Unit	Total Acres	Current Cover Type	Acres by Cover Type	Cover Type %	Historic Condition (Landfire)	Forest Habitat Treatment History (Total Acres)
		Bottomland Hardwood	288	14	American Sycamore-Sugarberry-Pine Willow Oak-Water Oak-American Elm Shortleaf Pine- Oak	Tree 1984 90 Acre Pine Seed Tree 1988 85 Acre Pine Seed Tree 1989 91 Acre Pine Seed Tree 1990 74 Acre Pine Seed Tree 1991 81 Acre Pine Seed Tree 1992 42 Acre Pine Seed Tree 1993 33 Acre Pine Seed Tree 1996 157 Acre Pine Seed Tree 1997 40 Acre Pine Seed Tree 1998 105 Acre Pine Seed Tree 1999 64 Acre Pine Seed Tree 2000 35 Acre Pine Seed Tree 2001 104 Acre Pine Seed Tree 2003 96 Acre Pine Seed
		Pine Hardwood	1,837	12		
		Upland Hardwoods	632	8		
		Field	294	2		
		Mixed	87	1		
		Right-of-Way	13	<1		

Management Unit	Total Acres	Current Cover Type	Acres by Cover Type	Cover Type %	Historic Condition (Landfire)	Forest Habitat Treatment History (Total Acres)
						Tree 2004 105 Acre Pine Thinning 2004 126 Acre Pine Seed Tree 2005 33 Acre Pine Thinning 2007 16 Acre Pine Bug Salvage 2007 41 Acre Pine Seed Tree 2007 159 Acre Thinning 2007 19 Acre Pine Thinning 2008 104 Acre Pine Thinning 2010 37 Acre Pine Seed Tree 2011 113 Acre Pine Thinning 2011 82 Acre Pine Thinning 2012
18 Lynn Creek Unit	2,004	Upland Hardwood	934	47	American Sycamore-Sugarberry-Pine Loblolly Pine-Willow	13 Acre Hardwood Salvage 2006 7 Acres Pine Regen 1997

Management Unit	Total Acres	Current Cover Type	Acres by Cover Type	Cover Type %	Historic Condition (Landfire)	Forest Habitat Treatment History (Total Acres)
		Bottomland Hardwood	417	21	Oak	4 Acre Pine Regen 1996
		Pine	412	21		
		Pine Hardwood	133	7		
		Moist Soil	70	3		
		Field	38	2		

CHAPTER III. RESOURCES OF CONCERN

Resources of Concern are defined by the Policy on Habitat Management Plans (620 FW 1) 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." The National Wildlife Refuge System (Refuge System) has further outlined a process for refuges to identify and prioritize Resources of Concern for management purposes, which uses a focal species approach. Additional refuge specific assessments are used to prioritize resources, including aspects such as relevance to local biological diversity and environmental health, role as an indicator, potential of the refuge habitats to support, responsiveness to management action, and partner priorities. Although the Resources of Concern terminology can imply to some readers that other resources not specifically highlighted within the Habitat Management Plan are not of concern, this is not the case. The identified Priority Resources of Concern should instead be recognized as the refuge priority resources to be used to define habitat management objectives and priorities, and are often focal species, suites, or communities which may represent the habitat needs of many additional complimentary species. Appendix J describes the habitat associations for several species of complimentary need expected to benefit from habitat management occurring under the goals and objectives of this plan.

The following species and suites of species have been identified as the priority Resources of Concern for the refuge's HMP in recognition of the (1) Endangered Species Act; (2) Migratory Bird Conservation Act; (3) refuge establishing purposes; (4) identification in CCP; (5) identification in other conservation plans; (6) the potential for the refuge to provide habitat to meet necessary life cycle components for each species/suite of species; (7) the species/suite of species can respond to habitat management; and (8) best science and professional judgment. The following were identified as priority Resources of Concern:

- Red-cockaded woodpecker
- Waterfowl (Wintering Waterfowl and Breeding Wood Duck)
- Forest Breeding Birds (surrogates: Louisiana Waterthrush (*Parkesia motacilla*), Wood Thrush (*Hylocichla mustelina*), Prothonotary Warbler (*Protonotaria citrea*), Yellow-throated Warbler (*Dendroica dominica)*, and Rusty Blackbird (*Euphagus carolinus)*)

While habitat objectives and strategies will be established based primarily on the habitat needs of the above identified Resources of Concern, it is recognized that refuges can and should be managed through an adaptive management approach that addresses first and foremost Resources of Concern for the purpose of habitat management planning and also those others that can be benefited within the scope of habitat objectives and that represent the intricacy and diversity of the ecosystem. It is expected that the identified Resources of Concern will also serve as surrogate species for other species having complimentary needs.

RED-COCKADED WOODPECKER

SIGNIFICANCE

The red-cockaded woodpecker (RCW) has been selected as a priority Resource of Concern due to several factors. Most significantly, the species is listed as federally endangered and the refuge bears regulatory and Recovery Plan specific responsibilities to the species. Further, there is a specific conservation plan (RCW Recovery Plan) that cites the refuge as a support population for the species. Five management units within the refuge, Management Units 3, 4, 11, 16 and 17, have potential to provide some level of habitat for the species, as the refuge anticipates being able to support 49 clusters (groups) throughout the refuge (Figure 11). 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 2003) 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.

The RCW population on the refuge has undergone significant changes since 1989, when intensive management of the birds began on the refuge. Initially the population rapidly expanded with the incorporation of artificial cavities and the creation of numerous recruitment clusters throughout the refuge's pine habitats. By 1992, the population had doubled to 34 active clusters and reached a high of 44 clusters in 2000. However, in 2002 a decline in the number of clusters began and continued through 2012. The latest survey in 2014 revealed 27 potential breeding pairs and one single male cluster making the total 28 active clusters (Steven Lewis per comm.). A total of 55 natural and artificially created partitions have been monitored for bird activity (Figure 12).

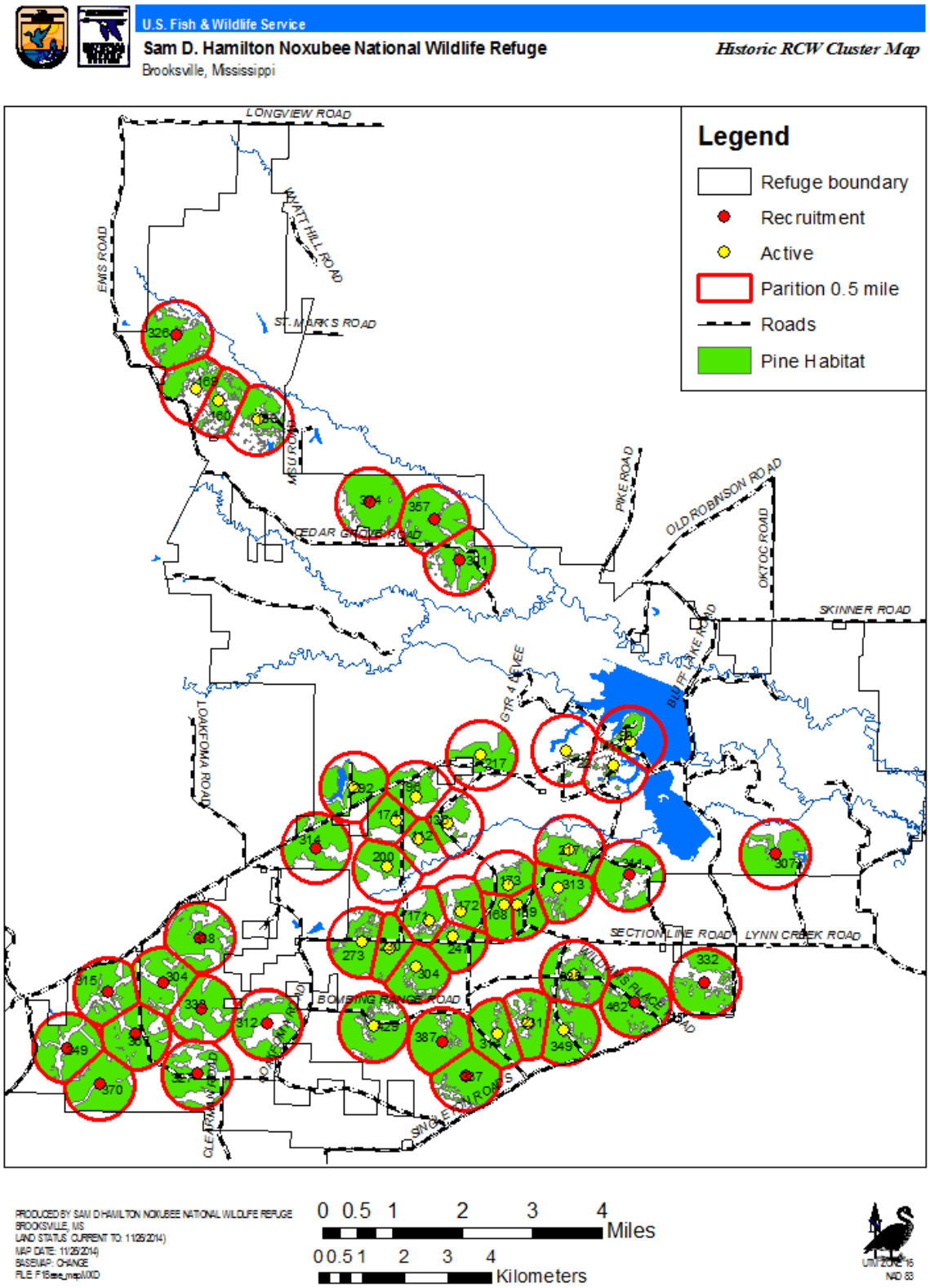


Figure 11. Locations of active and proposed recruitement partitions based on spatial analysis.

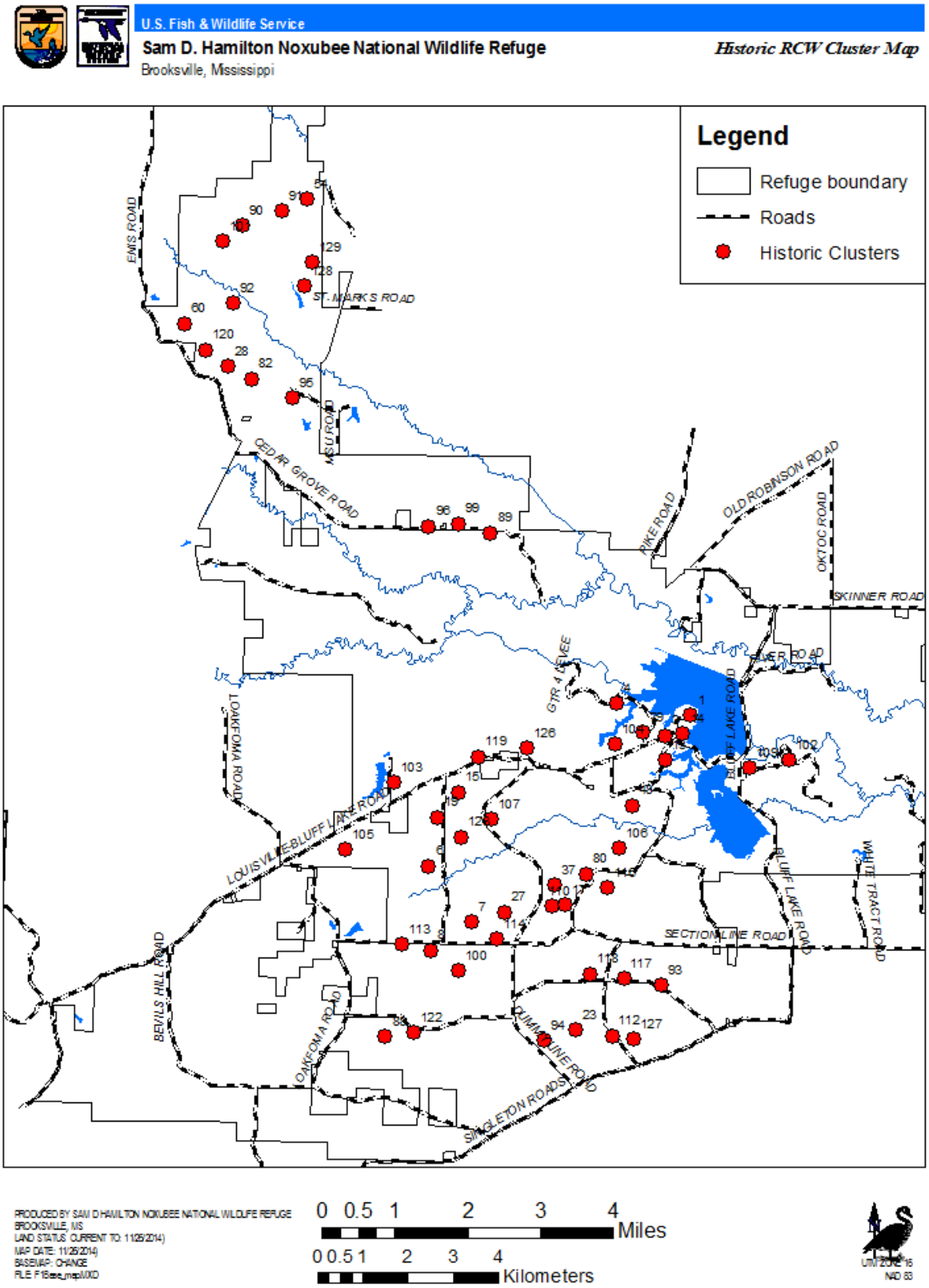


Figure 12. Location of 55 monitored active, inactive and abandoned red-cockaded woodpecker clusters and partitions, Sam D. Hamilton Noxubee NWR, 2014..

IDENTIFICATION OF HABITAT REQUIREMENTS

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 2003). 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 2003). 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, isstrongly 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 (MMS). It will be the goal of the refuge to manage all active partitions toward the goal of reaching GQFH.

Table 2. Good quality foraging habitat criteria (USFWS 2003)

Good Quality Foraging Habitat (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

SPECIES OF COMPLIMENTARY HABITAT NEEDS

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

Actual partitions could be mapped based on realized home ranges in order to conduct forage habitat analyses but this information is not currently available. Instead, 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 pine 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 28 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.

Assuming all currently active clusters can remain active regardless of the total acreage of pine available within their partitions, spatial analysis indicates the refuge can potentially support these 28 active partitions and an additional 21 recruitment clusters leading toward a possible future total of 49 active groups of RCW on the refuge (Figure 11). An estimated 8,865 acres of forested habitat within 26 of the indicated 49 partitions appear suitable for providing contiguous pine-dominated habitat conditions of sufficient size to be managed for long-term GQFH. Providing sustainable mature forest for RCWs could create an extremely unique habitat within this area of the state, as most adjoining lands are managed under a short rotational commercial forestry strategy.

At the time this plan was written, none of the habitat within any of the active or inactive partitions meets the criteria for GQFH. Total stand basal area is too high, groundcover is limited, hardwood midstory 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.

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.

WATERFOWL

SIGNIFICANCE

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, geese, 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), although receives no specific duck energy day allocation from the Service's Division of Migratory Birds. This suite of species responds well to water and habitat management such as moist-soil management, crop management, GTR management, and water level management of standing water bodies, all of which are potential provisions within the refuge.

The refuge serves as an important migratory and wintering ground for thousands of migratory waterfowl as well as a breeding ground for wood ducks. The refuge occupies a unique location within the non-delta Mississippi landscape and provides some of the only public managed waterfowl habitat in the EGCP landscape. The dominant waterfowl species on the refuge are mallard, wood duck, hooded merganser, and ringed necked duck. The refuge supports approximately 500 Canada geese with migratory geese being uncommon. The refuge supports a large local breeding population of wood ducks and lesser population of breeding hooded mergansers.

IDENTIFICATION OF HABITAT REQUIREMENTS

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 bottomland hardwood wetlands: herbaceous vegetation, woody vegetation, forest litter, and macroinvertebrates (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, thermal cover, and feeding (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 wigeon 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).

Flooded agricultural fields coupled with moist-soil management can provide important wildlife habitat (Tirpak et al. 2009) and lessen the number of acres of moist-soil and flooded GTR habitat required yearly. Agricultural crops can provide high energy food resources for waterfowl. Annual agricultural practices can also increase the productivity of moist-soil units by stimulating the growth of desirable plants. Crops preferred by waterfowl include corn, rice, milo, millet, wheat, soybeans, and buckwheat.

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 and geese pair and perform other life functions (e.g., females of some species [e.g., mallard] undergo a prebasic molt to acquire their breeding-season plumage) in readiness for reproduction. Disturbance-free habitat enables some species of waterfowl to prepare biologically for spring migration and reproduction (Reinecke *et al.* 1989, Strickland 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). Paulus (1984) found in Louisiana that increased foraging time by gadwalls was insufficient to counterbalance disturbance factors.

SPECIES OF COMPLIMENTARY HABITAT NEEDS

The habitat needs of waterfowl are consistent with a variety of forested and open wetland habitat species, including avian, terrestrial, and aquatic species. For example, management for the habitat needs of this species can provide benefits to a variety of other species known to use open and forested wetlands (e.g., wood stork, bald eagle, American alligator, various snakes and turtles, various amphibians).

POTENTIAL REFUGE CONTRIBUTION TO HABITAT NEEDS

The refuge can provide natural undisturbed rivers, man-made lakes, natural and artificially flooded forests, beaver impounded areas, managed moist-soil and agricultural fields, and sanctuaries for waterfowl. The refuge can also increase the amount of scrub/shrub habitat for wood duck broods within the annually flooded areas. Silvicultural practices can be used within forests used by waterfowl to promote forest structure and species diversity to ensure production of hard and soft mast.

FOREST BREEDING BIRDS

SIGNIFICANCE

Forest breeding birds, represented by five surrogates (i.e., prothonotary warbler (*Protonotaria citrea*), yellow-throated warbler (*Dendroica dominica*), Louisiana waterthrush (*Parkesia motacilla*), rusty blackbird (*Euphagus carolinus*), and wood thrush (*Hylocichla mustelina*)), were selected as a priority Resource of Concern due primarily to the recognized impacts of surrounding landscape conversion on bird populations and the ability of these species to serve as surrogates for other migratory birds of similar habitat needs. This broad suite of species is a trust resource as defined by the Migratory Bird Treaty Act, and similarly are consistent with refuge's migratory bird purpose. The selected surrogate species are additionally specifically highlighted in landscape level conservation plans (Partners in Flight North American Landbird Conservation Plan, Mississippi Comprehensive Wildlife Conservation Strategy, Red-cockaded Woodpecker Recovery Plan, North American Waterfowl Management Plan). The refuge has existing appropriate habitat and currently provides habitat values to forest breeding birds. This suite of species is expected to respond well to increases in hardwood habitat and to serve well to define generally beneficial forest conditions for many species of hardwood forest dependent wildlife. The refuge functions as stopover habitat and breeding grounds for various neotropical migratory birds, including many warbler, sparrow, thrush, flycatcher, vireo, woodpecker, nuthatch, wren and tanager species. The refuge also provides important overwintering habitat for northern species, such as white-throated sparrows, brown creepers, dark-eyed juncos, northern cardinals, blackbirds, waxwings, pipits, wrens, and snipe. Non-migratory species, such as Carolina chickadees and Carolina wrens, depend on the refuge for all life history stages.

IDENTIFICATION OF HABITAT REQUIREMENTS

Generally, forest interior birds require large tracts of un-fragmented forest for good breeding success to avoid nest parasitism by brown-headed cowbirds (Robinson and Wilcove 1994). Good vertical structure within the canopy, midstory, and understory generally provides the best habitat for forest birds' nesting and foraging habitat (LMVJV Forest Resource Conservation Working Group 2007). The creation and maintenance of the desired forest conditions is important to meeting the needs of these bird species (Table 3 and 4). The majority of the mixed pine/hardwood and bottomland hardwood forests will be managed for forest breeding birds.

Prothonotary warbler: Threatened by habitat deforestation and conversion within the southeast, prothonotary warblers are common migratory birds associated within bottomland hardwood and

floodplain forests of the refuge. As a secondary cavity nester, prothonotary warblers will occupy abandoned woodpecker cavities or other natural cavities contained within dead snags or branches of living trees. Nests are customarily located over or within 5 meters of large bodies of stagnant or slow-moving water, creeks, and streams such as the Noxubee River and its tributaries or seasonally flooded bottomland hardwood forest and bald cypress swamps. Common nest-cavity trees are bald cypress, willows, and sweet gum. Canopy height may significantly vary between 12 and 40 meters and canopy cover approximates 50-75 percent. Ground vegetation is sparse and of low stature. The relatively open microhabitat also provides suitable foraging habitat for the Acadian flycatcher (Petit 1999). GTRs within the refuge also provide excellent habitat for prothonotary warblers. After drawdown, small pools of water will provide excellent foraging habitat. The backwaters of Bluff Lake provide many forested acres that provide adequate habitat as well. Prone to nest parasitism by brown-headed cowbirds and exhibiting area sensitivity to habitat fragmentation, prothonotary warblers flourish at the refuge where forests greatly exceed 100 hectares.

Louisiana waterthrush: Abundant within late-successional forests rather than mid- or early-successional forests, the Louisiana waterthrush occupies a variety of habitat types ranging from mature deciduous forest to bottomland hardwoods. Because anthropogenic land uses and acidification processes degrade streambeds, the Louisiana waterthrush is highly dependent on medium to high grade, first- to third-order streams such as the Noxubee River and Oktoc Creek and their associated tributaries to forage for benthic macroinvertebrate communities. Preferential to selecting stream orders of high water quality, the Louisiana waterthrush requires well-developed pools and riffles with rocky or sandy substrate. The refuge forest provides nesting cover, such as small cavities and hollows within upturned and fallen trees. Exhibiting habitat sensitivity not only to stream order and water quality, the Louisiana waterthrush requires forest area greater than 350 hectares with the following habitat specifications: > 80% of canopy cover, <25% shrub cover, a 30-69% ratio of deciduous to coniferous cover, and <25% herbaceous cover (Mattsson et al. 2009).

Yellow-throated warbler: With limited expanses of bottomland hardwood forest found in this portion of the state, the refuge plays an important role within the landscape for the yellow-throated warbler. Nesting near water and at the end of horizontal canopy limbs of mature bottomland hardwoods and cypress swamps, such as that contained within Bluff Lake, the nests are constructed of leaves, herbaceous vegetation, and pine needles. Selective of foraging substrate, the yellow-throated warbler is strongly preferential to bald cypress and tupelo while avoiding other tree species, especially red maple. The yellow-throated warbler is also known to occupy dry, upland oak-pine forest and will forage on pine cones of loblolly pine, an abundant coniferous species on the refuge (McKay and Hall 2012).

Wood thrush: Within floodplains and forests such as those provided by the refuge, the wood thrush is preferential to mid- to late-successional timber classes within transitional shrub lands, deciduous and mixed forests, and woody wetlands; it is well documented that wood thrushes avoid evergreen plantations and forest compositions. The species requires forests comprised of moderate density of mid-canopy trees and shrubs for nesting and open understories providing ample leaf litter for foraging. Although displaying area sensitivity, wood thrushes will nest in

small forest fragments (<0.3 ha) and narrow riparian strips (<150 m in width) but in low densities and are often unsuccessful due to nest parasitism by brown-headed cowbirds and predation. Nest efficiency and productivity significantly increase when habitat is greater than 80 ha and buffers are wider than 530 meters. Nest success also correlates with forest suitability, which in turn is influenced by size and landscape context. Large expanses of forest within the refuge will provide necessary edge buffers to reduce nest parasitism by species advantageous of fragmentation. Selective silvicultural harvests may generate nesting and foraging sites if 70-80 percent of the forest remains intact (Evans et al. 2011).

Rusty blackbird: Although extensive historical land conversion has eliminated vast expanses of forested wetlands and bottomland hardwood forests within the southeast, the refuge can provide extensive habitat for overwintering rusty blackbirds. Within forests, wintering rusty blackbirds favor bottomland hardwood forests and bald cypress sloughs, but also occur in croplands and lawns. Rusty blackbirds primarily forage on ground stratum, to a lesser extent on floating mats or emergent vegetation and arboreal foraging. This species feeds on arthropods, insects, and berries in the leaf litter or puddles (Hamel 1992). Greenberg reported that on the wintering grounds, rusty blackbirds are ecological specialists. In bottomland hardwood forests and bald cypress sloughs, they seem to favor shallow, fluctuating surface water beneath or surrounded by forest canopy. The fluctuating water exposes mud flats where the rusty blackbirds forage for invertebrates. Aside from invertebrates, they also feed upon tiny acorn mast such as willow oak acorns and tree nuts. This mast may provide sustenance when conditions are not right for foraging on insects and small fish in vernal pools (Greenberg 2008). Other studies have found that the rusty blackbirds are commonly found in a variety of forested wetlands and adjacent agricultural fields. They appear to depend on forest wetlands with open water, but may use nearby disturbed sites, possibly to supplement with principal winter diet of invertebrates, acorns, and pine seeds with waste grains and weed seeds (Greenberg et al. 2010). However, few studies of non-breeding habitat are available for the rusty blackbird and these only reflect local conditions. No existing study satisfactorily explains how these birds use habitat at a landscape scale, or what the size of such a landscape might be. Until there is more detailed information on typical habitat elements within non-breeding ranges, specification of what constitutes habitat is necessarily general (Hamel et al. 2009).

Table 3. Desired landscape (forest) conditions (LMVJV Desired Forest Conditions 2007).

Habitat Type	Percent of Area	Description
Forest Cover	70-100%	Large (> 10,000 acre) contiguous forested areas are desired, At any point in time, a minimum of 35% and optimum of 50% of the forest should meet the desired stand structure conditions
Actively Managed Forest	70-95%	Forests that are managed via prescribed silvicultural treatments to meet desired stand conditions.
-Regenerating Forest	≤ 10%	Forest regeneration on areas > 7 acres (e.g. patchcuts where >80% of overstory has been removed) or forest restoration on agricultural lands (i.e., reforestation). However, achieving increased forest cover via reforestation overrides the 10% limitation.
-Shrub/Scrub	≤ 5%	Thamnic woody vegetation (hydric or mesic) within bottomland forests, including forests in early seral (successional) stages.
Passively Managed Forest	5-30%	Forest areas that are not subject to silvicultural manipulation (e.g., no-cut, wilderness, set-aside, and natural areas)

Table 4. Desired forest conditions for bottomland hardwood forests (LMVJV Desired Forest Conditions 2007).

Forest Variables	Desired Stand Structure	Conditions that may Warrant Management
Primary Management Factors		
Overstory Canopy Cover	60 – 70 %	> 80 %
Midstory Cover	25 – 40 %	< 20% to > 50%
Basal Area	13.7 – 16 m^2/ha (60 – 70 ft^2/ac) with ≥25% in older age classes	> 20.6 m^2/ha (> 90 ft^2/ac) **or** ≥ 60% in older age classes
Tree Stocking	60 – 70	< 50% or > 90%
Secondary Management Factors		
Dominant Trees	> 5/ha or 2/ac	< 2.5/ha or 1/ac
Understory Cover	25 – 40 %	< 20 %
Regeneration	30 – 40 % of area	< 20% of area
Coarse Woody Debris (> 25 cm or 10 in diameter)	≥ 14 m^3/ha (≥ 200 ft^3/ac)	< 7 m^3/ha (< 100 ft^3/ac)
Small Cavities (> 25 cm (10 in) diameter)	> 10 visible holes/ha (4/ac) **or** **>** 10 "snag" stems/ha ≥ 10 cm DBH (**>** 4/ac ≥ 4 in DBH) **or** ≥ 5 stems/ha > 51 cm DBH (≥ 2/ac > 20 in DBH)	< 5 visible holes/ha (2/ac) **or** **<** 5 "snag" stems/ha ≥ 10 cm DBH (**<** 2/ac ≥ 4 in DBH) **or** < 2.5 stems/ha > 51 cm DBH (< 1/ac > 20 in DBH)
Den Trees/Large Cavities (hole > 25 cm (10 in) diameter)	One visible hole/4 ha (10 ac) **or** ≥ 5 stems/ha ≥ 66 cm DBH (≥ 2/ac ≥ 26 in DBH) (≥ 1.8 m^2/ha BA ≥ 66 cm DBH) (≥ 0.4 ft^2/ac BA ≥ 26 in DBH)	No visible holes /4 ha (10 ac) **or** < 2.5 stems/ha ≥ 66 cm DBH (< 1 stems/ac ≥ 26 in DBH) (< 0.9 m^2/ha BA ≥ 66 cm DBH) (< 0.2 ft^2/ac BA ≥ 26 in DBH)
Standing Dead and/or Stressed Trees	> 15 stems/ha ≥ 25 cm DBH (> 6 stems/ac ≥ 10 in DBH) **or** ≥ 5 stems/ha ≥ 51 cm DBH (≥ 2 stems/ac ≥ 20 in DBH) (> 0.9 m^2/ha BA ≥ 25 cm DBH) (> 0.2 ft^2/ac BA ≥ 10 in DBH)	< 10 stems ≥ 25 cm DBH/ha (< 4 stems/ac ≥ 10 in DBH) **or** < 2.5 stems/ha ≥ 51 cm DBH (< 1 stems/ac ≥ 20 in DBH) (< 0.5 m^2/ha BA ≥ 25 cm DBH) (< 0.1 ft^2/ac BA ≥ 10 in DBH)

Provision of habitat to meet the needs of the selected forest breeding birds (FBB) surrogate species will involve management actions that produce transitory early successional habitat as a byproduct of maintaining extant forest diversity and structure. These temporarily available habitats will provide benefits to a suite of forest breeding birds that prefer early successional

habitat, including indigo bunting, Eastern towhee, brown thrasher, common yellowthroat, Swainson's warbler, and yellow breasted chat.

SPECIES OF COMPLIMENTARY HABITAT NEEDS

Habitat needs of forest breeding birds are consistent with a variety of mixed pine-hardwood and bottomland hardwood habitat species, including wood duck, resident forest bats, wild turkey, white-tailed deer, gray and fox squirrel, raptors, terrestrial snakes, and woodland amphibians. For example, habitat for forest breeding birds will provide a variety of small and large hardwood trees with natural deformities and cavities as well as a mixed pine/hardwood habitat with vertical structure.

POTENTIAL REFUGE CONTRIBUTION TO HABITAT NEEDS

The refuge potentially provides approximately 22,500 acres of appropriate habitat for this suite of species. Management for historical forested conditions as established by the CCP (2014) will provide a significant increase in the amount of improved hardwood habitat for forest breeding birds. Protection of GTRs from prolonged and frequent yearly flooding along with prescribed forest management could improve tree survival, increase species and structural diversity, and provide an environment for increased food sources, cover, and nesting areas for many species of forest breeding birds. Increased recognition of stream-side management zones and creation of management units reflecting hardwood forest breeding bird objectives around major streams will provide increased emphasis for hardwood species and forest breeding birds in habitats previously managed for pine habitat and pine dependent species.

RECONCILING CONFLICTING NEEDS

The intrinsic challenge to integrated habitat management is that the habitat needs of various resources of concern may conflict, requiring prioritization and sometimes mitigation to resolve management decisions consistently within the context of refuge purposes, legal mandates, Service policy, and realistic species and habitat constraints. Ideally, management actions would promote one Resource of Concern without a negative effect on others. This is not always the case and when unavoidable it is necessary to resolve conflicts through compromise or prioritization of the Resources of Concern. The following potential conflicts will be reconciled as follows:

- RCW habitat needs constrain hardwood succession within pine stands and require aggressive management to decrease vertical structure in the midstory and limit hardwood trees in the overstory. This removal of hardwood tree species and vertical structure limits the benefits of habitat for forest breeding birds. Since the RCW is an endangered species, the primary objective for the pine habitats within RCW managed units will be to provide foraging habitat for the RCW; management to meet GQFH criteria will take precedence over needs of other species, including forest breeding birds. However, as within the limits of GQFH, individual hardwood trees, particularly those with unique wildlife characteristics such as cavities and shaggy bark, can be retained and even promoted as long as these trees represent less than 30 percent of the canopy. No

midstory hardwoods will be intentionally retained. Additionally, as RCW partitions are strategically redefined over time to ensure GQFH, those acres not included in active RCW and recruitment partitions will not be subject to intensive control of hardwood species and will be increasingly beneficial to forest breeding birds. The Improvement Act and the policy for Biological Integrity, Diversity and Environmental Health sets a standard for refuge to manage for historic habitat condition in those areas not deemed essential for RCWs. The intended outcome is a net increase in benefit to both RCW and FBB Resources of Concern and reflective of biological integrity (USFWS 2003).

- GTR management for waterfowl has the potential to reduce forest structural complexity and species composition, and even promote tree mortality if conducted outside of recommendations. These affects could negatively impact the diversity and productivity of forest breeding birds. However, the strategy of flooding of GTRs on a rotational basis for waterfowl will ensure that potential negative impacts of consistent annual flooding are not realized.
- Management for waterfowl through provision of agricultural or moist-soil habitat creates fragmentation on the landscape, which is generally a negative impact on habitat for forest breeding birds. This existing conflict is recognized and no conversion of forest to open habitat for waterfowl is proposed by this HMP.
- Fish, including paddlefish, are susceptible to mortality during summer drawdowns of lakes to encourage the growth of moist-soil plants for wintering waterfowl. The construction of deep water habitat, such as already provided in Loakfoma Lake, provides refuge for fish during low water events and may quicken the recovery of fisheries resources within the lakes. Topographic relief conversely provides water edge habitat beneficial for migrating shorebirds and wading birds. Drawdowns also promote tree growth on islands and edges for possible bird roosting and wading bird rookeries.

CHAPTER IV. HABITAT GOALS AND OBJECTIVES

The following objectives refine, clarify, restate, disambiguate, and quantify objectives laid out in the CCP in order to provide detailed guidance to refuge managers. Each objective has an explicit reference to one or more habitat management-related CCP objectives.

CCP Goal B. Habitats (CCP 2014)

Manage and protect habitats for migratory and native wildlife on the refuge to contribute to the purposes for which the refuge was established as well as to fulfill the mission of the National Wildlife Refuge System (620 FW 1, USFWS 2002).

HMP GOAL 1. (CCP 2014 SUB-GOAL B.1)
Pine and Mixed Pine/Hardwood Achieve desired forest conditions within pine forests to protect, manage, enhance, and restore the values and functions of these habitats to sustain the biological needs of native wildlife and migratory birds.
HMP Goal 1. **Pine and Mixed Pine/Hardwood**
Achieve desired forest conditions within pine forests to protect, manage, enhance, and restore the values and functions of these habitats to sustain the biological needs of native wildlife and migratory birds. (CCP 2014 Sub-Goal B.1)

OBJECTIVE 1.1 (CCP OBJECTIVE B.1.1)

Within Management Units 3, 4, 11, 16, and 17, refuge staff will attempt to provide approximately 5,880 acres of beneficial Good Quality Foraging Habitat (GQFH) (Table 2) within all active and planned recruitment RCW clusters yearly, and where sufficient acreage exists optimally supply predictable amounts of habitat to meet long-term requirements of the RCW.

Management Units: 3, 4, 11, 16 & 17

Resource of Concern: Red-cockaded Woodpecker

Rationale: A well-positioned RCW cluster can have up to 502 acres and no less than 300 acres of pine within its partition boundary. RCWs living within a partition will defend and use the area to their yearly biological needs (e.g., roosting, nesting, foraging). The RCW Foraging Habitat Analysis (USFWS 2003) process allows for the identification and assessment of habitat quality within these spatially distributed RCW partitions. The specific metrics for the habitat conditions defined by GQFH, such as number of acres of pine, basal area, tree size and age, and hardwood midstory, are established by the RCW Recovery Plan (2003). Partition boundaries and the acres of pine available within partitions are determined around the specific locations of the cluster centers for each partition. Partitions based on clusters centers located in close proximity to other cluster centers or immediately adjacent to non-pine habitat types are

always limited in total pine acres available and have an increased likelihood of these clusters becoming inactive and abandoned due to habitat limitation. Partitions with greater than 300 acres of pine habitat available within their boundary can be readily managed to provide for GQFH over the long term. Partitions with fewer than 300 acres of pine habitat can only be managed toward providing GQFH during the life span of the trees, with regeneration being a limiting factor for the future. Providing future habitat for the long-term survival of RCW is dependent on the regeneration of the pine forest on which the birds depend. Under optimal conditions, each partition requires an equal amount of young pine moving into the 60-year age class to replace the mature pine leaving the forest due to various mortality factors.

Adaptive Management Monitoring Elements:

Primary Habitat Response Variables	Probable Assessment Methods
The primary habitat response variables will be forest overstory structure and composition, forest midstory and understory structure measured by forest inventory data.	Conduct RCW habitat monitoring according to the 2003 RCW Recovery Plan. Forest inventory.
Primary Wildlife Response Variables	**Probable Assessment Methods**
The primary wildlife response variable will be the number of active RCW clusters, group size and birds fledged yearly.	Conduct nest checks and banded bird observations according to the 2003 RCW Recovery Plan.

OBJECTIVE 1.2 (CCP OBJECTIVE B.1.2)

Additionally manage up to 8,500 acres of sustainable open pine forests in MU 11, 16, and 17 toward providing additional GQFH outside identified active or planned RCW partitions to benefit RCW and other native wildlife species.

Management Units: 11, 16 & 17

Resource of Concern: Red-cockaded Woodpecker

Rationale: Although RCW management is focused around providing GQFH within partitions calculated around cluster centers, the actual movement of birds within the habitat likely extends beyond these artificial boundaries. Pine habitat outside of the partitions is likely of benefit to RCW and benefits many other priority migratory and resident birds, including Northern bobwhite

quail, Eastern wild turkey, Bachman sparrow, and Brown-headed nuthatch. These species have needs that are compatible with RCW overstory and midstory targets (Objective 1.1). Other native species such as white-tailed deer and rabbit will also benefit from these conditions.

Adaptive Management Monitoring Elements:

Primary Habitat Response Variables	Probable Assessment Methods
The primary habitat response variables will be forest midstory and understory structure.	Conduct RCW monitoring according to the 2003 RCW Recovery Plan. Forest Inventory, including measures of ground cover, or fire fuels monitoring with measures of ground cover and litter.
Primary Wildlife Response Variables	**Probable Assessment Methods**
The primary wildlife response variable will be the number of active RCW clusters and birds fledged yearly, serving as a surrogate for open-pine grassland dependent species Secondarily, the number bobwhite quail coveys	RCW nest checks and banded bird observations Northern bobwhite quail covey counts

OBJECTIVE 1.3 (CCP OBJECTIVE B.1.3)

Excepting for habitat within active or planned recruitment RCW clusters, an approximate 7,323-acre area will be managed to allow for reversion of a habitat to a mixed hardwood pine forest (i.e., forest dominated by hardwood trees) consistent with the historical forest cover conditions, to benefit migratory birds and resident wildlife.

Management Units: 1, 3, & 4

Resource of Concern: Forest Breeding Birds (i.e., yellow-throated warbler (*Dendroica dominica*), Louisiana waterthrush (*Parkesia motacilla*), and wood thrush (*Hylocichla mustelina*)

Rationale: By allowing the natural succession of these stands to reestablish the historic forest cover type, condition, and diversity, the biological integrity of these units will be increased. The addition of this appropriate habitat into the local landscape, which is highly dominated by

commercial pine forests, has great benefit to forest breeding birds. These species will benefit from the shift in tree species composition as well as the expected increase in structural diversity, particularly in the midstory. Additionally, the reversion to a historical forest type will not require the intensive management associated with RCW management and will benefit a variety of other native wildlife, such as southern flying squirrel, bats such as southeastern myotis and northern long-eared bat, small terrestrial mammals, and litter dependent species such as salamanders.

Although the historic forest condition assessment for these management units indicated the areas as being hardwood and mixed hardwood-pine forests, previous management efforts have attempted to manage these units for RCW nesting and foraging areas, actively managing to limit regenerating and mature hardwood. Four active clusters currently exist within the area. Management of these partitions for GQFH will continue unless the clusters become inactive and abandoned.

Adaptive Management Monitoring Elements:

Primary Habitat Response Variables	Probable Assessment Methods
The primary habitat response variables will be forest overstory structure and composition, forest midstory and understory structure and bottomland hardwood forest health and productivity for wildlife.	Monitor the effects of forest management activities to maintain integrity of desired species composition, habitat structure, and forest health. Forest inventory, including metrics for species composition and structure in the midstory and understory.
Primary Wildlife Response Variables	**Probable Assessment Methods**
The primary wildlife response variable will be forest breeding bird species composition and abundance.	Forest breeding bird surveys (point counts).

HMP GOAL 2. BOTTOMLAND HARDWOOD FOREST CONDITION (CCP SUB-GOAL B.2)
Achieve desired forest conditions within bottomland hardwood forest to protect, manage, enhance, and restore the values and functions of these habitats to sustain the biological needs of native wildlife by implementing recommendations within the LMVJV Restoration, Management, and Monitoring of Forest Resources in the Mississippi Alluvial Valley: Recommendations for Enhancing Wildlife Habitat 2007 (aka Desired Forest Conditions).

OBJECTIVE 2.1 (CCP OBJECTIVE B.2.1)

Manage approximately 18,000 acres of bottomland hardwood forests within Management Units 2, 5, 6, 8, 9, 13, 14, and 18 to maintain one-third to half in Desired Forest Conditions at any time as recommended by Desired Forest Conditions Report of the LMVJV (2007) and encourage the development of large cavity trees, particularly within and adjacent to water bodies.

Management Units: 2, 5, 6, 8, 9, 13, 14, & 18

Resource of Concern: Forest Breeding Birds (i.e., prothonotary warbler (*Protonotaria citrea*), yellow-throated warbler (*Dendroica dominica*), Louisiana waterthrush (*Parkesia motacilla*), rusty blackbird (*Euphagus carolinus*), wood thrush (*Hylocichla mustelina*)

Rationale: Forest interior songbirds benefit from vertical structure within forested environments. Wintering waterfowl benefit from hard mast produced 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. This objective will achieve a diverse forest with thick understory, and well developed midstory and canopy to produce hard and soft mast, and provide snags and cavities.

Adaptive Management Monitoring Elements:

Primary Habitat Response Variables	Probable Assessment Methods
The primary habitat response variables are forest overstory structure and composition, forest midstory and understory structure and bottomland hardwood forest health and productivity for wildlife as measured by forest inventory data.	Monitor the effects of forest management activities to maintain integrity of desired species composition, habitat structure, and forest health. Forest inventory, including primary and secondary desired forest condition metrics (LMVJV, 2007)

Primary Wildlife Response Variables	Probable Assessment Methods
The primary wildlife response variables are forest breeding bird species composition and abundance.	Monitor forest breeding bird species through landbird surveys (point counts).

OBJECTIVE 2.2 (CCP OBJECTIVE B.2.2)

Protect forest health (e.g., tree species diversity, tree vigor) within GTRs (~1,726 acres) from prolonged artificial flooding and to recover and maintain forest structural diversity to match that of the surrounding management unit of similar habitat type.

Management Units: 9 & 13

Resource of Concern: Forest Breeding Birds (i.e., prothonotary warbler (*Protonotaria citrea*), yellow-throated warbler (*Dendroica dominica*), Louisiana waterthrush (*Parkesia motacilla*), rusty blackbird (*Euphagus carolinus*), wood thrush (*Hylocichla mustelina*)

Rationale: GTRs were created within the bottomland hardwood forest to provide predictable flooded hardwood forest for resting and feeding wintering waterfowl. Flooding these areas outside of the normal dormant season can negatively impact forest diversity, regenerations, and cause the direct mortality of water intolerant species. Although these areas benefit waterfowl during a 110-day period each year, this objective recognizes the needs of the forest breeding birds that use these habitats throughout the year. Extensive flooding in past years has impacted the existing forest composition and structure.

Adaptive Management Monitoring Elements:

Primary Habitat Response Variables	Probable Assessment Methods
The primary habitat response variables are forest overstory structure and composition, forest midstory and understory structure, and bottomland hardwood forest health and productivity for wildlife as measured by forest inventory data.	Monitor the effects of forest and water management activities to maintain integrity of desired species composition, habitat structure, and forest health as compared to the surrounding forest.
Annual acres and dates of flooded condition.	Surveillance of water levels in winter months.

Primary Wildlife Response Variables	Probable Assessment Methods
The primary wildlife response variables are wintering waterfowl use and forest breeding bird species composition and abundance.	Midwinter waterfowl survey and surveillance of duck use throughout winter months. Monitor forest breeding bird species through landbird surveys (point counts).

HMP GOAL 3. (CCP SUB-GOAL B.3)
Aquatic Environments Actively manage approximately 252 acres of shallow water moist-soil impoundments, 1,200 acres of lakes, and 1,645 acres of GTRs for native species including a diversity of reptiles, fish, and amphibians, and waterfowl species through water level manipulation and to fulfill the mission and purposes for which the refuge was established while maintaining functional integrity of the surrounding habitat.

OBJECTIVE 3.1 (CCP OBJECTIVE B.3.1)

Provide at minimum 1.1-million Duck Energy Days (DED) over a 110-day period yearly through the annual combination of 350 acres moist-soil plants producing 1.025-million DED and seasonally flooded GTRs producing 0.075-million DED in the form of hard and soft mast.

Management Units: 10, 12, & 15

Resource of Concern: Waterfowl

Rationale: The refuge serves as an important migratory and wintering ground for thousands of migratory waterfowl. Following the creation of the existing infrastructure more than 100,000 waterfowl were observed using the refuge; today the refuge records approximately 10,000 waterfowl. The reasons for the reduced level of use by ducks may be multifaceted and complex, but positive habitat conditions on private lands and changes in migration patterns have contributed to the decrease. The production of 1.1-million DEDs will provide sufficient resources for 10,000 waterfowl over the 110-day wintering period.

Moist-soil management provides highly valuable food and cover for wintering waterfowl and other migratory and resident species. The high seed production of moist-soil plants and their value as waterfowl foods have been known since at least the 1940s (Low and Bellrose 1944). Regardless of the quantity of seed produced, moist-soil management is highly recommended as a means of diversifying habitat for wintering waterfowl (Fredrickson and Taylor 1982, Reinecke

et al. 1989). Agricultural crops will be used as a rotational crop within the moist-soil Prisock Fields.

Adaptive Management Monitoring Elements:

Primary Habitat Response Variables	Probable Assessment Methods
The primary habitat response variable will be occurrence of beneficial plants.	Random points sampling each year during late summer early fall. Ocular observations throughout growing season to determine method feasibility (Strader and Stinson 2005).
Primary Wildlife Response Variables	**Probable Assessment Methods**
The primary wildlife response variable will be wintering waterfowl use.	Bi-weekly waterfowl counts from September 15 to April 1.

OBJECTIVE 3.2 (CCP OBJECTIVE B.3.2)

Provide accessible and secure habitat with beneficial food resources on approximately 1,060 acres of shallow water lake habitat for seasonal use by nesting and wintering waterfowl, wood stork, and other wading birds and for fish, deep water habitats to serve as refugia during seasonally managed periods of low water.

Management Units: 12 & 15

Resource of Concern: Waterfowl

Rationale: Loakfoma and Bluff lakes serve as both resting and feeding habitat for waterfowl during wintering months and through close proximately of the two resources, provide waterfowl with optimal wintering conditions. In spring, the shrub growth within the edges of the lake provide important brooding habitat. Seasonal floods and high water events benefit fisheries by providing spawning habitat within Loakfoma and Bluff lakes and the connected waterways for aquatic resources. Numerous wading birds also establish breeding colonies within the flooded timbered lake habitat. Drawdowns during summer months provide isolated shallow pools with fish and mud flats for wood stork and wading birds, and exposed lake bottom allow for the production of native moist-soil plants and increased growth of trees and shrubs. Gradual refilling of the lakes with water during winter migration periods once again provides resting and feeding habitat for migratory waterfowl. Throughout the year, numerous native species benefit from the habitat including aquatic invertebrates, crustaceans, small fish, amphibians, and reptiles.

Adaptive Management Monitoring Elements:

Primary Habitat Response Variables	Probable Assessment Methods
The primary habitat response variable will be percent herbaceous cover.	Bi-weekly ocular estimates during the growing season from fixed photo point sites.
Primary Wildlife Response Variables	**Probable Assessment Methods**
The primary wildlife response variable will be wintering waterfowl use. Wading bird rookery counts	Bi-weekly waterfowl counts from September 15 to April 1.

OBJECTIVE 3.3 (CCP OBJECTIVE B.3.3)

Operate Ross Branch Reservoir as a water supply to Management Unit 10, ensuring that the reservoir water volume reaches no less than 25 percent during winter months, with optimal depth being full pool during summer months.

Management Unit: 10

Resource of Concern: Waterfowl

Rationale: Water availability is a critical constraint on the moist-soil management performed to benefit wintering waterfowl in the moist-soil fields. The Ross Branch Reservoir was constructed and serves primarily as a water source for this purpose. Secondarily, native fish have been stocked into the reservoir for recreational anglers and other aquatic resources also benefit from the shallow waters along the shoreline.

Adaptive Management Monitoring Elements:

Primary Habitat Response Variables	Probable Assessment Methods
Water depth	Water control structure gauge measurements
Primary Wildlife Response Variables	**Probable Assessment Methods**

The primary wildlife response variable will be wintering waterfowl use in unit (Prisock Fields)	Bi-weekly waterfowl counts from September 15 to April 1.

HMP GOAL 4. (CCP SUB-GOAL B.4)
Proposed Wilderness **Manage the Proposed Wilderness to retain its primeval character and influence.**

OBJECTIVE 4.1 (CCP OBJECTIVE B.4.1)

Provide intact mature and over-mature bottomland hardwood habitat within approximately 1,200 acres for the benefit of forest breeding birds, within the context of protection of wilderness character attributes in accordance with the Wilderness Act (1964).

Management Unit: 7

Resource of Concern: Forest Breeding Birds (i.e., r**us**ty blackbird)

Rationale: Providing habitat within the context of the Wilderness Act entails a constraint against many typical strategies for active habitat management in bottomland hardwood forests (water control structures, commercial forest management, and associated vehicles). Therefore, this unit will be largely passively managed and is expected to provide a bottomland hardwood forest condition with open understory, heavy litter, and seasonal flooding. Rusty blackbird use habitat in this condition for foraging in winter, and it is consistent with forest breeding bird use, such as wood thrush, in summer. Management will, as intended, protect the wilderness character of the unit as well as providing a condition that is beneficial for many additional species, particularly waterfowl, forest bats, and amphibians.

Adaptive Management Monitoring Elements:

Primary Habitat Response Variables	Probable Assessment Methods
The primary habitat response variables are forest overstory structure and composition, forest midstory and understory structure, and bottomland hardwood forest health and productivity for wildlife as measured by forest inventory data.	Monitor the effects of forest management activities to maintain integrity of desired species composition, habitat structure, and forest health.

Primary Wildlife Response Variables	Probable Assessment Methods
The primary wildlife response variables are forest breeding bird species composition and abundance.	Monitor forest breeding bird species through landbird surveys (point counts).

CHAPTER V. HABITAT MANAGEMENT STRATEGIES

DESCRIPTION OF POTENTIAL HABITAT MANAGEMENT STRATEGIES

A list of potential management strategies that could be used to accomplish habitat objectives were identified by reviewing the scientific literature and consulting with experts. Each of these strategies was evaluated for possible inclusion in the HMP based on compliance with Service policies and mandates, as well as feasibility relative to refuge-specific management constraints (e.g., budget, personnel, and equipment). Those strategies that met both of these criteria were assessed for potential positive and negative impacts of these strategies on Resources of Concern and non-target resources. Based on this assessment, a final set of strategies were identified that would contribute to accomplishing habitat.

Forest Management Strategy:

Forest habitat management is to establish and maintain the desired forest conditions specified in the objectives (Chapter IV). Both commercial and non-commercial silvicultural treatments can be utilized when applying the potential methods; however, commercial timber harvest operations often are more effective and efficient and also provide an economic benefit to the community. Non-commercial treatments often are not feasible due to manpower and funding limits. Non-commercial treatments remain an option when commercial operations are unfeasible or cannot meet refuge objectives. A variety of silvicultural treatment types are well established to promote certain habitat responses, including combinations of overstory removal, midstory removal, uneven-aged and even-aged methods. Forest management strategy details associated specifically with administration of commercial application of timber removal are addressed in Appendix H.

A combination of silvicultural methods may be utilized to meet the forest management objectives described in the refuge CCP/HMP. The potential silvicultural methods are:

OVERSTORY MANAGEMENT

Free-thinning - Free-thinning, or thinning, is an overstory removal method aimed primarily at controlling the growth, structure, and composition of stands by manipulating stand density. 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, it 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. It is also expected to be beneficial to wintering waterfowl and breeding wood ducks, and forest breeding birds due to the increase in forest structure (short-term) and tree species composition (long-term), with promotion of hard mast producing species and retention of cavity trees. This method does not strongly promote regeneration of the forest.

Group Selection - This method removes trees from a stand in groups to create openings in the forest canopy. These openings are generally up to 2.5 acres in size. This technique is usually used to stimulate regeneration, and encourage the regeneration of more shade intolerant plant species such as sweetgum, red oaks, pecan, green ash, etc. As acreage increases so do impacts on wildlife favoring mature forests.

Patchcuts - This method removes all overstory trees in patches of 2.5 acres to 7 acres. Dependent upon the shape of the patchcuts, forest openings of this size will eliminate the effects of shading throughout most of the opening and benefit the regeneration of even the most shade intolerant plant species. A few trees may be left within each patchcut to provide perches and nest locations for some bird species or retain cavity trees. Patchcuts will provide small areas of even-aged forest scattered across an uneven-aged forested landscape that will benefit many tree species that need even-aged stand conditions to regenerate successfully such as sweetgum, red oaks, cottonwood, sycamore, pecan, etc. The method is also effective for treatment of forest spot pest or disease infections, where a group of infected and transmitting trees may be removed.

Seed Tree Harvests - The classic seed tree harvest method of regeneration leaves four to eight trees per acre standing (on stand average) to provide a seed source for regeneration. Once the stand is established, the seed trees can be removed or retained. This method can be used to promote regeneration of light seeded species (i.e., ash, cottonwood), 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.

Shelterwood Harvests - This even-aged method allows for the regeneration of the forest while leaving a seed source within the overstory. This method is generally applicable within an existing highly uniform overstory which would be variably harvested in the future. On establishment of sufficient regeneration into the midstory, the remnant overstory would be removed. During the initial years following the first harvest, residual trees may serve as habitat for RCW until regenerating trees become established.

Irregular Shelterwood Harvests - Is a system that incorporates the features of other shelterwood systems. One distinct characteristic of the irregular shelterwood system is that a component of the residual trees (approximately 20-40 BA) is left in a stand long after the regenerative phase. As regeneration advances, thinnings are to be used to maintain the stand in desired conditions. To create a diverse structure across the landscape, irregular group shelterwoods may also combine open patches and grouped

clusters of leave trees. Wildlife habitat and structure diversity is sustained at a much earlier stand age (Hodges et al. 1999). An uneven-aged stand may be produced if the procedure is applied to different patches within the stand at different ages (Meadows and Stanturf 1997).

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 generally efficient only in small areas.
- Mechanized techniques employ a variety of heavy machinery for severing 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.

MIDSTORY MANAGEMENT

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, removed 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.

Firewood Cutting - Firewood cutting by the public can provide removal of target trees, generally hardwood midstory trees, within a stand as to improve habitat quality for the RCW foraging areas. Individual trees are generally area selected and marked by refuge staff, with tree removal conducted by the general public for home use.

Single Tree Selection - This uneven-aged method can be used to address the regeneration of forest tree species within existing uneven-aged stands. Scattered individual trees of multiple age classes, whose canopies are not touching, are harvested. This type of selection system generally produces small canopy openings especially conducive to the establishment and growth of tolerant tree species.

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.

Wildlife Stand Improvement - Wildlife Stand Improvement (WSI) is the targeted removal or control of invasive, nonnative (exotic), or undesirable species in order to improve the growth, and regeneration of more desirable species using non-removal methods (e.g., mechanical or chemical damage to trees or shrubs which kills or controls the plant and leaves it on site). All forestry chemical treatments 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, Foliar Spay, and Basal Spray. All the treatment types are used to remove unwanted vegetation within a specified treatment area. There may be some short-term, negative impacts to desired species associated with applications, but will be minimized by proper application techniques and the use of the Pesticide Use Proposal approval process.

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 these cases, salvage can be used to remove damaged or dead trees: 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 wild fires 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 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 and creation of unburned 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.

Aquatic Management:

Water level manipulation, movement of water from one place to another and the protection of streams and ephemeral pools are water management methods that play an important role in the management for fish, waterfowl, amphibians, wading birds, and bats associated with aquatic habitats such Loakafoma Lake, Bluff Lake, and connected waterways. During spring, management of floodwaters within wooded habitats is used to provide isolated pools of water for amphibians. Backwater flooding from the rivers and lakes is used to interconnect water bodies to promote fish spawning for fish. Management of water is made possible through strategic retention of water using existing water control structures. During summer, slow water management drawdowns are used to isolate small fish within small pools of water within the upper reaches of the lakes for use by visiting wood stork and other wading birds. Mud flat created from these same drawdowns are used to promote plants beneficial for wintering waterfowl and discourage nuisance and exotic plants in lakes, waterways, and backwater areas. Later in fall, the slow systematic re-flooding of these exposed mudflats and shallow habitats provide wintering waterfowl resting and feeding habitat.

Recognition of Stream-side Management Zones is also an important aspect of protecting lakes, streams, and wetlands. The minimum extent of SMZ protection will be based on the streams order: Order-1, 9.8 m or 35 feet; Order-2, 30 m or 98 feet; and, Order-3, 90 m or 295 feet. Ephemeral pools will be considered an Order-1 feature. These distances represent not only those distances recommended to protect at least 80 percent of the amphibian community in riparian areas from direct impacts of timber harvest (Fogarty 2005), but also those distances that should provide protection from sediment concentration in streams due to disturbance of the forest floor near the stream (Keim and Schoenholtz 1999).

Managed Wetlands/Moist-Soil Management:

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

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

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

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 setback 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 3 to 10 years.

Mechanical control of woody vegetation **-** Used to remove undesirable vegetation that less invasive methods could not remove or control.

Cultipacker/roller - Used to prepare seed beds and create favorable conditions for seed to germinate. Roller may also be used to make seed source available for waterfowl.

Mowing **-** Mowing can be used in certain situations to set back succession in which other means are not viable, including broadleaves such as cocklebur and sesbania. Species 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. Timely removal of these species can prevent unwanted seed production and can allow sunlight to reach the ground, which promotes and releases the desirable grass species that are growing underneath the broadleaf canopy.

Summer Irrigation **-** Irrigation of refuge units provides water to enhance yields of moist-soil and agricultural crops, and can control unwanted species during the early germination stage. Summer flooding increases yields of annual seed producers and some perennials, and has the added benefit of creating stress for certain groups of plants. Summer irrigation is labor intensive, but can be a feasible alternative in a wetland complex that is correctly designed or with gravity flow capabilities. Irrigate when desirable plants show signs of desiccation, such as curled leaves or a pale coloration. Cocklebur can be controlled in its seedling stage by shallow flooding for 24 - 48 hours.

Agriculture planting (adapted from U.S. Fish and Wildlife Service 2007a) - Planting of common agricultural crops, also known as waterfowl hot foods, are a potential management technique to provide wintering waterfowl with the high densities of high energy foods during the 110-day period of winter migration. Staff and refuge equipment would be used to complete field preparations and planting operations of crop seeds during the normal agricultural growing summer season. Seeds used would be those consistent with current policy, currently including Japanese millet, milo, and corn. Use of hot foods is more acre-efficient in provision of wintering waterfowl food (DED)than moist-soil areas and GTRs.

Chemical, woody, and herbaceous control - All chemical treatments follow the Service's Pesticide Use Proposal approval process before use. Common application techniques that can be used in applications of chemical, which are as follows: broadcast, foliar spray, and spot treatments. All the treatment types are used to remove unwanted vegetation within a specified treatment area. There may be some short-term, negative impacts to desired species associated with applications which will be minimized by proper application techniques and the use of the Pesticide Use Proposal approval process.

Open-land Management

Frequent disturbance is required to ensure open lands (i.e., demonstration prairie, old fields, levees, power lines, and road sides) are maintained in an early successional stage. In

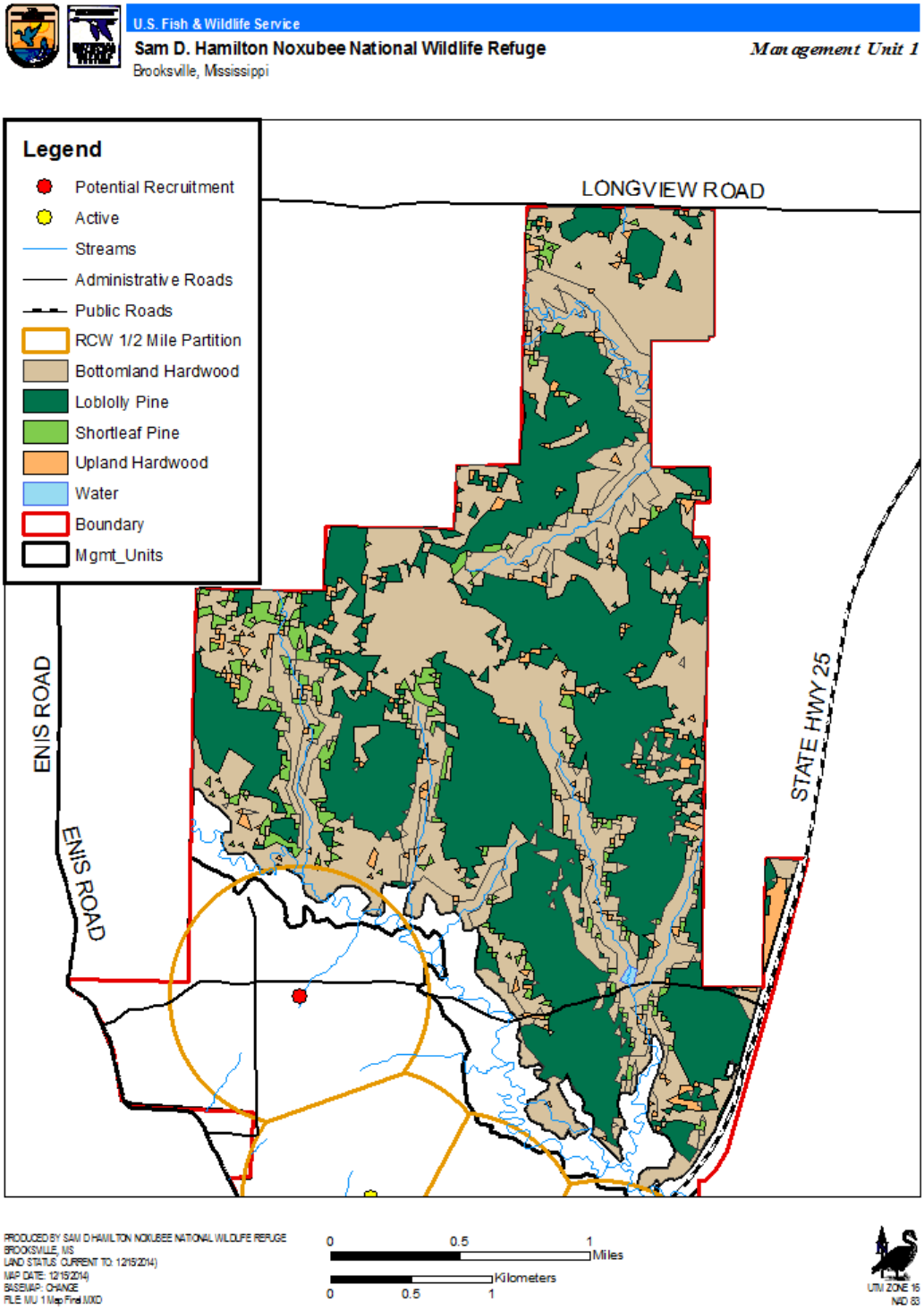
combination, mowing, prescribed fire, herbicides, and disking are used to set back succession, control undesirable plants, and expose bare soil for the establishment of native annual plants. These methods provide benefits to a variety of species including northern bobwhite, Henslow's sparrow, bats, turkey, and deer.

Administrative Use Lands Management

SELECTED MANAGEMENT STRATEGIES AND MANAGEMENT UNIT PRESCRIPTIONS

All of the above described habitat management strategies and methods have been assessed as appropriate for use within the scope of the hmp, given site and time specific need to address habitat objectives and appropriate site and time specific actions to mitigate negative impacts to refuge resources. Management prescriptions are developed to address habitat objectives (chapter iv), reflecting the habitat needs of resources of concern (chapter iii), while considering the historic, current, and desired habitat conditions, species with complimentary habitat needs, management constraints, unique features, and cultural resources found within the unit. Adaptive management monitoring elements help assess progress toward objectives and target habitat conditions. In the following sections, these elements are described and the management prescription for each management unit of the refuge is established.

MANAGEMENT UNIT 1
(Craig Pond Unit)



Resources of Concern:

Forest Breeding Birds (surrogates: Louisiana waterthrush and wood thrush)

Species of Complimentary Need:

Wild turkey (*Meleagris gallopavo*)
White-tailed deer (*Odocoileus virginianus*)
Gray squirrel (*Sciurus carolinensis)*
Wood duck (*Aix sponsa*)
Reptiles/Amphibians
Forest bats

Habitat Objective: 1.3

Current Condition and Special Considerations: Management Unit 1 consists of 2,714 acres of interspersed pine, mixed pine-hardwood, and hardwood located north of Chinchahoma Creek. Talking Warrior Creek extends through the north end of the unit. The unit contains first, second, and third order streams with numerous fingers of stream side management zones extending throughout the unit. Management Unit 1 is the northern most management unit within the refuge. A public road, Longview Road, runs east and west along the north boundary. Craig Pond Road, a refuge administrative road, extends east and west through a short section near the southern end of the unit. The 8-acre Craig Pond is located just north of Craig Pond road within the south end of the unit.

Historic habitat analysis for this unit indicates interspersed island habitats of Loblolly Pine-Willow Oak-1 (45 percent) surrounded by Bald Cypress-Atlantic White Cedar-Red Maple-5 (35 percent) and fingers of American Sycamore (*Platanus occidentalis*)–Sugarberry (*Celtis laevigata*)–Pine–3 (12 percent) habitat types (LANDFIRE 2008); six other habitat types make up the remaining 8 percent of the unit. The site index for both pine and hardwood tree species within this unit is high and more than 60.

With the 1995 Forest Management Plan, the refuge established goals to manage the management unit and all habitats within it for RCWs and as of 2012, six clusters were established within the unit. The most recent Red-cockaded Woodpecker Forage Habitat Analysis describes this unit as lacking sufficient GQFH for any of the six existing clusters. Of these six clusters only one was a natural start (Cluster 101), with the others being artificially created. None of these clusters remains active and all are considered abandoned. In the past, chemical hardwood control has been used in areas immediately around RCW clusters but not widely throughout the unit.

Areas of Management Unit 1 contain historical pine-dominated habitats, however, it addition to being highly fragmented the area is highly difficult to burn due to soil moisture and logistical problems with Highway 25 and prevailing winds during burning season. In the past, these difficulties have led to burn rotations up to 10 years and high amount of hardwoods within the midstory. Any clusters that could be formed would be isolated and staff would not be able to

manage the area toward good quality foraging habitat. All potential custers within the Unit would be more than three miles from the clusters within the southern subpopulation (Management Units 11 and 17). Within the past 15 years, population numbers have dropped drastically in the northern unit. Favorable habitat conditions for the RCW have degraded over that time and translocations of RCW from the southern population to the northern population has proven to be not practical.

Through time few areas of the unit have frequently been treated with fire to control the hardwood midstory; no prescribed fire has been used within the last 8 years. Attempts to make small units capable of being burned have established approximately 11 miles of fire lines throughout the unit extending along and across the intersecting waterways. Prescribed fire within this unit has been difficult due to wet soil conditions and limited access. Several intermittent drains run north to south and empty into the Chinchahoma Creek. The pine ridges are not much higher than the drainages and heavy hardwood basal areas cause drying time of fuels to increase. Smoke is an issue from prescribed burns due to Chinchahoma Creek running from west to east across Highway 25. Any residual smoke remaining after burns usually settles in drains running across Highway 25. The northern boundary of this unit is within 1.2 miles of Starkville city limits; smoke issues are also a concern within the city and the city airport.

Japanese climbing fern (*Lygodium japonicum Thunb. Ex Murr.*), Japanese stilt grass (*Microstegium vimineum*), privet (*Ligustrum vulgare*), and cogon grass (*Imperata brasiliensis*) are threats and all or one of these pests have been spot treated within the management unit in the past. The area does not have any private inholdings or old field habitats. In 1985, Craig Pond was created as a small water source for waterfowl. Water depth ranges up to 3 feet and beaver are active within the area of the pond.

River cane (*Arundinaria giganteais*) is found within this unit's low areas and streamside management zones but sparse in occurrence. Due to soil wetness throughout the unit, numerous ephemeral pools exist throughout the unit.

This unit serves as habitat for a suite of species benefiting from diverse hardwood forest structure including neotropical migratory birds, wild turkey, white-tailed deer, pileated woodpecker (*Dryocopus pileatus*), southern flying squirrel (*Glaucomys volans*), and numerous species of herpetofauna.

<u>Unique Features</u>:

The refuge possesses an existing right-of-way for administrative uses across private land to the west of the unit that allows access to the area north of Chinchahoma Creek. Much of the surrounding private lands are developed as housing or managed for commercial forest products. There is the potential for numerous historical sites including old home sites, cisterns, and artifacts from Native Americans.

Management Prescription:

Habitat within Management Unit 1 will be managed to enhance habitat for forest breeding birds (surrogates: Louisiana waterthrush and Wood thrush) by providing complex vertical and horizontal structure for nesting and foraging. During the next 15-year period, it will likely be allowed to follow natural successional patterns with active management focused on exotic plant control.

Forest Management

During the next 15-year period, the majority of the areas will likely be allowed to follow natural successional patterns with active management focused on exotic plant control. Active forestry will only occur within this unit if active RCW clusters are found within the unit. Habitat within the determined partition(s) would be directed toward providing at least 120 acres of GQFH as defined by the Red-cockaded Woodpecker Recovery Plan. Individual hardwood trees having particular wildlife value (i.e., den trees, cavity trees, and other unique characters) may be left growing throughout the pine dominated areas but canopy hardwoods will be kept to below 30 percent of canopy.

Free thinning along with chemical treatments and when possible prescribed fire will be used to provide GQFH within a minimum of 120 acres of mature pine forest within the cluster. No silvicultural regeneration treatments for pine will occur within the partition as number of contiguous pine acres would likely be limited. Given the limited areas of contiguous pine within the unit, no recruitment clusters will be formed and all abandoned clusters will be managed for historic habitat conditions.

Natural fire breaks will be favored to minimize the amount of artificial fire breaks installed or maintained. Existing fire lines near any future active clusters will be maintained to contain fire and new lines will be established if needed for the same purpose.

Aquatic Management

Beaver ponds (including Craig Pond) will be allowed to form naturally within the creek channels to benefit wood ducks, but beaver population and dam control actions will be used to keep beaver activity confined to the channels. All water manipulated by beavers that impacts live timber during the growing season will be removed and when needed beaver numbers controlled. The Craig Pond's water level will be maintained at full pool throughout the year with drawdowns only occurring to conduct water control structure maintenance.

SMZs will be protected based on stream order and the minimums defined previously. Prescribed fire will normally be allowed to burn into SMZs with site conditions (e.g., wetness) dictating burn extent into the zone. Fire will be excluded from SMZ when habitat conditions indicate undesirable impacts to regeneration, mortality of canopy trees, and increased soil erosion. Timber management may occur within the SMZs under guidelines within Mississippi's Best Management Practices for Forestry (2008) if needed to maintain the desired forest conditions.

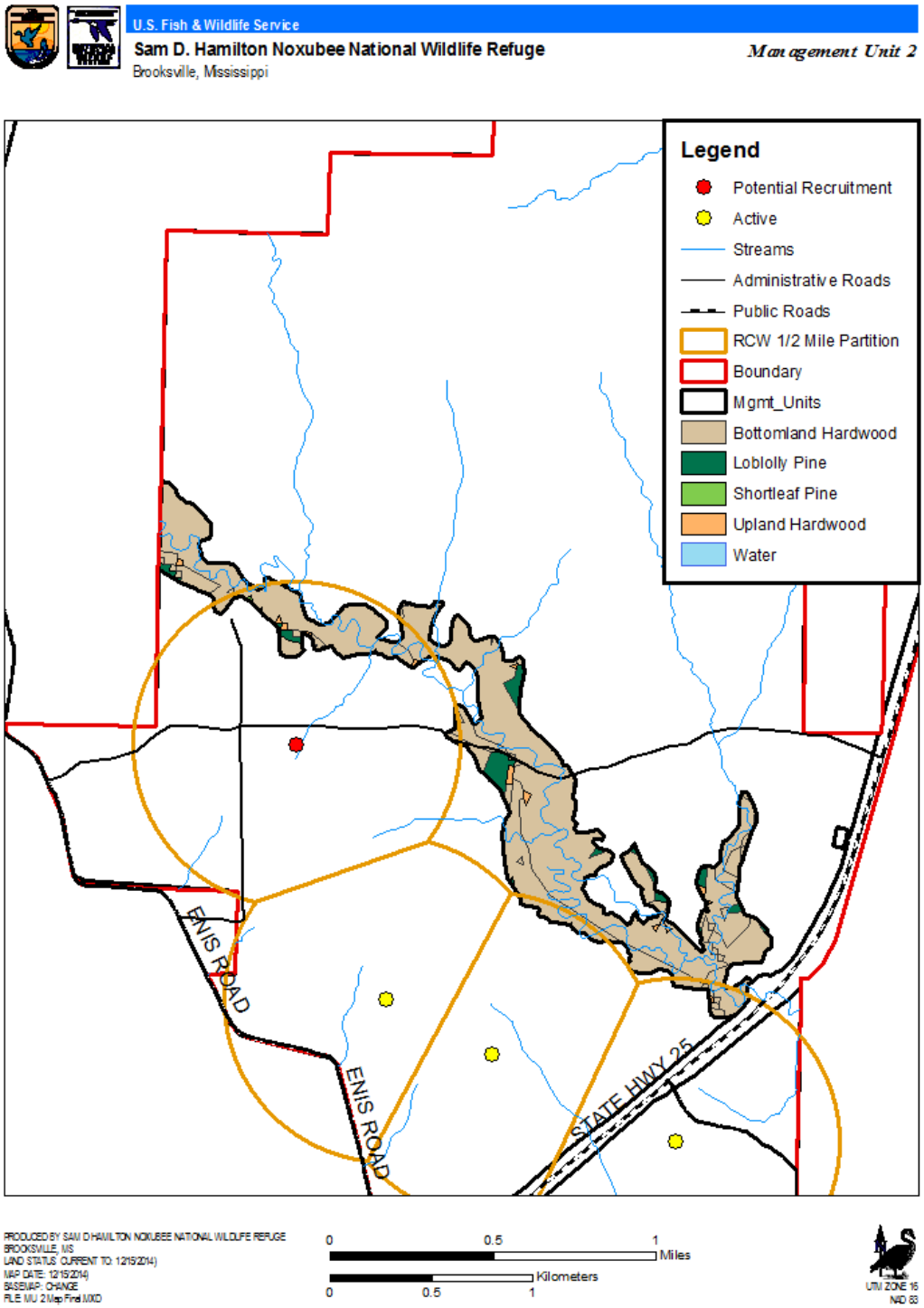
Administrative Use Lands

Administrative roads within the unit may be maintained in a maintained grass or gravel state from ditch to ditch and optimally will receive maintenance related activity throughout the year. Starting at the outside of the ditches, habitat will be maintained in the same manner as within the main unit. Vegetative barriers may be left along road edges to provide wildlife cover from road-related disturbance and to deter road hunting activities, particularly where roads are adjacent to open areas. Haul trails and loading decks created to facilitate removal of timber will be abandoned, possibly replanted to forest, and not maintained for vehicle use through time.

Adaptive Management Monitoring Elements:

- Conduct RCW monitoring according to the 2003 RCW Recovery Plan.
- The primary habitat response variables will be forest overstory structure and composition, forest midstory and understory structure and bottomland hardwood forest health and productivity for wildlife as measured by forest inventory data.
- The primary wildlife response variable will be forest breeding bird species composition and abundance using breeding landbird surveys (point counts).
- The refuge will consider conducting herptafauna surveys based on PARC guidelines and protocols (http://www.parcplace.org/publications/inventory-and-monitoring-guide.html).

MANAGEMENT UNIT 2
(Chinchahoma Creek West Unit)



Resources of Concern:

Forest Breeding Birds (surrogates: Rusty blackbird, Prothonotary warbler and Yellow-throated warbler)

Species of Complimentary Need:

Wild turkey (*Meleagris gallopavo*)
White-tailed deer (*Odocoileus virginianus*)
Squirrel (*Sciurus carolinensis)*
Wood duck (*Aix sponsa*)
Reptiles/Amphibians
Bats

Habitat Objective: 2.1

Current Condition and Special Considerations:

Management Unit 2 consists of 290 acres of mixed hardwood primarily located along Chinchahoma Creek with fingers of SMZs extending to the surrounding unit on both the north and south sides of the creek. The unit is almost completely enclosed within Management Unit 1 to the North and Management Unit 3 to the South, and dissected by existing administrative use roads and existing fire lines used during prescribed fire operations. Craig Pond Road bisects the unit in an east-west direction and bridges Chinchahoma Creek. Over time the area has been indirectly treated with fire to control the hardwood midstory within Management Unit 1 and 3. Fire has been allowed to back into the bottomland hardwoods, as 'wetness' conditions allow, instead of using pushed fire lines. Chemical hardwood control has not occurred within this unit but herbicides have been used to control exotics and invasive plants.

Historic habitat conditions for this unit indicate the area had American sycamore (*Platanus occidentalis*) - sugarberry (*Celtis laevigata*) - pine - 3 habitat type and bald cypress (*Taxodium distichum*) - and red maple (*Acer rubrum*) (LANDFIRE 2008) along the creek with the loblolly pine (*Pinus Taeda*) - willow oak (*Quercus phellos*) habitat type at the higher elevation sections interspersed within the unit. The southeastern portion of the management unit had portions that were represented by willow oak (*Quercus phellos*) and water oak (*Quercus nigra*). The current habitat conditions are consistant to historic bottomland hardwood conditions, but species composition is slightly different. Japanese climbing fern (*Lygodium japonicum Thunb. Ex Murr.*), Japanese stilt grass (*Microstegium vimineum*), privet (*Ligustrum vulgare*), and cogon grass (*Imperata brasiliensis*) continue to be a threat and all or one of these pests have been spot-treated in the past. Japanese stilt grass was recently (2012) found and treated along the creek and roadways within this unit. There are no private inholdings within the unit.

River cane (*Arundinaria giganteais*) within this unit is well distributed but sparse in occurrence due to the forest condition. Due to increased soil wetness, prescribed fire carries less readily and hardwood regeneration occurs more readily. This unit serves as habitat for a suite of

species including neotropical migratory birds, wild turkey, white-tailed deer, pileated woodpecker (*Dryocopus pileatus*), southern flying squirrel (*Glaucomys volans*), and numerous species of herpetofauna.

Unique Features:

There may be numerous historical sites including old home sites, cisterns, and artifacts from Native Americans.

Management Prescription:

Habitat within Management Unit 2 will be managed to benefit forest breeding birds by providing complex vertical and horizontal structure for nesting and foraging. Canopy gaps will be intermixed with dominate, shade-intolerant trees with expansive, long-limbed crowns that overtop large, individual, shade tolerant trees. Canebrakes will be encouraged to develop with canopy gaps. The desired forest condition will follow that recommended by the LMVJV Restoration, Management, and Monitoring of Forest Resources in the Mississippi Alluvial Valley: Recommendations for Enhancing Wildlife Habitat 2007.

Forest Management

Timber management including wildlife stand improvement techniques may occur within the SMZs under guidelines within Mississippi's Best Management Practices for Forestry (2008) if needed to maintain the desired forest conditions. Forest management will be conducted to favor shade-intolerant species and the establishment of large, over mature trees within the forest for the benefit of numerous wildlife species including bats and wood duck.

Triggers for prescribed silvicultural treatments will be:

(1) Overstory canopy cover: >70%
(2) Midstory cover: <25%
(3) Basal area: >70 square feet per acre
(4) More than 25% of basal area approaching biological maturity (i.e., senescence)
(5) Tree stocking >70%

During the next 15-year period, the majority of the areas will likely be allowed to follow natural successional patterns with active management focused on exotic plant control. With time, the likely silvicultural method to be used in this habitat management will be free-thinning to reduce basal area and increase species composition within the forest. WSI practices will also be used to manage habitat to reach the desired habitat conditions. Regardless of method and timing of active management, the goal is to promote forest diversity and health that resembles historic conditions indicated by the NatureServe terrestrial ecological systems (NatureServe 2011). The criteria for attaining these conditions will be based on the basal area of tree species composition being greater than 50 percent of the dominant species types according to NatureServe terrestrial ecological systems. In many areas conditions are not likely to be attained during the life of this plan, but significant efforts can be made to promote these conditions in habitats that have not drastically skewed from the historic conditions.

Prescribed fire may not be a major management tool in this unit but may be used in various places to remove unwanted vegetation or to remove debris. Some areas adjacent to the management unit may be treated indirectly with prescribed fire due to a minimizing fireline disturbance and allowing prescribed fire in adjacent units to back into the unit and self-extinguish.

Alternative firing techniques (e.g., backing fires) and the sites natural wetness will be used to ensure habitats within Management Unit 2 receive only slight impact along the transition zones. Fire may damage hardwoods on occasion, creating basal cavities which may be of later benefit to Rafinesque's big-eared bat (*Corynorhinus rafinesquii*). Natural fire breaks will be favored to minimize the amount of artificial fire breaks installed or maintained between management units.

Aquatic Management

Beaver ponds will be allowed to form naturally within the creek channels to benefit wood ducks, but beaver population and dam control actions will be used to keep beaver activity confined to the channels. All water managed by beavers that impacts live timber during the growing season or maintained access routes will be removed and when needed beaver numbers controlled.

SMZs will be protected based on stream order and the minimums defined previously. Prescribed fire will normally be allowed to burn into SMZs with site conditions (e.g., wetness) dictating burn extent into the zone. Fire will be excluded from SMZ when habitat conditions indicate impacts to regeneration, mortality of canopy trees, and increased soil erosion. Timber management may occur within the SMZs under guidelines within Mississippi's Best Management Practices for Forestry (2008) if needed to maintain the desired forest conditions.

Administrative Use Lands

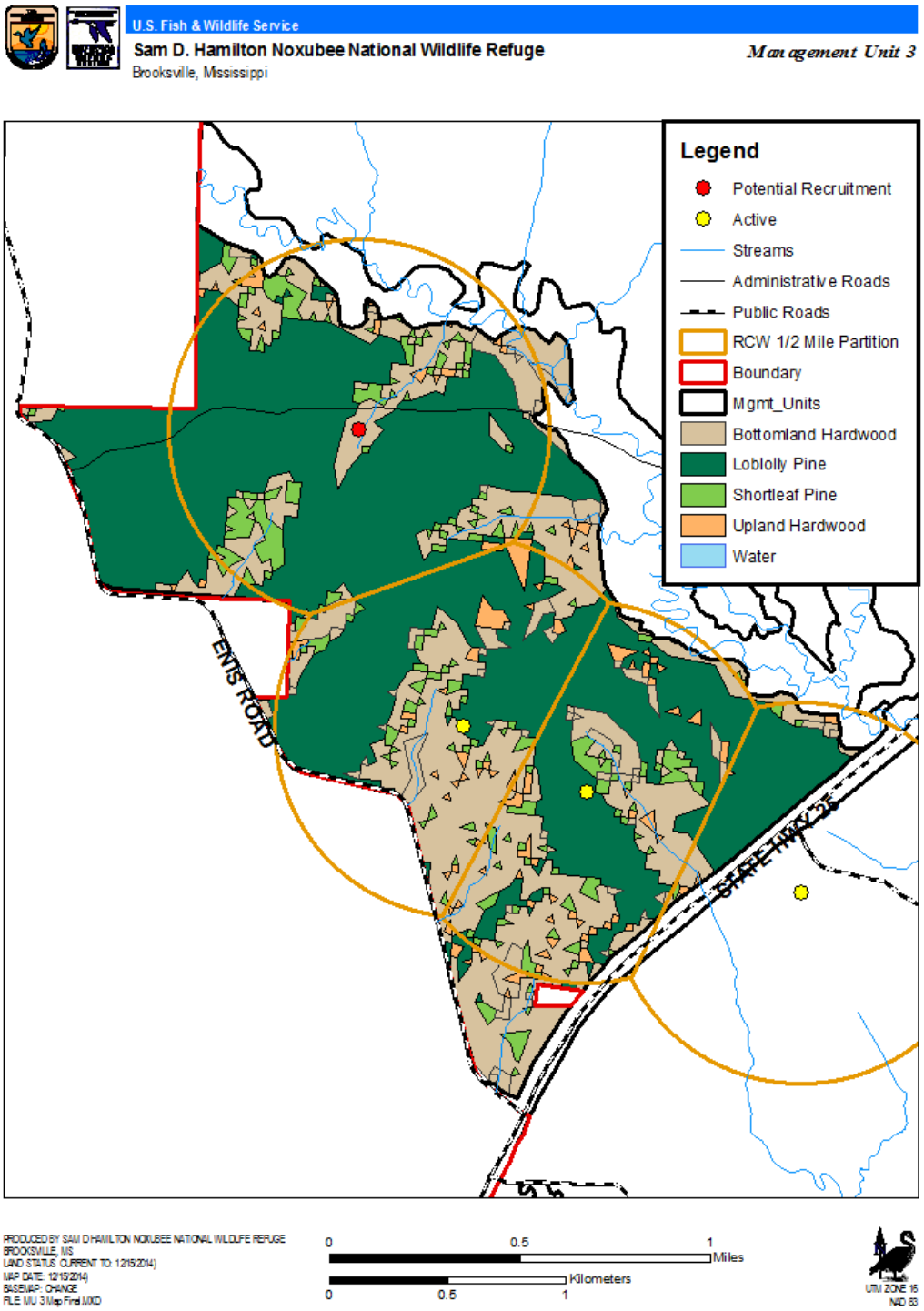
Administrative roads within the unit may be maintained in a graveled state from ditch to ditch and will receive maintenance related activity throughout the year. Starting at the outside of the ditches, habitat will be maintained in the same manner as within the main unit. Vegetative barriers may be left along road edges to provide wildlife cover from road related disturbance and to deter road hunting activities, particularly where roads are adjacent to fields. Haul roads created to facilitate removal of timber will be abandoned, possibly replanted to forest and not maintained through time.

<u>Adaptive Management Monitoring Elements</u>:

- The primary habitat response variables will be forest overstory structure and composition, forest midstory and understory structure and bottomland hardwood forest health and productivity for wildlife as measured by forest inventory data.
- The primary wildlife response variable will be forest breeding bird species composition and abundance, using breeding landbird surveys (point counts).
- The refuge will consider herptafauna survey (according to PARC guidelines and protocol) (http://www.parcplace.org/publications/inventory-and-monitoring-guide.html).
- The refuge will consider water quality sampling on an annual schedule within the unit.

- Monitor the effects of forest management activities to maintain integrity of desired species composition, habitat structure, and forest health.

MANAGEMENT UNIT 3
(Ennis Road Unit)



Resources of Concern:

Red-cockaded Woodpecker

Forest Breeding Birds (surrogates: Louisiana waterthrush and Wood thrush)

Species of Complimentary Need:

Wild turkey (*Meleagris gallopavo*)
White-tailed deer (*Odocoileus virginianus*)
Gray squirrel (*Sciurus carolinensis)*
Reptiles/Amphibians
Bats
Wood duck (*Aix sponsa*)

Habitat Objective: 1.3

Current Condition and Special Considerations:
Management Unit 3 consists of 1,270 acres of interspersed pine, mixed pine-hardwood and hardwood primarily located south of Chinchahoma Creek, with numerous fingers of streamside management zones extending throughout the unit. Management Unit 3 is similar in habitat type as Management Unit 1; the two are divided by Management Unit 2. Ennis Road, a public road, runs northwesterly and southeasterly along the west boundary. Highway 25 serves as the southeast border of the management unit. Craig Pond Road, a refuge administrative road, extends east and west through a short section near the northern end of the unit. The unit contains first, second, and third order streams.

Historic habitat analysis for this unit indicates the potential for historic conditions as having interspersed island habitats of loblolly pine-willow oak-1 (59 percent) surrounded by bald cypress-Atlantic white cedar-red raple-5 (27 percent) and fingers of American sycamore (*Platanus occidentalis*)–sugarberry (*Celtis laevigata*)–pine–3 (4 percent) habitat types and shortleaf pine – oaks-1 (6 percent)(LANDFIRE); five other habitat types make up the remaining 4 percent of the unit. The current habitat condition of the management unit appears of consistent type with past forest prescriptions designed to favor the loblolly pine. The site index for both pine and hardwood tree species within this unit is high and more than 60. Japanese climbing fern (*Lygodium japonicum Thunb. Ex Murr.*), Japanese stilt grass (*Microstegium vimineum*), privet (*Ligustrum vulgare*), and cogon grass (*Imperata brasiliensis*) continue to be a threat and all or one of these pests have been spot treated in the past. Japanese stilt grass can be found within the unit. The area possesses no private inholdings or old field habitats.

With the 1995 Forest Management Plan, the refuge established goals to manage the management unit and all habitats within it for RCWs and as of 2012, five clusters were established within the unit. The most recent RCW Forage Habitat Analysis shows this unit as not providing sufficient GQFH for the three inactive clusters and two active clusters. Chemical hardwood control has been used in areas immediately around RCW clusters but not widely

throughout the unit. Of these five clusters, three were natural starts, with the others being artificially created. Today, two clusters remains active (Clusters 82 and 28) and all others considered abandoned. A third active cluster, Cluster 95, located in Management Unit 4, has it a portion of its partition overlapping into this management unit.

Through time the unit has infrequently been treated with fire to control the hardwood midstory; very minimal prescribed fire has been used within the last several years. Approximately 9 miles of fire lines have been established throughout the unit extending along and across the intersecting waterways. Prescribed fire within this unit has been difficult due to wet soil conditions and limited access. Any residual smoke remaining after burns will settle in drains running across Highway 25. The northern boundary of this unit is within 3 miles of Starkville city limits.

River cane (*Arundinaria giganteais*) is found within this unit's waterways but sparse in occurrence. Due to increased soil wetness, prescribed fire carries less readily and hardwood regeneration occurs more readily. This unit serves as habitat for a suite of species including neotropical migratory birds, wild turkey, white-tailed deer, pileated woodpecker (*Dryocopus pileatus*), southern flying squirrel (*Glaucomys volans*), and numerous species of herpetofauna.

Unique Features:

The management unit has a church property inholding and a power line right of way in the southeast corner of the management unit. Craig Pond Road also bisects this unit. There may be numerous historical sites including old home sites, cisterns, and artifacts from Native Americans.

Management Prescription:

Except within the active and, if needed, identified recruitment RCW cluster partitions, habitat within Management Unit 3 will be managed for Louisiana waterthrush and wood thrush, by providing complex vertical and horizontal structure for nesting and foraging. Louisiana waterthrush and wood thrush will serve as the surrogate species of other priority forest birds. Group tree selection and free thinning could be used to create canopy gaps to promote forest structure and an intermixed forest with dominate, shade-intolerant trees with expansive, long-limbed crowns that overtop large, individual, shade tolerant trees. Canebrakes will be encouraged to develop within canopy gaps. Triggers for prescribed silvicultural treatments will be:

(1) Overstory canopy cover: >70%
(2) Midstory cover: <25%
(3) Basal area: >70 square feet per acre
(4) More than 25% of basal area approaching biological maturity (i.e., senescence)
(5) Tree stocking >70%

Habitat with active and established recruitment clusters will be managed toward providing GQFH for red-cockaded woodpeckers.

Forest Management

During the next 15-year period, the majority of the area within this unit may be managed for RCW. All other areas outside the managed partitions will likely be allowed to follow natural successional patterns with active management focused on exotic plant control. Habitat within the active partitions will be directed toward providing at least 120 acres of GQFH per partition as defined by the Red-cockaded Woodpecker Recovery Plan. When determined necessary, this same habitat management may also occur within no more than two recruitment clusters for a total of up to four partitions (counting Cluster 95). Individual hardwood trees having particular wildlife value (i.e., den trees, cavity trees, and other unique characters) may be left growing throughout the pine dominated areas but canopy hardwoods will be kept to below 30 percent of canopy.

Free thinning along with chemical treatments and prescribed fire will be used toward providing GQFH within a minimum of 120 acres of mature pine forest within the cluster. No silvicultural regeneration treatments for pine will occur within the partitions unless the partition contains more than 120 acres of pine habitat. No new recruitment clusters will be formed beyond the targeted four clusters and all abandoned clusters will be managed for historic habitat conditions and forest breeding birds.

Natural fire breaks will be favored to minimize the amount of artificial fire breaks installed or maintained between management units. Existing fire lines near the active clusters will be maintained to contain fire and new lines will be established if needed for the same purpose.

Aquatic Management

SMZs will be protected based on stream order and the minimums defined previously. Prescribed fire will normally be allowed to burn into SMZs with site conditions (e.g., wetness) dictating burn extent into the zone. Fire will be excluded from SMZs when habitat conditions indicate impacts to regeneration, mortality of canopy trees, and increased soil erosion. Timber management may occur within the SMZs under guidelines within Mississippi's Best Management Practices for Forestry (2008), if needed to maintain the desired forest conditions.

Beaver ponds will be allowed to form naturally within the creek channels to benefit wood ducks, but beaver population and dam control actions will be used to keep beaver activity confined to the channels. All water managed by beavers that impacts live timber during the growing season will be removed and when needed beaver numbers controlled.

Administrative Use Lands

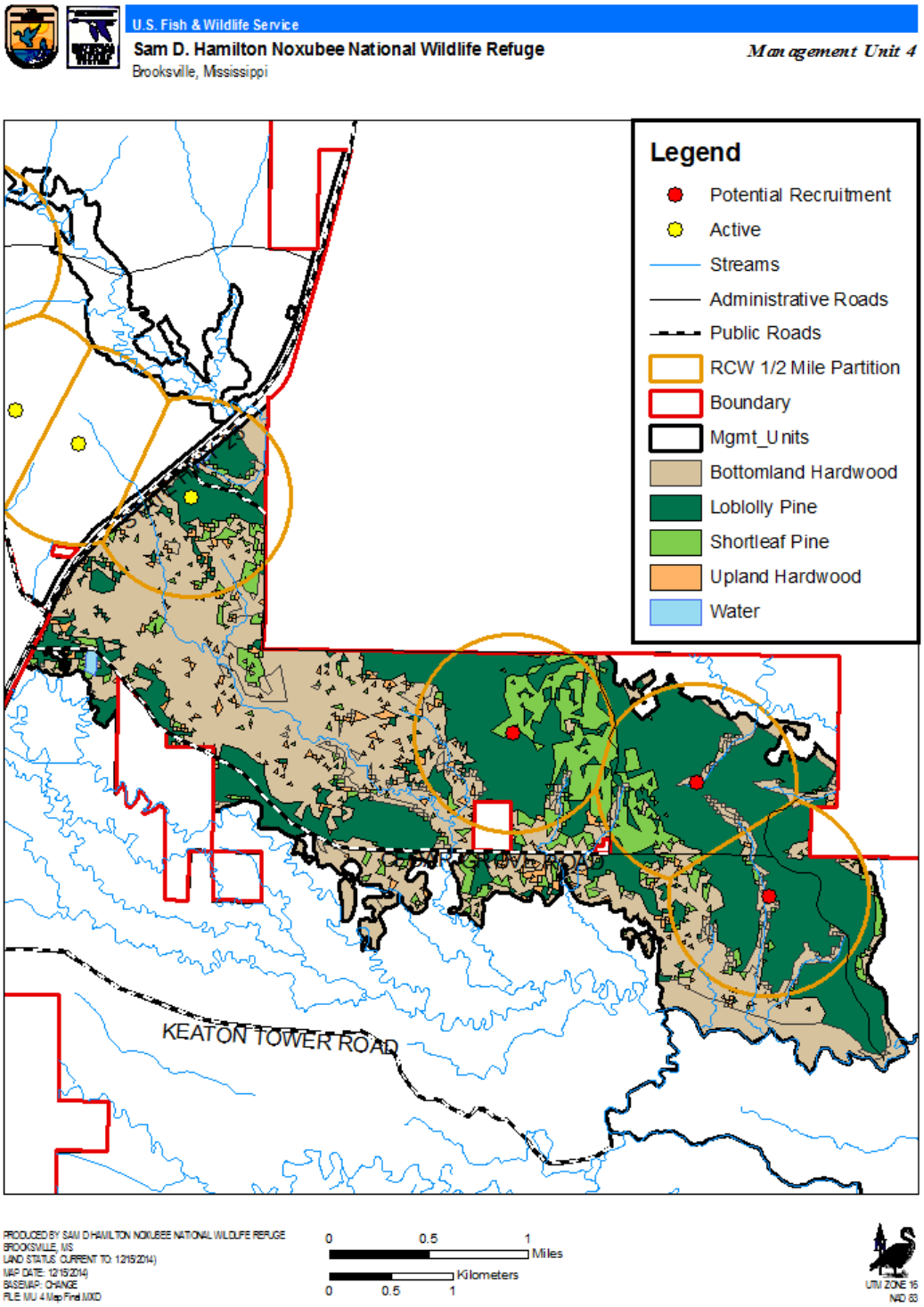
Open public and administrative roads within the unit may be maintained in a graveled state from ditch to ditch and will receive maintenance related activity throughout the year. Starting at the outside of the ditches, habitat will be maintained in the same manner as within the main unit. Vegetative barriers may be left along road edges to provide wildlife cover from road related

disturbance and to deter road hunting activities, particularly where roads are adjacent to fields. Haul roads created to facilitate removal of timber will be abandoned, possibly replanted to forest and not maintained through time.

Adaptive Management Monitoring Elements:

- Conduct RCW monitoring according to the 2003 RCW Recovery Plan.
- The primary habitat response variables will be forest overstory structure and composition, forest midstory and understory structure and bottomland hardwood forest health and productivity for wildlife as measured by forest inventory data.
- The primary wildlife response variable will be forest breeding bird species composition and abundance, using breeding landbird surveys (point counts).
- The refuge will consider herptafauna survey (according to PARC guidelines and protocol) (http://www.parcplace.org/publications/inventory-and-monitoring-guide.html).
- Monitor the effects of forest management activities to maintain integrity of desired species composition, habitat structure, and forest health.

MANAGEMENT UNIT 4



Resources of Concern:

Red-cockaded Woodpecker

Forest Breeding Birds (surrogates: Louisiana waterthrush and Wood thrush)

Species of Complimentary Needs:

Wild turkey (*Meleagris gallopavo*)
White-tailed deer (*Odocoileus virginianus*)
Gray squirrel (*Sciurus carolinensis)*
Reptiles/Amphibians
Bats
Wood duck (*Aix sponsa*)

Habitat Objectives: 1.1, 1.2

Current Condition and Special Considerations:

Management Unit 4 is a 3,338-acre unit consisting of ridge line of loblolly pine along the length and around the eastern end of Cedar Grove Road. Upland hardwood stringers and stands are intermixed within the pine forest, and bottomland hardwood forest dominates the lower elevations. The management unit is bordered by bottomland hardwoods to the south and east and Mississippi State University short-rotation age pine plantations to the north. The unit is bordered by Highway 25 on the west. The management unit is dissected by existing public use roads and existing fire lines that facilitate both administrative, public access, and use of prescribed fire. Approximately 2,170 acres have been infrequently treated with prescribed fire to control hardwood midstory and understory. Chemical hardwood control occurred on 125 acres to control midstory and invasive plants. Active forest management has been conducted at the stand level. The current pine forest (based on stand inventories) consists of the following age classes: 0 – 10 years (5%, 166 acres); 11 – 20 years (2%, 70 acres); 21 – 30 years (3%, 102 acres); 31 – 40 years, (1%, 28 acres); 41 – 50 years (6%, 19 acres); 51 – 60 years, (7 %, 231 acres); 61 – 70 years (42%, 1397 acres); 71 – 80 years (19.4%, 648 acres); 81 – 90 year (8%, 272 acres); 91 – 100 years (4%, 132 acres); and 101+ years (8%, 263 acres). The most recent Red-cockaded Woodpecker Forage Habitat Analysis describes this unit of pine forest as lacking sufficient GQFH.

With the 1995 Forest Management Plan, the refuge established goals to manage the management unit and all habitats within it for RCWs and as of 2012, six clusters were established within the unit. All six clusters in this unit were artificially created. Today, only one of these clusters remains active (95), and all others considered abandoned due to hardwood encroachment. The most recent Red-cockaded Woodpecker Forage Habitat Analysis describes this unit as lacking sufficient GQFH for any of the six recorded clusters. Chemical hardwood control has been used in areas immediately around RCW clusters but not widely throughout the unit.

The current habitat condition of the management unit appears to be of consistent type with past forest prescriptions designed to favor the loblolly pine. *Lespedeza bicolor*, Japanese climbing fern (*Lygodium japonicum Thunb. Ex Murr.*), and cogon grass (*Imperata brasiliensis*) are a threat and some or all of these pests have been treated on 125 acres within this unit. River cane (*Arundinaria giganteais*) is found within this unit's low areas and streamside management zones but sparse in occurrence. Due to soil wetness throughout the unit, numerous ephemeral pools exist throughout the unit.

This unit serves as habitat for a suite of species desiring diverse hardwood forest structure including neotropical migratory birds, wild turkey, white-tailed deer, pileated woodpecker (*Dryocopus pileatus*), southern flying squirrel (*Glaucomys volans*), and numerous species of herpetofauna.

Unique Characteristics:

Management within the unit is impacted by Highway 25 and several private inholding that complicate use of prescribed fire as acceptable wind direction for smoke management is limited to a southeasterly flow. The unit contains numerous historical and archaeological sites including a Civil War Era cemetery. In addition to smoke management issues, ability to manage habitat for the RCW is impacted by placement of potential habitat along boundary lines. This management unit is in relatively close proximity to the Dorman Lake Lodge owned by Mississippi State University's College of Forest Resources and this non-refuge land has different management objectives than the refuge.

Management Prescriptions:

Cluster 95 remains as the sole active RCW cluster within the unit and its partition overlaps with habitat in Management Unit 4. The cluster's partition is made up of 392 total acres of which 336 acres are pine dominated habitat. This cluster is difficult to burn due to natural soil moisture and logistical problems with Highway 25 and prevailing winds for smoke management during burning season. These difficulties have led to infrequent burn rotations and high amounts of hardwoods remaining within the midstory. Up to three additional recruitment clusters could be created within this unit for a total of four total possible partitions being managed for RCW.

Habitat outside of Cluster 95 and, if determined needed for RCW, the recruitment clusters will be managed for Louisiana waterthrush and wood thrush by providing complex vertical and horizontal structure for nesting and foraging. Louisiana waterthrush, rusty blackbird, and wood thrush will serve as the surrogate species of other priority forest birds.

Forest Management

Group tree selection and free thinning could be used to create canopy gaps to promote forest structure and an intermixed forest with dominate, shade-intolerant trees with expansive, long-limbed crowns that overtop large, individual, shade tolerant trees. Canebrakes will be encouraged to develop within canopy gaps.

During the next 15-year period, the majority of the areas outside Cluster 95 will likely be allowed to follow natural successional patterns with active management focused on exotic plant control. With time, the likely silvicultural method to be used in this habitat management will be free-thinning to reduce basal area and increase desired species composition within the forest. WSI practices will also be used to manage habitat to reach the desired habitat conditions. Regardless of method and timing of active management, the goal is to promote forest diversity and health that resemble historic conditions indicated by the NatureServe (Nature Serve 2011) terrestrial ecological systems. The criteria for attaining these conditions will be based on the basal area of tree species composition being greater than 50 percent of the predominant species types according to NatureServe (Nature Serve 2011) terrestrial ecological systems. In areas of the management unit that are similar to historic conditions, current forest regeneration methods such as seed tree, shelterwood, irregular shelterwood, or groups selection may be used to sustain the habitat and historic conditions across time. In many areas, conditions are not likely to be attained during the life of this plan, but significant efforts can be made to promote these condition in habitat that have not drastically skewed from the historic conditions.

Habitat within the partitions managed for RCW will be directed toward providing at least 120 acres of GQFH as defined by the Red-cockaded Woodpecker Recovery Plan. Individual hardwood trees having particular wildlife value (i.e., den trees, cavity trees, and other unique characters) may be left growing throughout the pine dominated areas but canopy hardwoods will be kept to below 30 percent of canopy.

Free thinning along with chemical treatments and prescribed fire will be used to provide GQFH within a minimum of 120 acres of mature pine forest within the cluster. No silvicultural regeneration treatments for pine will occur within the partition except when promoting historical forest conditions. No new recruitment clusters will be formed and all abandoned clusters will be managed for historic habitat conditions.

Natural fire breaks will be favored to minimize the amount of artificial fire breaks installed or maintained between management units. Existing fire lines near the active clusters will be maintained to contain fire and new lines will be established if needed for the same purpose. If Cluster 95 becomes abandoned, management focus would change to that similar for recruitment clusters to favor forest breeding birds similar to that of the surrounding habitat unless determined necessary for RCW management.

Aquatic Management

SMZs will be protected based on stream order and the minimums defined previously. Prescribed fire will normally be allowed to burn into SMZs with site conditions (e.g., wetness) dictating burn extent into the zone. Fire will be excluded from SMZs when habitat conditions indicate impacts to regeneration, mortality of canopy trees, and increased soil erosion. Timber management may occur within the SMZs under guidelines within Mississippi's Best Management Practices for Forestry (2008), if needed to maintain the desired forest conditions.

Beaver ponds will be allowed to form naturally within the creek channels to benefit wood ducks, but beaver population and dam control actions will be used to keep beaver activity confined to the channels. All water managed by beavers that impact live timber during the growing season will be removed and when needed beaver numbers controlled.

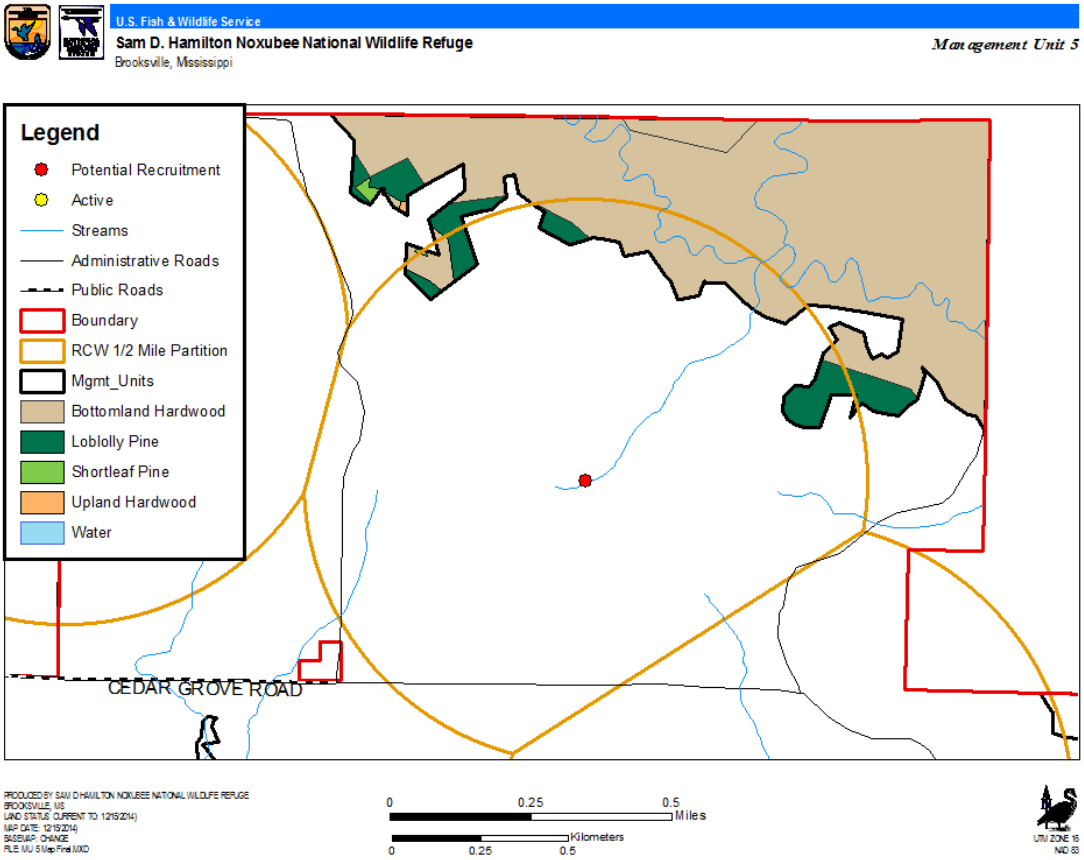
Administrative Use Lands

Open public and administrative roads within the unit may be maintained in a graveled state from ditch to ditch and will receive maintenance related activity throughout the year. Starting at the outside of the ditches, habitat will be maintained in the same manner as within the main unit. Vegetative barriers may be left along road edges to provide wildlife cover from road related disturbance and to deter road hunting activities, particularly where roads are adjacent to fields. Haul roads created to facilitate removal of timber will be abandoned, possibly replanted to forest and not maintained through time.

Adaptive Management Monitoring Elements:

- The primary habitat response variables will be forest overstory structure and composition, forest midstory and understory structure and bottomland hardwood forest health and productivity for wildlife as measured by forest inventory data.
- The primary wildlife response variable will be forest breeding bird species composition and abundance using breeding landbird surveys (point counts).
- The refuge will consider herptafauna survey (according to PARC guidelines and protocol) (http://www.parcplace.org/publications/inventory-and-monitoring-guide.html).
- The refuge will consider water quality sampling on an annual schedule within the unit.
- Monitor the effects of forest management activities to maintain integrity of desired species composition, habitat structure, and forest health.

MANAGEMENT UNIT 5
(Chinchahoma Creek East Unit)



Resources of Concern:

Forest breeding birds (surrogates: Prothonotary warbler, Rusty blackbird, and Yellow-throated warbler)

Species of Complimentary Need:

Wild turkey (*Meleagris gallopavo*)
White-tailed deer (*Odocoileus virginianus*)
Squirrel (*Sciurus carolinensis)*
Reptiles/Amphibians
Bats
Wood duck (*Aix sponsa*)

Habitat Objective: 2.1

Current Condition and Special Considerations:

Management Unit 5 consists of 220 acres of mixed hardwood primarily located along Chinchahoma Creek with fingers of SMZs extending to the surrounding units on both the north and south sides of the creek. The unit is bordered by Management Unit 4 to the south and the refuge boundary with Mississippi State University property (John W. Starr Memorial Forest) to the north. The unit is accessed via the left fork of Cedar Grove road, running north to the east refuge boundary. The area has been rarely treated with fire except for control burns from Management Unit 5 allowed to back into the bottomland hardwoods instead of using pushed fire lines. Chemical hardwood control has not occurred within this unit but herbicides have been used to control exotics and invasive plants. Historic habitat analysis for this unit indicates the largest portion of the management unit had a portion that was represented by willow oak (*Quercus phellos*) – water oak (*Quercus nigra*). The historic type also showed loblolly pine (*Pinus Taeda*) – willow oak (*Quercus phellos*) habitat type at the higher elevation sections along the southern edge leading up the slope toward management Unit 4. The current habitat condition is consistent to historic conditions on the fact that they are still bottomland hardwoods. Japanese climbing fern (*Lygodium japonicum Thunb. Ex Murr.*), Japanese stilt grass (*Microstegium vimineum*), privet (*Ligustrum vulgare*), and cogon grass (*Imperata brasiliensis*) could be a threat. There are no private inholdings within the unit.

River cane (*Arundinaria giganteais*) is found throughout this unit and is well distributed but sparse in occurrence due to the forest condition. Due to increased soil wetness, prescribed fire carries less readily and hardwood regeneration occurs more readily. This unit serves as habitat for a suite of species including neotropical migratory birds, wild turkey, white-tailed deer, pileated woodpecker (*Dryocopus pileatus*), southern flying squirrel (*Glaucomys volans*), and numerous species of herpetofauna.

Unique Characteristics:

Unit borders Mississippi State University property on the north and east and it is almost 100 percent bottomland habitat. There may be numerous historical sites including old home sites, cisterns, and artifacts from Native Americans.

Management Prescription:

Habitat within Management Unit 5 will be managed to benefit forest breeding birds by providing complex vertical and horizontal structure for nesting and foraging. Canopy gaps will be intermixed with dominate, shade-intolerant trees with expansive, long-limbed crowns that overtop large, individual, shade tolerant trees. Canebrakes will be encouraged to develop with canopy gaps.

Forest Management

The desired forest condition will follow that recommended by the LMVJV Restoration, Management, and Monitoring of Forest Resources in the Mississippi Alluvial Valley: Recommendations for Enhancing Wildlife Habitat 2007. Timber management including Wildlife

Stand Improvement techniques may occur within the SMZs under guidelines within Mississippi's Best Management Practices for Forestry (2008), if needed to maintain the desired forest conditions. Forest management will be conducted to favor shade-intolerant species and the establishment of large, over mature trees within the forest for the benefit of numerous wildlife species including bats and wood duck.

Various silvicultural methods could be used to create canopy gaps to promote forest structure and an intermixed forest with dominate, shade-intolerant trees with expansive, long-limbed crowns that overtop large, individual, shade tolerant trees. The methods used for regeneration of the hardwood forest in this management unit could likely consist of patch cuts, single tree selection, group selection, shelterwood, irregular shelterwood, afforestation, and reforestation. The regeneration methods used will be site and habitat condition dependent based on observed site conditions and proximate location to other feature within the unit. All decisions on location, frequency, and intensity of treatments will be determined by habitat condition and needs of the resource of concern in the management unit. Trees having unique wildlife values (i.e., cavity and den trees) will be left throughout the unit. Canebrakes will be encouraged to develop within canopy gaps.

During the next 15-year period, the majority of the areas will likely be allowed to follow natural successional patterns with active management focused on exotic plant control. With time, the likely silvicultural method to be used in this habitat management will be free-thinning to reduce basal area and increase species composition within the forest. WSI practices will also be used to manage habitat to reach the desired habitat conditions. Regardless of method and timing of active management, the goal is to promote forest diversity and health that resemble historic conditions indicated by the NatureServe terrestrial ecological systems. The criteria for attaining these conditions will be based on the basal area of tree species composition being greater than 50 percent of the predominant species types according to NatureServe (Nature Serve 2011) terrestrial ecological systems. In areas of the management unit that are similar to historic conditions, current forest regeneration methods such as seed tree, shelterwood, irregular shelterwood, or groups selection may be used to sustain the habitat and historic condition across time. In many areas conditions are not likely to be attained during the life of this plan, but significant efforts can be made to promote these condition in habitats that have not drastically skewed from the historic conditions.

Triggers for prescribed silvicultural treatments will be:

1. Overstory canopy cover: >70%
2. Midstory cover: <25%
3. Basal area: >70 square feet per acre
4. More than 25% of basal area approaching biological maturity (i.e., senescence)
5. Tree stocking >70%

Prescribed fire may not be a major management tool in this unit, but may be used in various places to remove unwanted vegetation or to remove debris. Natural fire breaks will be favored to minimize the amount of artificial fire breaks installed or maintained between management units. Alternative firing techniques (e.g., backing fires) and the sites natural wetness will be

used to ensure habitats within Management Unit 5 receive only slight impact along the transition zones. Fire may damage hardwoods creating basal cavities which may be of later benefit to Rafinesque's big-eared bat (*Corynorhinus rafinesquii*).

Aquatic Management

SMZs will be protected based on stream order and the minimums defined previously. Prescribed fire will normally be allowed to burn into SMZs with site conditions (e.g., wetness) dictating burn extent into the zone. Fire will be excluded from SMZ when habitat conditions indicate impacts to regeneration, mortality of canopy trees, and increased soil erosion. Timber management may occur within the SMZs under guidelines within Mississippi's Best Management Practices for Forestry (2008) if needed to maintain the desired forest conditions.

Beaver ponds will be allowed to form naturally within the creek channels to benefit wood ducks, but beaver population and dam control actions will be used to keep beaver activity confined to the channels. All water managed by beavers that impacts live timber during the growing season will be removed and when needed beaver numbers controlled.

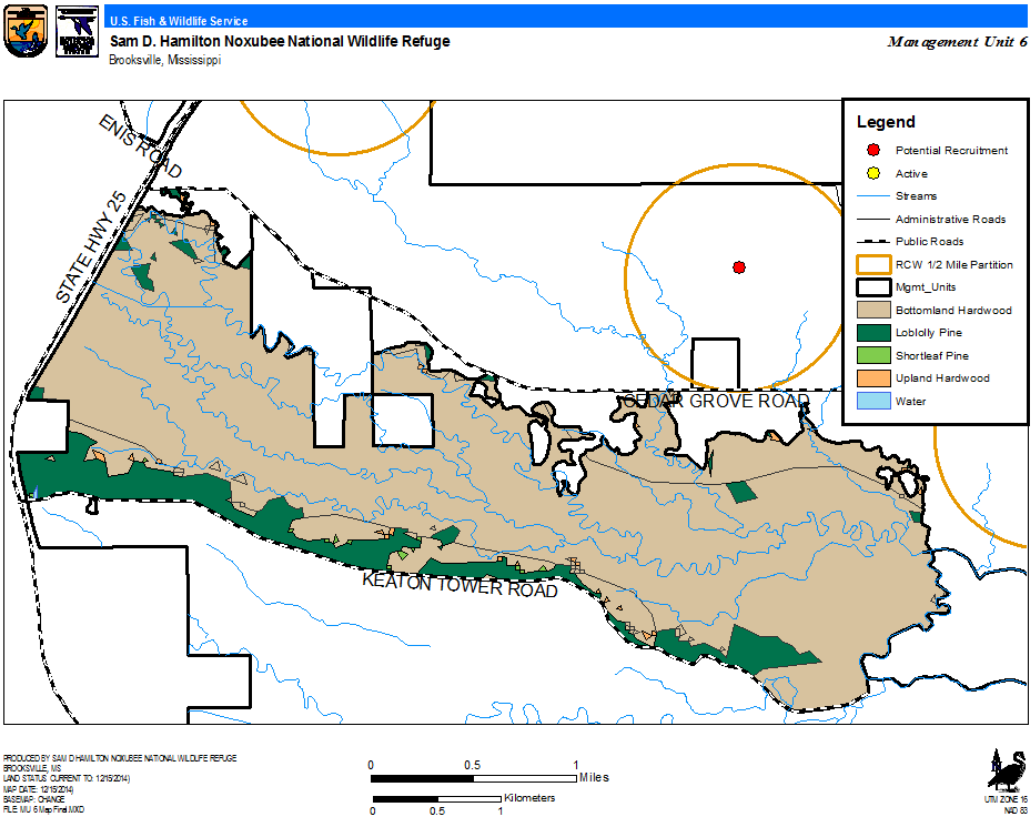
Administrative Use Lands

With no roads inside the management unit, road maintenance is not required within this unit. Invasive and exotic plants will receive spot treatments of herbicide.

Adaptive Management Monitoring Elements:

- The primary habitat response variables will be forest overstory structure and composition, forest midstory and understory structure and bottomland hardwood forest health and productivity for wildlife as measured by forest inventory data.
- The primary wildlife response variable will be forest breeding bird species composition and abundance using breeding landbird surveys (point counts).
- The refuge will consider herptafauna survey (according to PARC guidelines and protocol) (http://www.parcplace.org/publications/inventory-and-monitoring-guide.html).
- The refuge will consider water quality sampling on an annual schedule within the unit.
- Monitor the effects of forest management activities to maintain integrity of desired species composition, habitat structure, and forest health.

MANAGEMENT UNIT 6
(Keaton Tower Road North)



Resources of Concern:

Forest Breeding Birds (surrogates: Prothonotary warbler, Rusty blackbird and Yellow-throated warbler)

Species of Complimentary Need:

Wild turkey (*Meleagris gallopavo*)
White-tailed deer (*Odocoileus virginianus*)
Squirrel (*Sciurus carolinensis)*
Reptiles/Amphibians
Bats
Wood duck (*Aix sponsa*)

Habitat Objective: 2.1

Current Condition and Special Considerations:

Management Unit 6 consists of 2,368 acres of mixed hardwood primarily located along Cypress Creek with fingers of first and second order streams extending to the surrounding ridges along Keaton Tower Road and Cedar Grove Road. The unit boundaries are Highway 25 to the west, Keaton Tower Road to the South, Unit 4 to the North, and Unit 7 to the East. The unit has limited access with very few roads and numerous streams. The unit has had very little, if any, forestry activity in it for some amount of time. Over time the boundary areas have been indirectly treated with fire to control the hardwood midstory within the pine stands along Keaton Tower and Cedar Grove Roads. Fire lines have been established at the base of both ridges to the north and south of the unit, but fire has also been allowed to back into these hardwood bottoms to minimize the impacts of heavy equipment usage. Chemical control of hardwoods has been minimal within this unit but herbicides have been used to control exotics and invasive plants. Historic habitat analysis for this unit indicates the area as having the potential for willow oak (*Quercus phellos*) - water oak (*Quercus nigra*) in the cypress creek bottoms, which is still represented today. Loblolly pine (*Pinus teada*) - willow oak (*Quercus phellos*) type along the ridges and bald cypress (*Taxodium distichum*) - red maple (*Acer rubrum*) along the transition from upland to bottoms, which is currently not well represented. The current habitat condition of the management unit appears of similar type. Japanese climbing fern (*Lygodium japonicum Thunb. Ex Murr.*), Japanese stilt grass (*Microstegium vimineum*), privet (*Ligustrum vulgare*), and cogon grass (*Imperata brasiliensis*) continue to be a threat and all or one of these pests have been spot treated in the past. Several private inholdings exist adjacent to and within the unit along Cedar Grove Road and Highway 25. The area also contains 22 acres of fields that are occasionally mowed or disked every few years, but shows advanced signs of regeneration into forest with significant sweetgum (*Liquidambar styraciflua*). The original management intent for these fields was to provide habitat for wild turkey.

River cane (*Arundinaria giganteais*) is found throughout this unit and is well distributed but sparse in occurrence due to the forest condition. Due to increased soil wetness, prescribed fire carries less readily and hardwood regeneration occurs more readily. This unit serves as habitat for a suite of species including neotropical migratory birds, wild turkey, white-tailed deer, pileated woodpecker (*Dryocopus pileatus*), southern flying squirrel (*Glaucomys volans*), and numerous species of herpetofauna.

There is the potential for numerous historical sites including old home sites, cisterns, and artifacts from Native Americans. Old road beds and one old home site can still be found along Keaton Tower Road and Cedar Grove Road.

Unique Features:

There are several fields along Keaton Tower Road that have been maintained in early successional habitat for over 30 years. The unit borders the Proposed Wilderness Area to the west.

Management Prescriptions:

Habitat within Management Unit 6 will be managed to benefit forest breeding birds by providing complex vertical and horizontal structure for nesting and foraging. Canopy gaps will be intermixed with dominate, shade-intolerant trees with expansive, long-limbed crowns that overtop large, individual, shade tolerant trees. Canebrakes will be encouraged to develop with canopy gaps.

Forest Management

The desired forest condition will follow that recommended by the LMVJV Restoration, Management, and Monitoring of Forest Resources in the Mississippi Alluvial Valley: Recommendations for Enhancing Wildlife Habitat 2007. Timber management including wildlife stand improvement techniques may occur within the SMZs under guidelines within Mississippi's Best Management Practices for Forestry (2008) if needed to maintain the desired forest conditions. Forest management will be conducted to favor shade-intolerant species and the establishment of large, over-mature trees within the forest for the benefit of numerous wildlife species including bats and wood duck.

During the next 15-year period, the majority of the areas will likely be allowed to follow natural successional patterns with active management focused on exotic plant control. With time, the likely silvicultural method to be used in this habitat management will be free-thinning to reduce basal area and increase species composition within the forest. WSI practices will also be used to manage habitat to reach the desired habitat conditions. Regardless of method and timing of active management, the goal is to promote forest diversity and health that resemble historic conditions indicated by the NatureServe terrestrial ecological systems. The criteria for attaining these conditions will be based on the basal area of tree species composition being greater than 50 percent of the predominant species types according to NatureServe (Nature Serve 2011) terrestrial ecological systems. In many areas conditions are not likely to be attained during the life of this plan, but significant efforts can be made to promote these conditions in habitats that have not drastically skewed from the historic conditions.

Triggers for prescribed silvicultural treatments will be:

1. Overstory canopy cover: >70%
2. Midstory cover: <25%
3. Basal area: >70 square feet per acre
4. More than 25% of basal area approaching biological maturity (i.e., senescence)
5. Tree stocking >70%

Various silvicultural methods could be used to create canopy gaps to promote forest structure and an intermixed forest with dominate, shade-intolerant trees with expansive, long-limbed crowns that overtop large, individual, shade tolerant trees. Canebrakes will be encouraged to develop within canopy gaps.

The methods used for regeneration of the hardwood forest in this management unit could likely consist of patch cuts, single tree selection, group selection, shelterwood, irregular shelterwood,

afforestation, and reforestation. The regeneration methods used will be site and habitat condition-dependent based on observed site conditions and proximate location to other feature within the unit. All decisions on location, frequency, and intensity of treatments will be determined by habitat conditions and needs of the resource of concern in the management unit. Trees having unique wildlife values (i.e., cavity and den trees) will be left throughout the unit.

Prescribed fire may be used in the management unit to promote early successional stages within old fields and the pine ecosystem along the ridge on Keaton Tower road to benefit some forest breeding birds and other native wildlife. Natural fire breaks will be favored to minimize the amount of artificial fire breaks installed or maintained between management units. Alternative firing techniques (e.g., backing fires) and the site's natural wetness will be used to ensure habitats within Management Unit 6 receive only slight impact along the transition zones. Fire may damage hardwoods creating basal cavities which may be of later benefit to Rafinesque's big-eared bat (*Corynorhinus rafinesquii*).

Aquatic Management

SMZs will be protected based on stream order and the minimums defined previously. Prescribed fire will normally be allowed to burn into SMZs with site conditions (e.g., wetness) dictating burn extent into the zone. Fire will be excluded from SMZs when habitat conditions indicate impacts to regeneration, mortality of canopy trees, and increased soil erosion. Timber management may occur within the SMZs under guidelines within Mississippi's Best Management Practices for Forestry (2008) if needed to maintain the desired forest conditions.

Transition habitats found outside the areas defined as SMZs and along the perimeter of the management unit and within old fields will be managed to provide high density saplings, shrubs, cane, or vines. Old fields within the unit will continue to be managed as fields with mowing and disking occurring on a 3-year rotation to the benefit species like the American woodcock.

Beaver ponds will be allowed to form naturally within the creek channels to benefit wood ducks, but beaver population and dam control actions will be used to keep beaver activity confined to the channels. All water managed by beavers that impacts live timber during the growing season will be removed and when needed beaver numbers controlled.

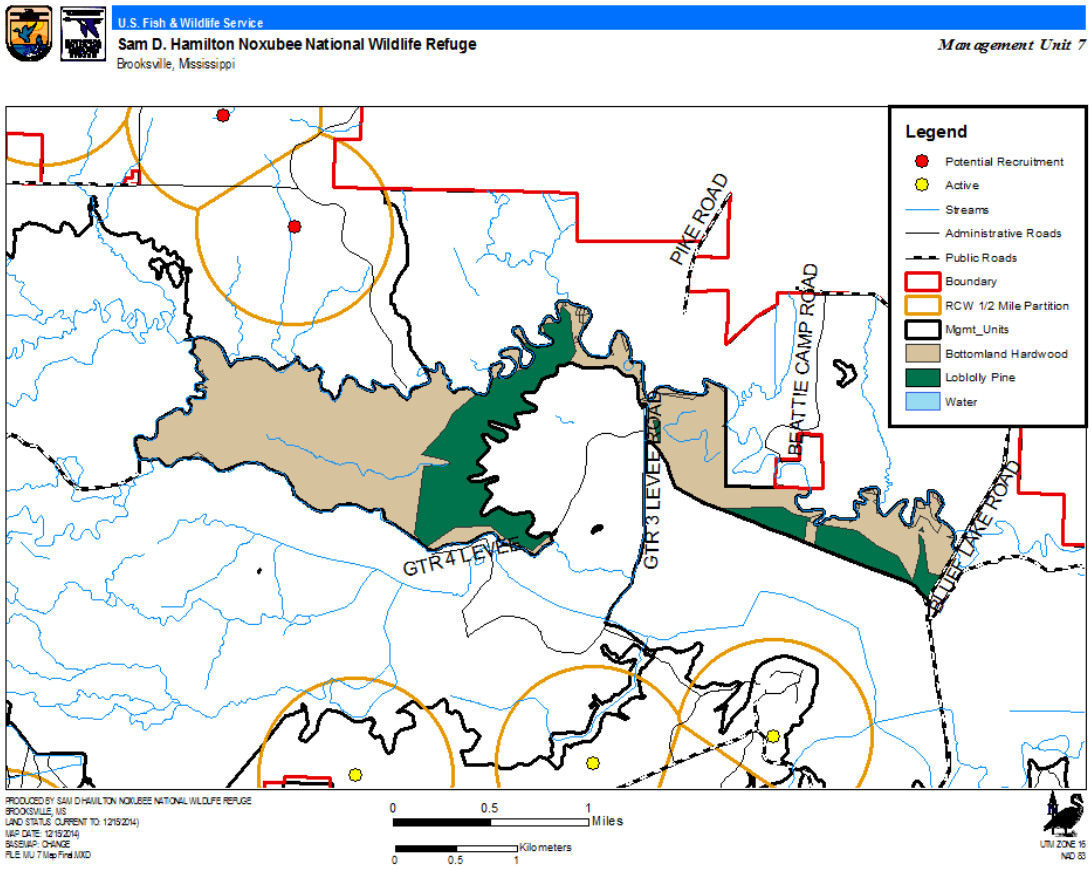
Administrative Use Lands

Open public and administrative roads within the unit may be maintained in a graveled state from ditch to ditch and will receive maintenance related activity throughout the year. Starting at the outside of the ditches, habitat will be maintained in the same manner as within the main unit. Vegetative barriers may be left along road edges to provide wildlife cover from road related disturbance and to deter road hunting activities, particularly where roads are adjacent to fields. Haul roads created to facilitate removal of timber will be abandoned, possibly replanted to forest and not maintained through time.

Adaptive Management Monitoring Elements:

- The primary habitat response variables will be forest overstory structure and composition, forest midstory and understory structure, and bottomland hardwood forest health and productivity for wildlife as measured by forest inventory data.
- The primary wildlife response variable will be forest breeding bird species composition and abundance using breeding landbird surveys (point counts).
- The refuge will consider herptafauna survey (according to PARC guidelines and protocol) (http://www.parcplace.org/publications/inventory-and-monitoring-guide.html).
- Monitor the effects of forest management activities to maintain integrity of desired species composition, habitat structure, and forest health.

MANAGEMENT UNIT 7
(Noxubee Wilderness Area)



<u>Resources of Concern</u>: Forest Breeding Birds (surrogates: Prothonotary warbler and Rusty blackbird)

<u>Habitat Objective</u>: 4.1

<u>Current Condition and Special Considerations</u>:

Management Unit 7 consists of 1,185 acres of mixed hardwood primarily located between Noxubee River and Oktoc Creek. The unit boundaries are Noxubee River to the north and west, Oktoc Creek, Management Unit 9 and Bluff Lake North Levee to the south, and Management Unit 12 to the east. A large portion of the management unit is not easily accessible by roads. A Wilderness Review was completed in 1974, resulting in a 1,200-acre proposed wilderness within the National Wilderness Preservation System at the refuge. The proposed wilderness area is managed using the guidance in 6 RM 8, Wilderness Area Management.

Historic habitat analysis for this unit indicates the area as having Willow Oak (*Quercus Phellos*) -Water Oak (*Quercus Nigra*) in the Noxubee River Bottoms, which is still represented today. Loblolly Pine (*Pinus Teada*) – Willow Oak (*Quercus Phellos*) are not currently represented, likely due to hydrological changes associated with GTR 3. The current habitat condition of the management unit appears to be of similar type in the areas historically shown to be bottomland hardwood species. Japanese climbing fern (*Lygodium japonicum Thunb. Ex Murr.*), Japanese stilt grass (*Microstegium vimineum*), privet (*Ligustrum vulgare*), and cogon grass (*Imperata brasiliensis*) continue to be a threat and all or one of these pests have been spot treated in the past. No inholdings exist adjacent to and within the unit.

Unique Features:

The Historic Robinson Road crossed the Noxubee River in the vicinity of due north of the end of the GTR 3 main levee. Seasonally flooded and timbered bottomland hardwoods have been proposed as wilderness since 1974. The area is bounded by the Noxubee River on the west and north, Oktoc Creek on the south, and Bluff Lake on the southeast. The area timber and land has not been impacted by man since before the refuge was established in 1940. There is a 3-mile loop primitive foot trail in the proposed wilderness that has been historically maintained by the Sierra Club. There also have been times when chain saws were used to clear the trail and trail markers have been put up in conflict with the Wilderness Act.

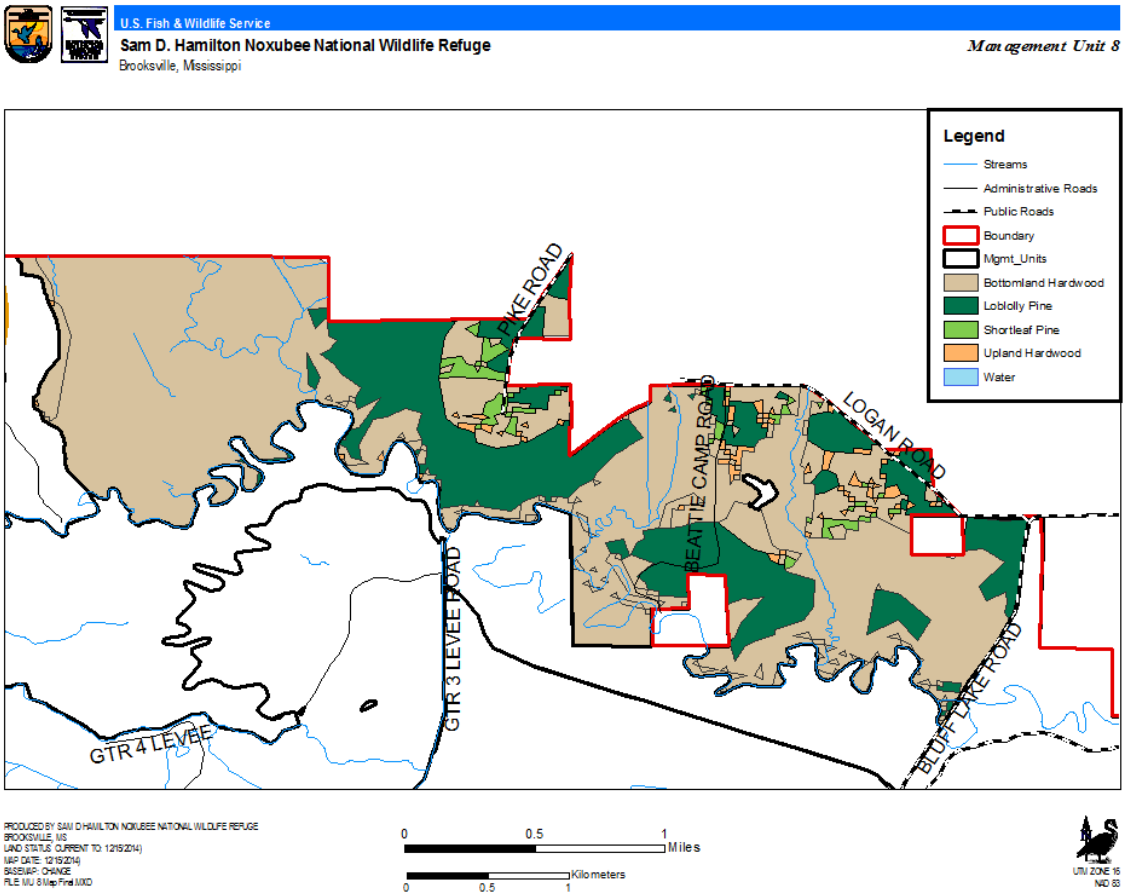
Management Prescription:

Management Unit 7 will be managed as a wilderness area in accordance to the Wilderness Act. The metal bridge into the wilderness area at the end of Keaton Tower road will be removed and the wilderness hiking trail will cease to be maintained. Restoration work will be formulated to remove the footprint of the abandoned access road to private land from Bluff Lake Road near Noxubee River. If needed to protect the areas wilderness character, exotic plant and animal control may occur within the unit using chemicals or mechanical methods. This may include the control of beaver and beaver dams. Management actions will adhere to procedures dictated by the Wilderness Act and Wilderness Policy.

Adaptive Management Monitoring Elements:

- Monitor wilderness character once every 5 years.

MANAGEMENT UNIT 8
(Beattie Camp Unit)



<u>Resources of Concern</u>:

Forest Breeding Birds (surrogates: Louisiana waterthrush and wood thrush)

<u>Species of Complimentary Need</u>:

Wild turkey (*Meleagris gallopavo*)
White-tailed deer (*Odocoileus virginianus*)
Squirrel (*Sciurus carolinensis)*
Reptiles/Amphibians
Bats
Wood duck (*Aix sponsa*)

Habitat Objective: 2.1

Current Condition and Special Considerations:

Management Unit 8 consists of 1,590 acres of mixed hardwood primarily located along Noxubee River and 425 acres of pine forest on higher elevations. The total acreage for the management unit is approximately 1,585 acres. Noxubee River is the primary drainage in this unit with fingers of first and second order streams extending to the north to refuge boundary and beyond. The unit boundaries are the refuge boundary and Logan Road to the north, Management Unit 4 to the west, Noxubee River to the south, and Logan Road and Bluff Lake Levee Road to the east. The pine forest habitat is fairly accessible via Pike Road, Beattie Camp Road, and Logan Road. The unit has had very little if any forestry activity in recent years. Over time the boundary areas have been indirectly treated with fire to control the hardwood midstory within the pine stands along Logan Road and Beattie Camp Road. Fire lines have been established at the confluence of the bottomland hardwood and pine ecosystems. Fire has also been allowed to back into these hardwood bottoms to minimize the impacts of heavy equipment usage. Chemical control of hardwood has been minimal within this unit, but herbicides have been used to control exotics and invasive plants.

Historic habitat analysis for this unit indicates the area as having willow oak (*Quercus Phellos*) - water oak (*Quercus Nigra*) in the Noxubee River Bottoms, which is still represented today. Loblolly pine (*Pinus Teada*) - willow oak (*Quercus Phellos*) type along the ridges and Bald Cypress (*Taxodium Distichum*) - red maple (*Acer Rubrum*) occurs along the transition from upland to bottoms, which is not well represented currently. The current habitat condition of the management unit appears of similar type. Japanese climbing fern (*Lygodium japonicum Thunb. Ex Murr.*), Japanese stilt grass (*Microstegium vimineum*), privet (*Ligustrum vulgare*), and cogon grass (*Imperata brasiliensis*) continue to be a threat and all or one of these pests have been spot treated in the past. Several private inholdings exist adjacent to and within the unit along Logan Road and Beattie Camp Road.

River cane (*Arundinaria giganteais*) is associated throughout this unit and is well distributed but sparse in occurrence due to the forest condition. Due to increased soil wetness, prescribed fire carries less readily and hardwood regeneration occurs more readily. This unit serves as habitat for a suite of species including neotropical migratory birds, wild turkey, white-tailed deer, pileated woodpecker (*Dryocopus pileatus*), southern flying squirrel (*Glaucomys volans*), and numerous species of herpetofauna.

Unique Features:

The unit has several unique characteristics including a 40-acre beaver deadening, a 17-acre slough, and a 8.5-acre duck impoundment installed by a previous landowner which has not be utilized by the Service. The unit also contains the location where the Old Robinson Road crossed the Noxubee River. There is the potential for numerous historical sites including old home sites, cisterns, and artifacts from Native Americans. Old road beds and several old home sites can still be found along Logan Road, Beattie Camp Road, Pike Road, and the Old Robinson Road bed.

Management Procedures:

Habitat within Management Unit 8 will be managed to benefit forest breeding birds by providing complex vertical and horizontal structure for nesting and foraging. Canopy gaps will be intermixed with dominate, shade-intolerant trees with expansive, long-limbed crowns that overtop large, individual, shade tolerant trees. Canebrakes will be encouraged to develop with canopy gaps.

Forest Management

The desired forest condition will follow that recommended by the LMVJV Restoration, Management, and Monitoring of Forest Resources in the Mississippi Alluvial Valley: Recommendations for Enhancing Wildlife Habitat 2007. Timber management including wildlife stand improvement techniques may occur within the SMZs under guidelines within Mississippi's Best Management Practices for Forestry (2008) if needed to maintain the desired forest conditions. Forest management will be conducted to favor shade-intolerant species and the establishment of large, over-mature trees within the forest for the benefit of numerous wildlife species including bats and wood duck.

During the next 15-year period, the majority of the areas will likely be allowed to follow natural successional patterns with active management focused on exotic plant control. With time, the likely silvicultural method to be used in this habitat management will be free-thinning to reduce basal area and increase species composition within the forest. WSI practices will also be used to manage habitat to reach the desired habitat conditions. Regardless of method and timing of active management, the goal is to promote forest diversity and health that resemble historic conditions indicated by the NatureServe terrestrial ecological systems. The criteria for attaining these conditions will be based on the basal area of tree species composition being greater than 50 percent of the predominant species types according to NatureServe (Nature Serve 2011) terrestrial ecological systems. In many areas conditions are not likely to be attained during the life of this plan, but significant efforts can be made to promote these conditions in habitats that have not drastically skewed from the historic conditions.

Triggers for prescribed silvicultural treatments will be:

1. Overstory canopy cover: >70%
2. Midstory cover: <25%
3. Basal area: >70 square feet per acre
4. More than 25% of basal area approaching biological maturity (i.e., senescence)
5. Tree stocking >70%

Various silvicultural methods could be used to create canopy gaps to promote forest structure and an intermixed forest with dominate, shade-intolerant trees with expansive, long-limbed crowns that overtop large, individual, shade tolerant trees. Canebrakes will be encouraged to develop within canopy gaps.

The methods used for regeneration of the hardwood forest in this management unit could likely consist of patch cuts, single tree selection, group selection, shelterwood, irregular shelterwood, afforestation, and reforestation. The regeneration methods used will be site and habitat condition-dependent based on observed site conditions and proximate location to other feature within the unit. All decisions on location, frequency, and intensity of treatments will be determined by habitat conditions and needs of the resource of concern in the management unit. Trees having unique wildlife values (i.e., cavity and den trees) will be left throughout the unit.

Prescribed fire may not be a major management tool in this unit but may be used in various places to remove unwanted vegetation or to remove debris. Natural fire breaks will be favored to minimize the amount of artificial fire breaks installed or maintained between management units. Alternative firing techniques (e.g., backing fires) and the site's natural wetness will be used to ensure habitats within Management Unit 8 receive only slight impact along the transition zones. Fire may damage hardwoods creating basal cavities which may be of later benefit to Rafinesque's big-eared bat (*Corynorhinus rafinesquii*).

Aquatic Management

SMZs will be protected based on stream order and the minimums defined previously. Prescribed fire will normally be allowed to burn into SMZs with site conditions (e.g., wetness) dictating burn extent into the zone. Fire will be excluded from SMZs when habitat conditions indicate impacts to regeneration, mortality of canopy trees, and increased soil erosion. Timber management may occur within the SMZs under guidelines within Mississippi's Best Management Practices for Forestry (2008) if needed to maintain the desired forest conditions.

Beaver ponds will be allowed to form naturally within the creek channels to benefit wood ducks, but beaver population and dam control actions will be used to keep beaver activity confined to the channels. All water managed by beavers that impacts live timber during the growing season will be removed and when needed beaver numbers controlled.

Administrative Use Lands

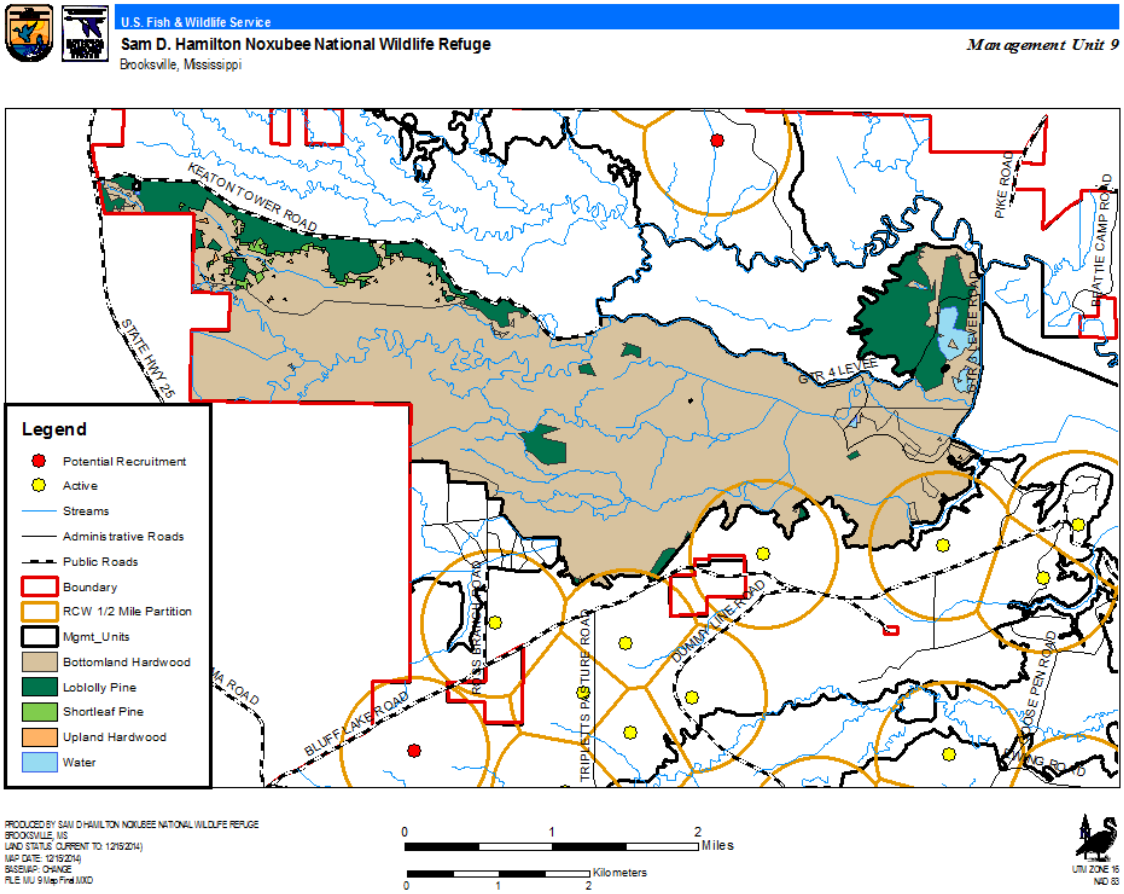
Open public and administrative roads within the unit may be maintained in a graveled state from ditch to ditch and will receive maintenance related activity throughout the year. Starting at the outside of the ditches, habitat will be maintained in the same manner as within the main unit. Vegetative barriers may be left along road edges to provide wildlife cover from road related disturbance and to deter road hunting activities, particularly where roads are adjacent to fields. Haul roads created to facilitate removal of timber will be abandoned, possibly replanted to forest and not maintained through time. Sections of the Old Robinson Road that are visible should be protected from disturbance to maintain the integrity of the old road bed.

<u>Adaptive Management Monitoring Elements</u>:

- The primary habitat response variables will be forest overstory structure and composition, forest midstory and understory structure, and bottomland hardwood forest health and productivity for wildlife as measured by forest inventory data.

- The primary wildlife response variable will be forest breeding bird species composition and abundance using breeding landbird surveys (point counts).
- The refuge will consider herpetofauna survey (according to PARC guidelines and protocol) (http://www.parcplace.org/publications/inventory-and-monitoring-guide.html).
- Monitor the effects of forest management activities to maintain integrity of desired species composition, habitat structure, and forest health.

MANAGEMENT UNIT 9
(Oktoc Creek Unit)



<u>Resources of Concern</u>:

Forest Breeding Birds (surrogates: Prothonotary warbler, Rusty blackbird and Yellow-throated warbler)

<u>Species of Complimentary Need</u>:

Wild turkey (*Meleagris gallopavo*)
White-tailed deer (*Odocoileus virginianus*)
Squirrel (*Sciurus carolinensis)*
Reptiles/Amphibians
Bats
Wood duck (*Aix sponsa*)

Habitat Objective: 2.1

Current Condition and Special Considerations:

Management Unit 9 consists of 4,728 acres of mostly mixed bottomland hardwood located along Noxubee River with fingers of first and second order streams extending to the surrounding ridges along Keaton Tower Road and the interior flatwoods north of Bluff Lake Road. The unit boundaries are the refuge boundary against the College of Forest Resources for portions to the west, Keaton Tower Road and Oktoc Creek to the north, and Bluff Lake to the East and several management units to the south. The unit has limited access with very few roads and numerous streams. The unit has had very little if any forestry activity in it. Over time the boundary areas have been indirectly treated with fire to control the hardwood midstory within the pine stands along Keaton Tower Road. Fire lines have been established at the base of both ridges to the north of the unit, but fire has also been allowed to back into these hardwood bottoms to minimize the impacts of heavy equipment usage. Chemical hardwood control has been minimal within this unit, but herbicides have been used to control exotics and invasive plants.

Historic habitat analysis for this unit indicates the area as having the potential for willow oak (*Quercus phellos*) - water oak (*Quercus nigra*) in the Cypress Creek Bottoms, which is still represented today. For loblolly pine (*Pinus teada*) - willow oak (*Quercus phellos*) along the ridges and bald cypress (*Taxodium distichum*) - red maple (*Acer rubrum*) along the transition from upland to bottoms, which is currently not well represented. The current habitat condition of the management unit appears of similar type. Japanese climbing fern (*Lygodium japonicum Thunb. Ex Murr.*), Japanese stilt grass (*Microstegium vimineum*), privet (*Ligustrum vulgare*), and cogon grass (*Imperata brasiliensis*) continue to be a threat and all or one of these pests have been spot treated in the past. There are no private inholdings located within the management unit. The area also contains 21 acres of out of condition hay fields occasionally mowed or disked every few years, but shows advanced signs of regeneration into forest with significant sweetgum (*Liquidambar styraciflua*). The original management intent for these fields was to provide habitat for wild turkey. The unit also contains GTR 3 (547 acres) and GTR 4 (620 acres) habitat in which water levels are manipulated to create or improve use by migrating waterfowl within the winter months.

River cane (*Arundinaria giganteais*) is associated throughout this unit and is well distributed but sparse in occurrence due to the forest condition. Due to increased soil wetness, prescribed fire carries less readily and hardwood regeneration occurs more readily. This unit serves as habitat for a suite of species including neotropical migratory birds, wild turkey, white-tailed deer, pileated woodpecker (*Dryocopus pileatus*), southern flying squirrel (*Glaucomys volans*), and numerous species of herpetofauna.

There is the potential for numerous historical sites including old home sites, cisterns, and artifacts from Native Americans. Old road beds and old home sites can still be found along Keaton Tower Road and along the Robinson Road.

Unique Characteristics:

This unit contains GTR 3 and GTR 4. GTR 3 most likely will no longer be managed as a GTR but returned to a bottomland hardwood forest. Portions of Old Robinson road run along the southern boundary and within the unit.

Management Prescriptions:

Habitat within Management Unit 9 will be managed to benefit forest breeding birds by providing complex vertical and horizontal structure for nesting and foraging. Canopy gaps will be intermixed with dominate, shade-intolerant trees with expansive, long-limbed crowns that overtop large, individual, shade tolerant trees. Canebrakes will be encouraged to develop with canopy gaps.

Forest Management

The desired forest condition will follow that recommended by the LMVJV Restoration, Management, and Monitoring of Forest Resources in the Mississippi Alluvial Valley: Recommendations for Enhancing Wildlife Habitat 2007. Timber management including wildlife stand improvement techniques may occur within the SMZs under guidelines within Mississippi's Best Management Practices for Forestry (2008) if needed to maintain the desired forest conditions. Forest management will be conducted to favor shade-intolerant species and the establishment of large, over-mature trees within the forest for the benefit of numerous wildlife species including bats and wood duck.

During the next 15-year period, the majority of the areas will likely be allowed to follow natural successional patterns with active management focused on exotic plant control. With time, the likely silvicultural method to be used in this habitat management will be free-thinning to reduce basal area and increase species composition within the forest. WSI practices will also be used to manage habitat to reach the desired habitat conditions. Regardless of method and timing of active management, the goal is to promote forest diversity and health that resembles historic conditions indicated by the NatureServe terrestrial ecological systems. The criteria for attaining these conditions will be based on the basal area of tree species composition being greater than 50 percent of the predominant species types according to NatureServe (Nature Serve 2011) terrestrial ecological systems. In many areas conditions are not likely to be attained during the life of this plan but, significant efforts can be made to promote these conditions in habitats that have not drastically skewed from the historic conditions.

Triggers for prescribed silvicultural treatments will be:

1. Overstory canopy cover: >70%
2. Midstory cover: <25%
3. Basal area: >70 square feet per acre
4. More than 25% of basal area approaching biological maturity (i.e., senescence)
5. Tree stocking >70%

Various silvicultural methods could be used to create canopy gaps to promote forest structure and an intermixed forest with dominate, shade-intolerant trees with expansive, long-limbed crowns that overtop large, individual, shade tolerant trees. Canebrakes will be encouraged to develop within canopy gaps.

The methods used for regeneration of the hardwood forest in this management unit could likely consist of patch cuts, single tree selection, group selection, shelterwood, irregular shelterwood, afforestation, and reforestation. The regeneration methods used will be site and habitat condition-dependent based on observed site conditions and proximate location to other feature within the unit. All decisions on location, frequency, and intensity of treatments will be determined by habitat conditions and needs of the resource of concern in the management unit. Trees having unique wildlife values (i.e., cavity and den trees) will be left throughout the unit.

Prescribed fire may be used in the management unit to promote early successional stages within old fields and the pine ecosystem along the ridge along Keaton Tower road to benefit some forest breeding birds and other native wildlife. Natural fire breaks will be favored to minimize the amount of artificial fire breaks installed or maintained between management units. Alternative firing techniques (e.g., backing fires) and the site's natural wetness will be used to ensure habitats within Management Unit 9 receive only slight impact along the transition zones. Fire may damage hardwoods, creating basal cavities which may be of later benefit to Rafinesque's big-eared bat (*Corynorhinus rafinesquii*).

Aquatic Management

SMZs will be protected based on stream order and the minimums defined previously. Prescribed fire will normally be allowed to burn into SMZs with site conditions (e.g., wetness) dictating burn extent into the zone. Fire will be excluded from SMZ when habitat conditions indicate impacts to regeneration, mortality of canopy trees, and increased soil erosion. Timber management may occur within the SMZs under guidelines within Mississippi's Best Management Practices for Forestry (2008) if needed to maintain the desired forest conditions.

The transition habitats found outside the areas defined as SMZs and along the perimeter of the management unit and within old fields will be managed to provide high density saplings, shrubs, cane or vines. Old fields within the unit will continue to be managed as old fields with mowing and disking occurring on a 3-year rotation to the benefit species like the American woodcock.

Beaver ponds will be allowed to form naturally within the creek channels to benefit wood ducks, but beaver population and dam control actions will be used to keep beaver activity confined to the channels. All water managed by beavers that impacts live timber during the growing season will be removed and when needed beaver numbers controlled.

The unit also contains GTR 3 and GTR 4 habitat in which water levels are manipulated to create or improve usage by migrating waterfowl within the winter months. The levee of GTR 4 is contained within the management unit and will be maintained as a functional levee for water management in GTR 4. The open area of GTR 3 that has been maintained as a moist-soil unit

will be reforested to site appropriate tree species and allowed to return to an unmanaged flood regime by degrading the wing levee of GTR 3.

Administrative Use Lands

Open public and administrative roads within the unit may be maintained in a graveled state from ditch to ditch and will receive maintenance related activity throughout the year. Starting at the outside of the ditches, habitat will be maintained in the same manner as within the main unit. Vegetative barriers may be left along road edges to provide wildlife cover from road related disturbance and to deter road hunting activities, particularly where roads are adjacent to fields. Haul roads, created to facilitate removal of timber, will be abandoned and possibly replanted to forest and not maintained through time. Sections of the Old Robinson Road that are visible should be protected from disturbance to maintain the integrity of the old road bed. The levee of GTR 3 is also included in the management unit and will be maintained as a road instead of functional levee.

Adaptive Management:

- The primary habitat response variables will be forest overstory structure and composition, forest midstory and understory structure, and bottomland hardwood forest health and productivity for wildlife as measured by forest inventory data.
- The primary wildlife response variable will be forest breeding bird species composition and abundance using breeding landbird surveys (point counts).
- The refuge will consider herptafauna survey (according to PARC guidelines and protocol) (http://www.parcplace.org/publications/inventory-and-monitoring-guide.html).
- Monitor the effects of forest management activities to maintain integrity of desired species composition, habitat structure, and forest health.

MANAGEMENT UNIT 10

Resources of Concern:

Waterfowl

Species of Complimentary Need:

Wood duck (*Aix sponsa*)
Invertebrates
Wading birds
Shorebirds

Habitat Objectives: 2.1, 2.2

Current Condition and Special Considerations:

Management Unit 10 consists of 339 acres of moist-soil fields and a small stand of hardwood timber located south of Jones Creek and north of Ross Branch Reservoir. The management unit was established to focus solely on waterfowl management. This area can provide agricultural crops, moist-soil plants, and flooded hard mast within the management unit for

wintering waterfowl. Ross Branch Reservoir was designed to hold water for flooding this management unit during the winter.

Management Unit 10 has been in moist-soil management for several years with very little agricultural crop production. When resources and time permit the refuge would like to take a portion of the unit (<50%) out of moist-soil management for a season and add a crop (i.e., millet, milo, or corn). These are considered hot foods for ducks and produce more calories per acre than moist-soil plants, invertebrates, and hard mast.

This area will start the flooding process around November 15 and will slowly allow water to move into the impoundments throughout the winter. These impoundments can be flooded in a variety of ways, but are generally flooded through seasonal rains and utilizing a portion of Ross Branch Reservoir's volume. Impoundments are generally flooded from easterly to westerly direction. Some of the northwestern impoundments rely on rain water capture to flood them.

Unique Features:

This unit is closed to all public entry. An eagle nest is located within the northern portion of the unit. It is the main moist-soil area on the refuge and it is the only designated moist-soil unit. GTR 3 does have many moist-soil characteristics but is not classified as a refuge moist-soil area. This area has a small GTR located in the heart of the unit.

Management Prescriptions:

Habitat within Management Unit 10 will be managed following the moist-soil management guidelines for the Service in the Southeast Region. In late spring and early summer, water levels will be lowered to encourage production of native moist-soil plants and expose mud flats. This same management regime will benefit wood storks, shorebirds, and wading birds by providing mud flats and shallow water habitat. Beaver and nutria activity within the unit will be strictly controlled and kept outside the boundaries of the unit. If feral hogs become prevalent within this unit, active trapping will take place.

Forest Management

The areas within the unit will be managed for non-woody native plants and agricultural crops through mowing, disking, agricultural practices, chemical treatment, prescribed fire, and water level manipulation occurring seasonally to benefit waterfowl species. Timber existing within the unit will be passively managed and subject to flooding coinciding with the neighboring moist-soil field subunit. Areas not used for moist-soil management will be returned to forested habitat consistent with bottomland hardwood forests.

Aquatic Management

These impoundments are managed to hold water into late spring and early summer. The prolonged submerging of these fields promotes the desired annual plant growth (i.e., Eleocharis Spp., Cyperus Spp. Leptochloa Spp., etc.). These plants are also promoted by the use of selective chemicals. The chemical, 2-4, D, is a selective herbicide that controls broad-leaved

plants while maintaining grasses. It does an outstanding job of releasing grasses in these impoundments. With the lack of agriculture adjacent to this area, drift is not a major concern when using 2-4, D in the impoundments.

When crops are planted, the fields need to be drained with an early drawdown to allow farm equipment early access to the area. These fields need to be planted in the April-May timeframe while soil temperatures are still cool and soil moisture is maintained. A no-till planting method would be best to prevent soil disturbance and promotion of undesirable completion for planted crops. A crop can be planted and potentially sprayed with 2-4, D prior to the stalks reaching tractor-axle height. This will allow an added advantage for these planted crops to out-compete undesirable plants.

Fall burning will be implemented under an adaptive management style. Burning has not been attempted in this unit per the refuge records. This will help set back succession and promote desirable species the coming spring. Other refuges practice this method and have had successful waterfowl use in the recently burned areas.

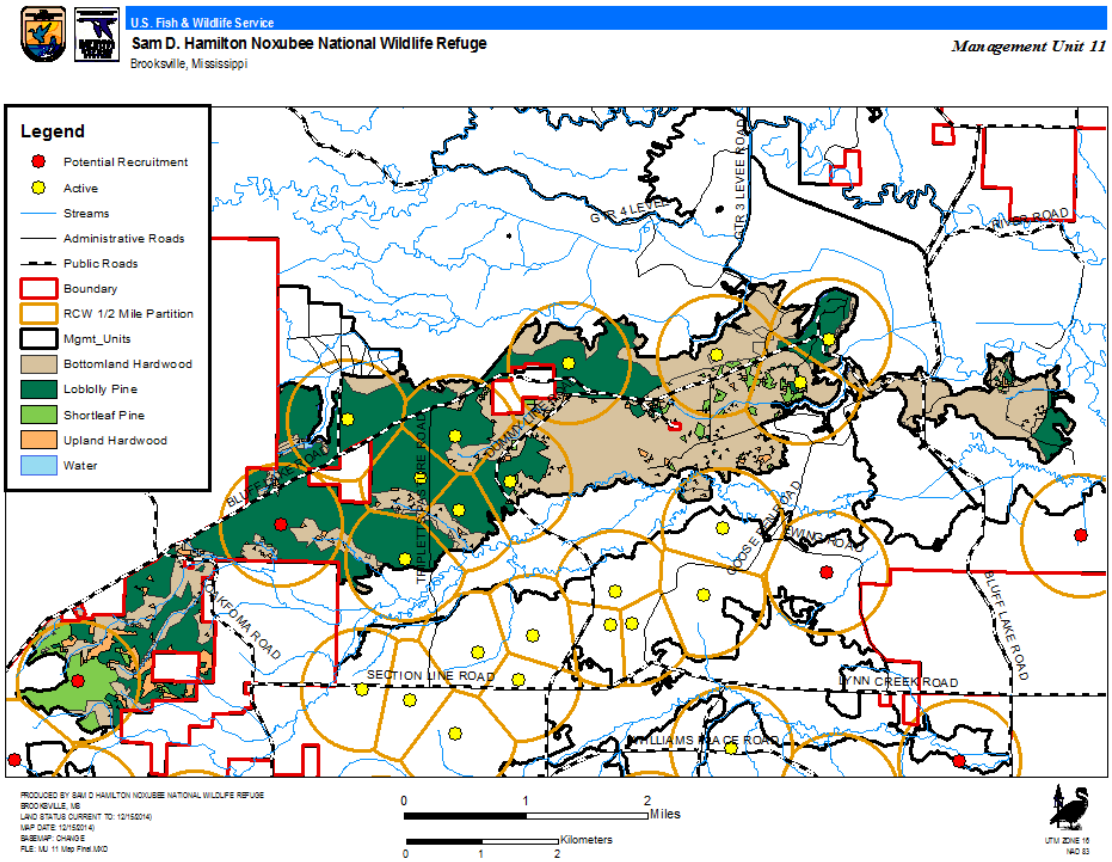
Administrative Use Lands

The Ross Branch Administrative Access Road enters the unit from the south and allows access to numerous levee roads. Levees will be maintained to control woody vegetation. Driving lanes will be periodically mowed or chemically sprayed to control grass height, while levee banks will be protected from disturbance from mid April through early August to enhance habitat for ground nesting birds.

Adaptive Management Monitoring Elements:

- The primary habitat response variable will be percent desirable moist-soil plant cover measured using a recorded sampling design during late summer, early fall.
- The second habitat response variable will be estimated bushels per acre of crop in the planted area during late summer/early fall in agricultural areas.
- The primary wildlife response variable will be wintering waterfowl use measured by bi-weekly waterfowl counts from September 15 to April 1.
- Noxious/invasive plant and animal surveys will be conducted periodically throughout the growing season.

MANAGEMENT UNIT 11
(Bluff Lake Road Unit)



Resources of Concern:

Red-cockaded Woodpecker (*Picoides borealis*)

Species of Complimentary Needs:

Wild turkey (*Meleagris gallopavo*)
Northern bobwhite (*Colinus virginianus*)
Bachman's sparrow (*Aimophila aestivalis*)
Brown-headed nuthatch (*Sitta pusilla*)

Habitat Objective: 1.1

Current Condition along with Special Considerations:

Management Unit 11 is a 5,190-acre management unit consisting predominantly of loblolly pine in the interior flatwoods and bottomland hardwoods in lower elevations. From 2010 to 2012, a

total of 2,096 acres were burned. Overtime, 60 percent of the area has been treated to control hardwood midstory. Chemical control occurred on over 633 acres to control midstory. Throughout the history of the refuge, active forest management started with plantings of trees in the late 1940s as part of stand level restoration activities. Less than 25 percent of the forest within the management unit is less than 60 years old. The majority of the pine forest consists of 60 to 80 year old trees (Figure 13).

Historic habitat analysis for this unit indicates the area as having pine habitat type (LANDFIRE) and the current condition is consistent with this description. Areas that are not predominantly pine spp. may be managed as hardwood stand to mimic historic conditions. *Lespedeza bicolor,* Japanese climbing fern (*Lygodium japonicum*), and cogon grass (*Imperata brasiliensis*) are threats and some or all of these pests have been treated on 60 acres within this unit. Several private inholdings exist in the interior of the management unit along Bluff Lake Road and the 16th Section School Board Property, and other various landowners on the south border. The area also contains several out of condition hay fields that are occasionally mowed or disked every few years, but all fields show signs of regeneration into forest with significant sweet gum (*Liquidambar styraciflua*) and loblolly pine (*Pinus taeda*) establishment. The original management intended for these fields was to provide habitat for wild turkey and northern bobwhite.

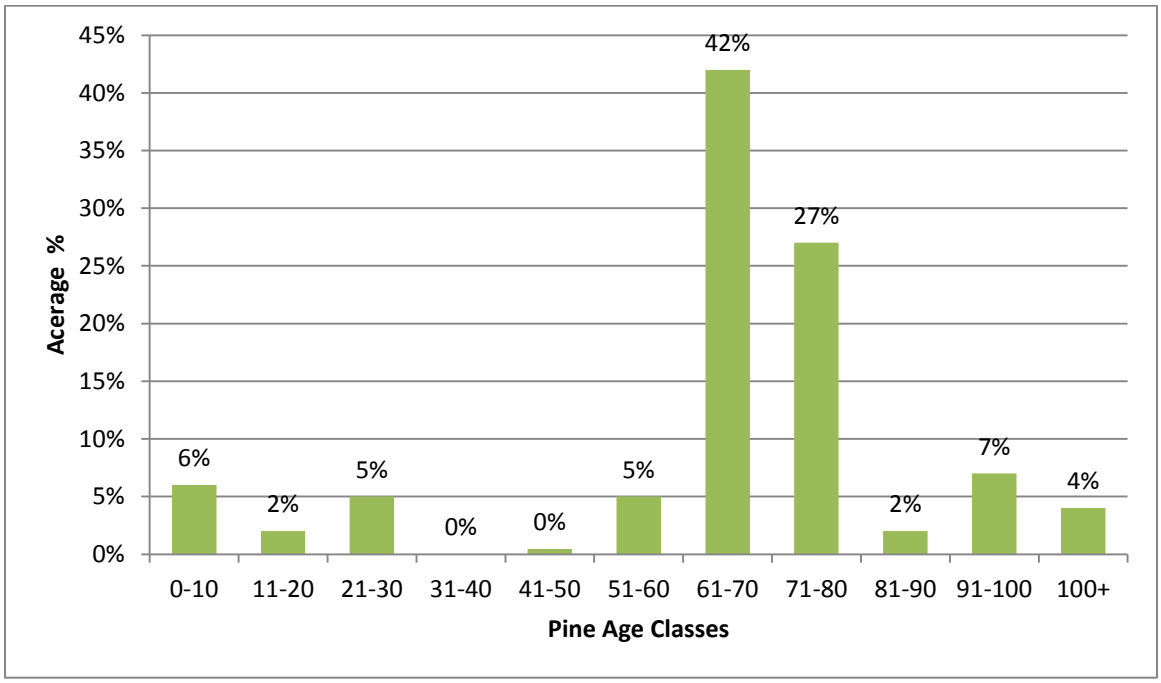


Figure 13. Age class distribution for pine within Management Unit 11 as determined by stand inventories, 2012.

The unit contains first and second order streams. SMZs within Management Unit 11 consist of the red oak type. These areas have been included previously in forest management and protected following Mississippi's Best Management Practices for Forestry (2008). Numerous small perennial and intermittent streams along with drains are distributed throughout the unit.

River cane is found within these zones and well distributed but sparse in occurrence. A shift in community type from pine to hardwood occurs in these areas. Due to the increased soil wetness, prescribed fire carries less readily and hardwood regeneration occurs more readily. These zones provide habitat components for a suite of species including wild turkey, white-tailed deer, pileated woodpecker (*Dryocopus pileatus*), southern flying squirrel (*Glaucomys volans*) and numerous species of herpetofauna. These hardwood SMZs will be protected from commercial logging disturbance based on the standards exceeding the Mississippi Best Management Practices document but prescribed fire will be allowed to enter these zones. There may be areas where unusual or rare plant communities are encountered within the management unit that need to be protected from disturbance.

With the 1995 Forest Management Plan, the refuge established goals to manage the management unit and all habitats within it for RCWs and as of 2012, nineteen clusters were established within the unit. Of these nineteen clusters, twelve were natural starts with the others being artificially created. Today, ten of these clusters contain RCW groups and all other clusters are considered abandoned. The most recent Red-cockaded Woodpecker Forage Habitat Analysis demonstrated this unit as lacking sufficient GQFH for any of the remaining group's partitions. Chemical hardwood control has been used in areas immediately around RCW clusters but not widely throughout the unit. All the cluster partitions described below are not meeting GQFH criterion due to presence of hardwood midstory greater than 7 feet tall, pine basal area greater than 80 square feet per acre, and groundcover being comprised of less than 40 percent herbaceous cover. Also some of these cluster partitions cannot meet sustainable GQFH goals due to acreage constraints based on available pine acres. The only criteria that the partitions currently meet are at least 18-stem-per-acre of pine greater than 14 inches diameter at breast height that are greater than 60 years of age and prescribed fire interval of less than 5 years carried by fuels other than herbaceous ground cover.

Cluster 14 – This 385-acre partition is on a peninsula bordered by Bluff Lake to the north, east and along part of its western edge. The partition is compressed and unable to reach its full acreage of 502 acres due to the proximity of Cluster 13. The 342-acre Cluster 13 partition makes up most of the western and southern boundary to Cluster 14. Under its current configuration, Cluster 14 can provide a maximum of 137 acres (36 percent) of pine habitat within its compressed boundary. The remaining 248 acres within the foraging partition are not of historic pine type and currently consist of open water, agricultural fields, and bottomland hardwood habitats.

Cluster 13 – This cluster is bordered by Cluster 14 to the north, Doyle Arm of Bluff Lake to east, and Cluster 104 to the west. Due to this location, the foraging partition is compressed and contains 342 acres. In addition, the lake's water body extends into the partition as well. The remaining acres consist of water, fields, and bottomland hardwoods. Currently, Cluster 13 provides 161 acres (47 percent) of pine habitat, falls under the 200-acre minimum needed to sustain GQFH.

Cluster 104 – This 459-acre partition is bordered on the east with Cluster 13. This cluster does not border any additional clusters to the south or the west. Currently, Cluster 104 contains 299

acres (60 percent) of pine habitat within the partition. The remaining acreage consists of wetlands, water, fields, and bottomland hardwoods.

Cluster 6 – This cluster is bordered by Cluster 19 to the northwest and Cluster 123 to the northeast. The cluster partition is made up of 408 total acres and 191 (47 percent) of the 408 acres are pine dominated habitat.

Cluster 123 – This cluster is bordered by Cluster 19 to the northwest, Cluster 15 to the north, Cluster 107 to the northeast, and Cluster 6 to the southwest. The cluster partition is made up of 225 total acres and 166 (74 percent) of the 225 acres are pine dominated habitat.

Cluster 107 – This cluster is bordered by inactive Cluster 119 to the north, Cluster 15 to the northwest, Cluster 123 to the southwest. The cluster partition is made up of 350 total acres and 192 (55 percent) of the 350 acres are pine dominated habitat.

Cluster 19 – This cluster is bordered by Cluster 103 to the northwest, Cluster 15 to the northeast, Cluster 123 to the southeast, and Cluster 6 to the south. The cluster partition is made up of 222 total acres and 221 (99 percent) of the 222 acres are pine dominated habitat.

Cluster 15 – This cluster is bordered by Cluster 103 to the west, Cluster 107 to the east, Cluster 123 to the south, and Cluster 19 to the southwest. The cluster partition is made up of 305 total acres and 274 (90 percent) of the 305 acres are pine dominated habitat. This cluster does have enough acres to sustain GQFH.

Cluster 103 – This cluster is bordered by Cluster 15 to the east and Cluster 19 to the southeast. The cluster partition is made up of 380 total acres and 320 (84 percent) of the 380 acres are pine dominated habitat. This cluster does have enough acres to sustain GQFH for the life of the cluster.

Cluster 126 – This cluster is bordered by Cluster 15 to the east and Cluster 19 to the southeast. The cluster partition is made up of 451 total acres and 254 (56 percent) of the 451 acres are pine dominated habitat.

Cluster 119 (inactive) – This cluster will continue to be managed for inactive cluster as per the RCW Recovery Plan. This cluster will not be used for a recruitment site as it does not provide adequate pine acres for a recruitment site. This cluster area will be utilized by Cluster 126, 15, and 107.

<u>Unique Features</u>:

Several private and public inholdings are located within this unit. There are numerous historical sites including old home sites, cisterns, and remnants of the Historic Robinson Road. The management unit also contains all of the refuge offices, shops, fire tower, compounds, and residences. The area known as Douglas Bluff is a unique geological area in the unit that contains an abrupt shift in elevation from the interior flatwoods into a bottomland hardwood ecosystem.

Management Prescriptions:

Habitat within Management Unit 11 will be primarily directed toward providing for the needs of the federally listed RCW. A total of 11 partitions, including the ten currently active and one potential recruitment partition, may be managed within this unit. The site index for both pine and hardwood tree species within this unit is more than 60. In areas outside the locations defined as SMZs, the forest will be managed toward providing at least 120 acres of GQFH per RCW group, as defined by the Red-cockaded Woodpecker Recovery Plan (Table 2). Individual hardwood trees having particular wildlife value (i.e., den trees, cavity trees, and other unique characters) may be left growing throughout the pine dominated forest but canopy hardwoods will be kept to below 30 percent of canopy.

Forest Management

To accomplish the habitat management objectives for RCW within this unit, it will be necessary to manage clusters and their locations to provide a target 300 acres of pine habitat per cluster to sustain a perpetual 120 acres of GQFH of pine for RCWs.

Cluster 14 – The pine forested area of this cluster does not provide the 300-acre minimum needed to sustain GQFH into the long-term future (2003 RCW Recovery Plan). Left under its current condition, this cluster may at best be managed for GQFH for no more than another 50 years. Within the near future, the forest within this cluster can be expected to degrade and eventually not provide habitat for the RCW. Once the pine habitat degrades, it will be approximately 30 years before a regenerated pine forest will be able to again providing foraging habitat. Until a long-term solution can be realized that would allow for an increase of pine acres, management efforts will be to provide the best foraging habitat possible within 120 acres through control of midstory vegetation and protection of nesting and roosting trees from bug outbreaks. Regeneration within the remaining 17 acres of pine would occur toward meeting longer term habitat needs. Given the limited number of pine acres, the selected method for regeneration should be one that best retains overstory as foraging habitat while growing young pine within the understory (a two-aged strategy), therefore allowing for a future site of pine for foraging without overly impacting the birds' present needs for mature pines. This strategy is challenging to apply successfully and may require extensive use of herbicides to control competing hardwoods and intensive tree individual tree management. This two-aged strategy may extend the lifespan of this individual cluster, but will do little to sustain the cluster indefinitely since it long-term problem is lack of space.

The planned long-term approach for this cluster will be to combine the partition to that of the adjoining Cluster 13 to support one cluster with a minimum of 300 to potentially support perpetual GQFH. Although not immediately possible since both clusters are currently active, this combined partition would provide ample acreage of pine habitat within which 120 acres of foraging habitat could be provided and additional pine acres could be used to regenerate pine for use as future GQFH. This long-term strategy may require more than 60 years before reaching fruition and depends on one or the other cluster becoming inactive.

Cluster 13 –This cluster contains approximately 60 acres of fields that will be afforested to pine habitat that will bring the total pine acreage to approximately 220 pine acres (64 percent) within the partition. Approximately 41 acres of mature pine could be managed for regeneration of pine within the current partition, with 120 acres being managed toward GQFH. The preferred long-term approach for this cluster will be to combine the partition to that of the adjoining Cluster 14 to support one cluster with a minimum of 300 to potentially support perpetual GQFH. Although not immediately possible since both clusters are currently active, this combined partition would provide ample acreage of pine habitat within which 120 acres of foraging habitat could be provided. This long-term strategy may require more than 60 years before reaching fruition.

Cluster 104 – With a minor shift in the cluster of 0.125-mile to the west, the partition could add 80 acres of pine habitat. This shift would also allow more pine acres to be added to the future combined cluster created by the merge of Clusters 13 and 14. Afforestation of the 17-acre field would also provide additional pine habitat. These changes would increase pine habitat to approximately 400 acres within the partition. A total of 120 acres of mature pine forest within Cluster 104 will need treatment to reduce basal area and midstory to strive for GQFH. The targeted location for treatment would from Griffen Slough north to the bottomland hardwood stand and from Griffen Slough south down to south end of the partition and east of Smith Fields Road. Portions of the partition not needed to meet current GQFH needs will be managed for regeneration of pine.

Cluster 6 – This partition also has 50 acres of fields that can be converted to pine acres, thus increasing total pine acres for this partition to 241. Once these fields are regenerated, the cluster will not provide ample acres to support GQFH. A minimum of 120 acres of mature pine forest within the cluster partition will need treatment to reduce basal area and midstory to meet GQFH. This cluster could have approximately 121 acres of mature pine forest to be regenerated for future GQFH.

Cluster 123 – Over a 60-year period, this cluster will gain acreage (up to 80 acres) from Cluster 107 shifting to the north approximately 0.25-mile, and Cluster 15 shifting to the northeast approximately 0.25-mile to allow Cluster 123 more partition acres. With the shift, this cluster would provide ample acres to support management toward GQFH for the life of the cluster. A minimum of 120 acres of mature pine forest within the cluster partition will need treatment to reduce basal area and midstory to strive for GQFH. This cluster has approximately 105 acres of mature pine forest to be regenerated for use as future GQFH.

Cluster 107 – This cluster needs to shift slightly (0.125-mile) to the north/northeast to maximize its pine acres within a partition and allow surrounding clusters to gain pine acres. A minimum of 120 acres of mature pine forest within the cluster partition will need treatment to reduce basal area and midstory to strive for GQFH. This cluster has approximately 350 acres of mature pine forest within the partition to be used toward regeneration of pine for providing GQFH into the future.

Cluster 19 – This cluster does not have enough acres to sustain GQFH and would benefit from a shift of Cluster 15 and 107 to the north/northeast. This would provide more acreage for this

cluster, but may never meet the minimum acreage needed to sustain GQFH. A minimum of 120 acres of mature pine forest within the cluster partition will need treatment to reduce basal area and midstory to strive for GQFH. This cluster needs approximately 101 acres of mature pine forest within the partition that could be used to regenerate pine for future GQFH.

Cluster 15 – A shift to the north/northeast would benefit this cluster and clusters 107, 123, 19, and 6. A minimum of 120 acres of mature pine forest within the cluster partition will need treatment to reduce basal area and midstory to strive for GQFH. This cluster has approximately 154 acres of mature pine forest within this partition that can be regenerated for future GQFH.

Cluster 103 – This cluster does have enough acres to sustain GQFH for the life of the cluster. Although this cluster does currently have the pine acres to support GQFH, this cluster and surrounding clusters could benefit from a slight shift to the west, 0.125- to 0.25-mile would increase pine acreage within the partition. A minimum of 120 acres of mature pine forest within the cluster partition will need treatment to reduce basal area and midstory to meet GQFH. This cluster has approximately 200 acres of mature pine forest within the partition that can be regenerated for providing GQFH into the future.

Cluster 126 – Although this cluster does currently have the pine acres to support GQFH, it would benefit from a slight shift to the east. A shift of 0.125- to 0.25-mile would increase pine acreage within the partition and create a greater distance from private land and allow more acreage for clusters 15 and 107 as they shift to the north/northeast. A minimum of 120 acres of mature pine forest within the cluster partition will need treatment to reduce basal area and midstory to meet GQFH. This cluster currently has 134 acres of mature pine forest within the partition available for regeneration to provide future GQFH.

Cluster 119 (inactive) – This cluster will continue to be managed as an inactive cluster as per the RCW Recovery Plan. This cluster will not be used for a recruitment site as it does not provide adequate pine acres for a recruitment site. This cluster area will be utilized to improve clusters 126, 15, and 107.

Any future recruitment cluster established within this unit will need contain at least 300 acres of pine habitat. A minimum of 120 acres of mature pine forest within the recruitment cluster partition will need treatment to reduce basal area and midstory to strive for GQFH. Mature pine forest located outside of the 120 acres needed for GQHF may be used toward regeneration of pine for providing GQFH into the future.

The use of free-thinnings, pre-commercial thinnings, and WSI methods will be tools in managing the forest to meet the habitat criteria for RCW. The most common silvicultural method, free-thinning, will be used to reduce pine basal area and remove hardwood midstory trees to improve GQFH. WSI practices will also be used to manage tree species diversity to reach the desired habitat conditions for areas not suitable for commercial harvest. Other methods may be used to remove unwanted understory or to reduce basal within stands, including manual or mechanized pre-commercial thinning, commercial biomass thinning, mulching, or permitted firewood cutting of hardwoods. Alone or in combination, prescribed fire, mechanical control

methods, and use of herbicides may be widely used to control hardwood growth and create the desired understory and ground characteristics needed to produce insects for use by the woodpeckers. Regardless of method, the goal would be to promote GQFH in stands that have become over stocked with trees or contain high amounts of hardwoods within the midstory component.

Irregular shelterwood silvicultural techniques will be used for regeneration of the forest within the partitions where the foraging habitats are constrained (i.e., proximity to other partition, acreage, and potential dispersal corridors). Irregular shelterwood will minimize foraging habitat fragmentation, allow for the residual stem to be available for future cavity trees and provide an age structure that could expedite potential suitable GQFH in the regenerated stand.

Thinning, irregular shelterwood, or seedtree may be used in stands of habitat within Management Unit 11 that is currently mixed pine-hardwood to promote a greater pine component. In areas where the habitat constraints mentioned above are not present, the use of shelterwood, irregular shelterwood, seedtree harvest, patch cuts, afforestation, and reforestation may all be viable options to promote a sustainable pine-hardwood forest habitat. The exact regeneration methods used will be site and habitat condition-specific based on observed site conditions and proximate location to the existing GQFH within the partition.

Existing fire lines will be maintained to contain fire and new lines will be established to protect regenerating tree species. Natural fire breaks and use of temporary hand-lines will be favored to minimize the amount of artificial fire breaks installed or maintained between forest stands. All decisions on location, frequency, and intensity of treatments will be determined by habitat condition and needs of the RCW for foraging habitat. Administrative utility terrain vehicle (UTV) trails may be improved to prevent soil erosion and protect water quality. Improvements may include use of erosion control fabric, gravel, and small bridges.

Aquatic Management

Soils and waterways within SMZs will be protected based on stream order as described previously. Prescribed fire will normally be allowed to burn into SMZs with site conditions (e.g., wetness) dictating burn extent into the zone. Fire may be excluded from SMZs when habitat conditions indicate impacts to regeneration, mortality of canopy trees, and increased soil erosion. Timber management may occur within the SMZs under guidelines within Mississippi's Best Management Practices for Forestry (2008), if needed to maintain the desired forest conditions.

Open Land Management

All old field locations determined to be needed for RCW management within Management Unit 11 will be reforested in pine species (i.e., loblolly, short-leaf pine, and long-leaf pine) that best represent historical forest and site conditions and facilitate the management of the habitat for RCWs. Seedlings will be planted using either natural reseeding or manual replanting of seedlings. These same species and techniques may also be used to regenerate damaged habitats within forest openings such as those caused by southern pine beetle, ips, or storms.

All habitat management activity will occur when site and species conditions are favorable for the management activity to happen, and minimally impact the habitat or resource of concern. The forest management operations within RCW areas will adhere to the RCW Recovery Plan Guidelines.

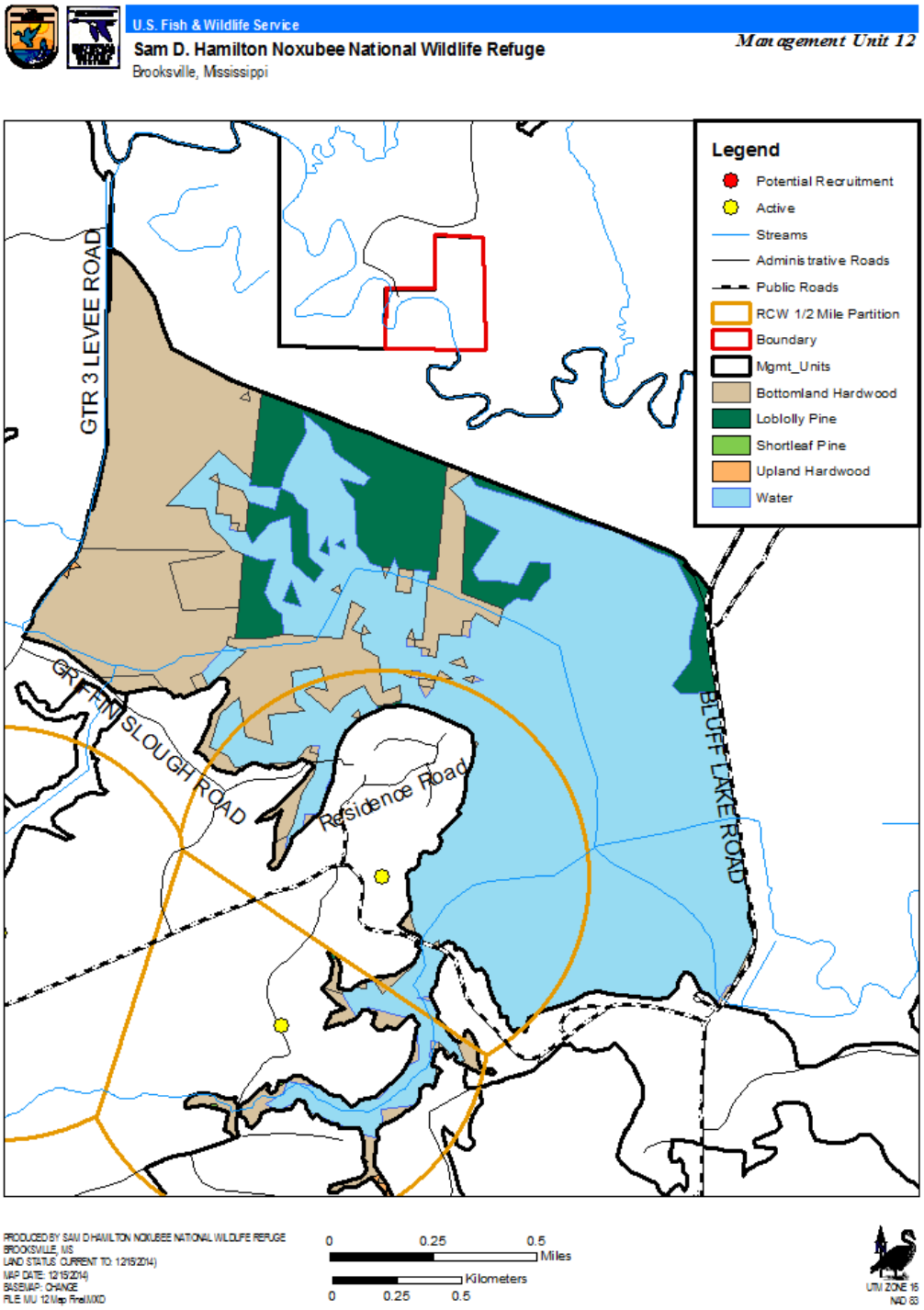
Administrative Land Management

Open public and administrative roads within the unit may be maintained in a graveled state from ditch to ditch and will receive maintenance related activity throughout the year. Starting at the outside of the ditches, habitat will be maintained in the same manner as within the main unit. Vegetative barriers may be left along road edges to provide wildlife cover from road related disturbance and to deter road hunting activities, particularly where roads are adjacent to fields. Sections of the Old Robinson Road that are visible should be protected from disturbance, to maintain the integrity of the old road bed. Areas around the immediate infrastructure of the shop, residences, and office will be maintained to be presentable to the public. Haul roads created to facilitate removal of timber will be abandoned, possibly replanted to forest and not maintained through time. Administrative UTV access trails may be needed to be created to facilitate the monitoring of birds at individual cluster locations. These trails will not be highly developed but may be improved to provide year-round UTV access without damage to soil or water quality.

Adaptive Management Monitoring Elements:

- Conduct RCW monitoring according to the 2003 RCW Recovery Plan.
- The primary habitat response variables will be forest overstory structure and composition, forest midstory and understory structure, and productivity for wildlife as measured by forest inventory data.
- The primary wildlife response variable will be forest breeding bird species composition and abundance using breeding landbird surveys (point counts).
- The refuge will consider herptafauna survey (according to PARC guidelines and protocol) (http://www.parcplace.org/publications/inventory-and-monitoring-guide.html).
- Monitor the effects of forest management activities to maintain integrity of desired species composition, habitat structure, and forest health.

MANAGEMENT UNIT 12
(Bluff Lake Unit)



Resources of Concern:

Waterfowl

Species of Complimentary Need:

Wood duck (*Aix sponsa*)
Bass
Brim
Wood stork

Habitat Objectives: 3.1, 3.2

Current Condition and Special Considerations:

Management Unit 12 consists of 1,040 acres of shallow lake habitat located within Oktoc Creek and surrounding edge habitats. The entire area to Management Unit 12 is estimated at 1,000 acres, when including levee, shore, and habitat near the main water control structure. The unit is adjacent to Management Units 8, 13, 10, 12, 21 and 22 and hydrologically connected to Oktoc Creek, Jones Creek, and Loakfoma Lake. The original spillway of Bluff Lake and the clearing of the forest for the lake were completed in 1939. The lake was estimated at 900 acres at time of completion. The lake remained in that condition until spring of 1979, when a catastrophic flood blew the levee in several locations. The levee and new radial gate structure were constructed in 1981.

Prior to 2009, Bluff Lake and the surrounding habitats have been managed primarily for waterfowl. Each year an early summer/late spring drawdown occurred to facilitate planting of crops on adjacent fields. The lake was returned to full pool once plantings were complete. In early July, water levels were again lowered to encourage production of native moist-soil plants within the lake's mud flats. The lake was brought back to full pool again by October 15. Since 2009, little active management of the lake's water levels has occurred, with levels remaining near full pool.

Unique Features:

The refuge office and visitor center is located on the south shore of the lake. The Bluff Lake Boardwalk, the Cypress Cove Boardwalk, and the Goose Overlook are also key features utilized by the public on Bluff Lake. Public use facilities on the lake also include a concrete boat launch, graveled parking areas, picnic area, and a public restroom. This unit provides important summer feeding and roosting habitat for the federally listed wood stork. More than 100 wood storks visit the refuge starting in late June, feeding within open shallow water areas. These birds typically leave the refuge by September.

Management Prescriptions:

Habitat within Management Unit 12 will be managed following the pre-2009 management practices used to benefit waterfowl, with emphasis on water management to promote annual vetetation and availability of seeds to wintering waterfowl.

Managed Wetlands/Moist-Soil Management

Moist-soil areas within the unit will continue to be managed for non-woody native plants through mowing, disking, chemical treatment, prescribed fire, and water level manipulation occurring seasonally to benefit waterfowl species.

Aquatic Management

In early July, water levels will be lowered to encourage production of native moist-soil plants within the lake's mud flats. This same management regime will benefit wood storks, by providing mud flats and shallow water habitat with stranded fish during the summer months. Beaver activity within the unit will be strictly controlled and kept outside the boundaries of the unit. The transition habitats found outside the lake will be defined as SMZs and provide habitat for brooding wood ducks and other wetland species.

Island habitat and up to 10 percent (25 acres) of the shallow water habitats will be allowed to develop woody vegetation as brooding habitat for waterfowl. Island habitats will be allowed to develop into trees, while the shallow water habitat is kept in the scrub/shrub stage. Mechanical treatments will be used to control the woody vegetation within the shallow water habitats.

The lakes surface water will be maintained as greater than or equal to 75 percent (681 acres) open water. The remaining acreage will be allowed to vegetate with American lotus and other native aquatic plants. However, aquatic vegetation will be controlled once more than 25 percent (227 acres) of the lake's water surface is covered. Exotic vegetation will be controlled and if possible, eradicated, using spot treatments.

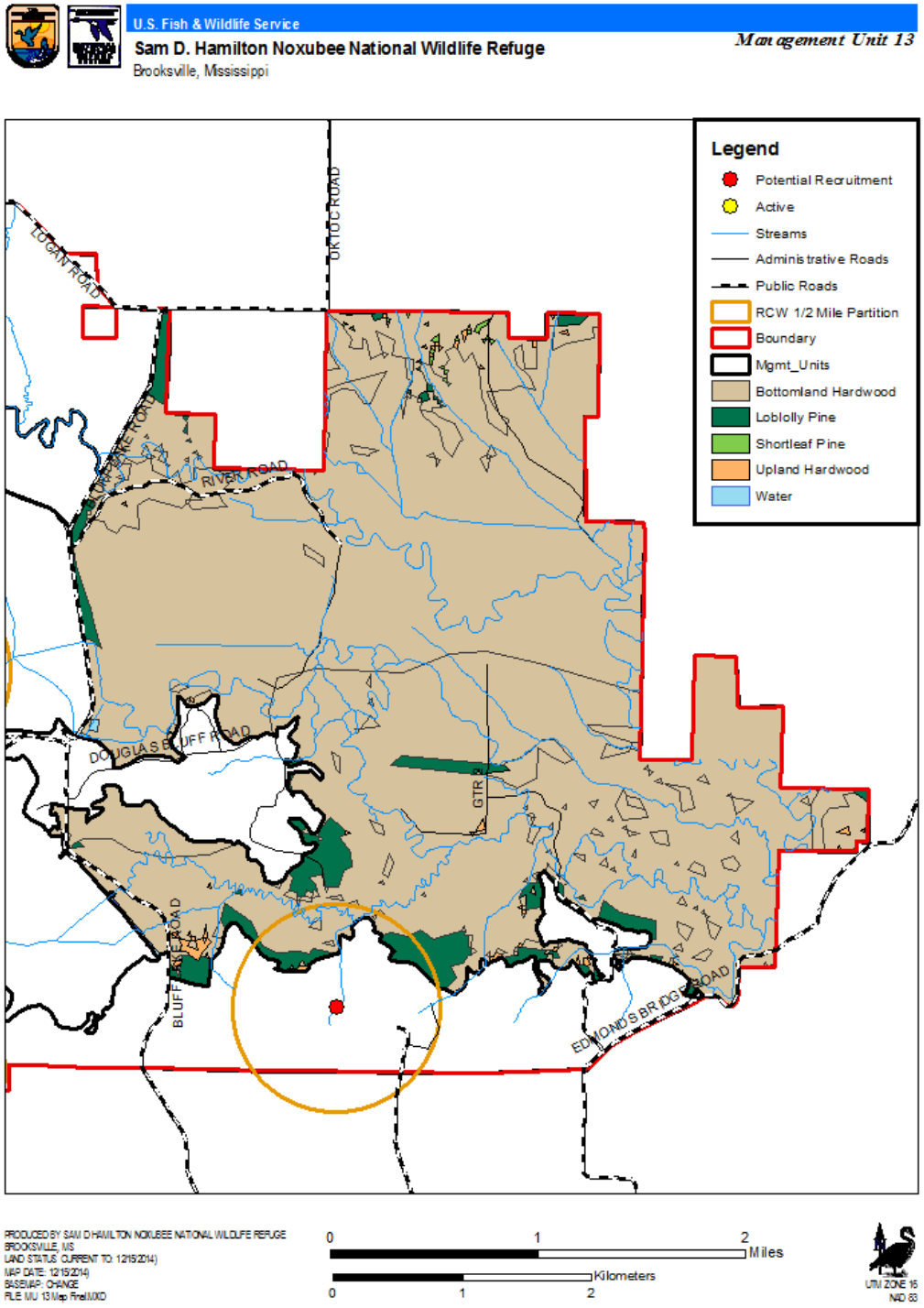
Administrative Lands Management

Public fishing on the lake will be allowed and some habitat will be disturbed to create and improve parking and boat launch facilities along with access trails to the lake's shoreline.

Adaptive Management Monitoring Elements:

- The primary habitat response variable will be percent herbaceous cover measured by bi-weekly ocular estimates during the growing season from fixed photo point sites.
- The primary wildlife response variable will be wintering waterfowl use measured by bi-weekly waterfowl counts from September 15 to April 1.
- Noxious plant surveys will be conducted periodically throughout the growing season.

MANAGEMENT UNIT 13
(Noxubee Bottoms Unit)



Resources of Concern:

Forest Breeding Birds (surrogates: Prothonotary warbler, Rusty blackbird, and Yellow-throated warbler)

Species of Complimentary Need:

Bats
Squirrel (*Sciurus carolinensis)*
Reptiles/Amphibians
Waterfowl
White-tailed deer (*Odocoileus virginianus*)
Wild turkey (*Meleagris gallopavo*)
Wood duck (*Aix sponsa*)

Habitat Objectives: 2.1, 2.2

Current Condition and Special Considerations:

Management Unit 13 consists of 4,890 acres of mixed hardwood primarily located along Noxubee River at the eastern end of the refuge. Historic habitat analysis for this unit indicates the area as having the potential willow oak, water oak, and American sycamore habitat type (LANDFIRE) almost entirely through the area. The current habitat condition of the management unit appears to be similar. The area contains two GTRs. GTR-1 is located closest to Bluff Lake and is 131 acres in size when flooded. GTR-2 is down stream of GTR-1 and is 214 acres in size when flooded. Water must flow through GTR-1 to fill GTR-2. The unit contains first, second, third, fourth, and fifth order streams, including Noxubee River and Loakfoma Creek. Two small old fields are located near the end of Douglas Bluff Road and are regenerating to forest.

The unit had once contained numerous large, over-mature trees of various species that qualified as state champions; however, no such individual trees are known to exist within the current forest. Along with previous silvicultural treatments, the unit's forest has received storm damage for repeated years. Changes in flooding regime due to hydrologic control have negatively impacted red oak regeneration within the unit with tree species of greater water tolerance being favored. Water management for both GTR units has favored persistent waterfowl conditions over those needed for a healthy forest; GTR-1 has served as the refuge primary waterfowl hunting location for many years. Natural flooding of the unit occurs yearly following heavy rains both locally and upstream.

River cane (*Arundinaria giganteais*) is associated throughout this unit and is well distributed but highly sparse in occurrence due to the hydrology and forest condition. This unit serves as habitat for a suite of species including forest breeding birds, wood duck, wild turkey, white-tailed deer, pileated woodpecker (*Dryocopus pileatus*), southern flying squirrel (*Glaucomys volans*),

and numerous species of herpetofauna. Exotic bamboo (*Phyllostachys aurea* Carr. Ex A. & C. Riviere) is well established along the unit's western boundary at Bluff Lake.

Unique Features:

Associated with the two GTRs are extensive levee systems used to control water flow. River Road is located within the unit and extends eastward along the bank of the Noxubee River. During high water this road and much of the unit is flooded. Paddlefish are known to use the unit's waterways. It is currently hypothesized that the paddlefish once spawned in the area. Herbert Lake located between GTR-1 and GTR-2 appears to have the most favorable current conditions for paddlefish use along with the deep water habitat located at the Bluff Lake Spillway. The spill way hole is estimated at more than 30 feet deep. A right-of-way for a high power line runs through the unit near its eastern border and is maintained by the power company as open land. Soil erosion is a concern in areas subject to illegal mud-riding by privately owned vehicles.

Management Prescriptions:

Habitat within Management Unit 13 will be managed to benefit forest breeding birds by providing complex vertical and horizontal structure for nesting and foraging. Canopy gaps will be intermixed with dominate, shade-intolerant trees with expansive, long-limbed crowns that overtop large, individual, shade tolerant trees. Canebrakes will be encouraged to develop with canopy gaps. The GTRs may be flooded to provide wintering habitat for waterfowl. No one GTR within this unit will be flooded for management reasons more than once every three years to encourage red oak survival, and when flooded will contribute to the targeted 1.1 million yearly DEDs for the refuge. When flooded, GTR-1 and -2 provides an estimated 27,117 DEDs and 44,298 DEDs, respectively. Managed water will target the non-growing season dates between November 15 and February 15.

Forest Management

The desired forest condition will follow that recommended by the LMVJV Restoration, Management, and Monitoring of Forest Resources in the Mississippi Alluvial Valley: Recommendations for Enhancing Wildlife Habitat 2007. Timber management including WSI techniques may occur within the SMZs under guidelines within Mississippi's Best Management Practices for Forestry (2008), if needed to maintain the desired forest conditions. Forest management will be conducted to favor shade-intolerant species and the establishment of large, over-mature trees within the forest for the benefit of numerous wildlife species including bats and wood duck.

During the next 15-year period, the majority of the areas will likely be allowed to follow natural successional patterns with active management focused on exotic plant control. With time, the likely silvicultural method to be used in this habitat management will be free-thinning to reduce basal area and increase species composition within the forest. WSI practices will also be used to manage habitat to reach the desired habitat conditions. Regardless of method and timing of active management, the goal is to promote forest diversity and health that resemble historic

conditions indicated by the NatureServe terrestrial ecological systems. The criteria for attaining these conditions will be based on overstory tree species composition being greater than 50 percent of the dominant species types according to NatureServe terrestrial ecological systems. In many areas conditions are not likely to be attained during the life of this plan, but significant efforts can be made to promote these conditions in habitats that have not drastically skewed from the historic conditions.

Triggers for prescribed silvicultural treatments will be:

1. Overstory canopy cover: >70%
2. Midstory cover: <25%
3. Basal area: >70 square feet per acre
4. More than 25% of basal area approaching biological maturity (i.e., senescence)
5. Tree stocking >70%

Various silvicultural methods could be used to create canopy gaps to promote forest structure and an intermixed forest with dominate, shade-intolerant trees with expansive, long-limbed crowns that overtop large, individual, shade tolerant trees. Canebrakes will be encouraged to develop within canopy gaps.

The methods used for regeneration of the hardwood forest in this management unit could likely consist of patch cuts, single tree selection, group selection, shelterwood, irregular shelterwood, afforestation, and reforestation. The regeneration methods used will be site and habitat condition-dependent based on observed site conditions and proximate location to other feature within the unit. All decisions on location, frequency, and intensity of treatments will be determined by habitat condition and needs of the resource of concern in the management unit. Trees having unique wildlife values (i.e., cavity and den trees) will be left throughout the unit. Old fields within the unit will not be managed as old fields and allowed to continue to return to a hardwood dominated forested habitat.

Prescribed fire may not be a major management tool in this unit, but may be used in various places to remove unwanted vegetation or to remove debris. Natural fire breaks will be favored to minimize the amount of artificial fire breaks installed or maintained between management units.

Aquatic Management

SMZs will be protected based on stream order and the minimums defined previously. Prescribed fire will normally be allowed to burn into SMZs with site conditions (e.g., wetness) dictating burn extent into the zone. Fire will be excluded from SMZs when habitat conditions indicate impacts to regeneration, mortality of canopy trees, and increased soil erosion. Timber management may occur within the SMZs under guidelines within Mississippi's Best Management Practices for Forestry (2008), if needed to maintain the desired forest conditions.

Beaver ponds will be allowed to form naturally within the creek channels to benefit wood ducks, but beaver population and dam control actions will be used to keep beaver activity confined to

the channels. All water managed by beavers that impacts live timber during the growing season will be removed and when needed beaver numbers controlled.

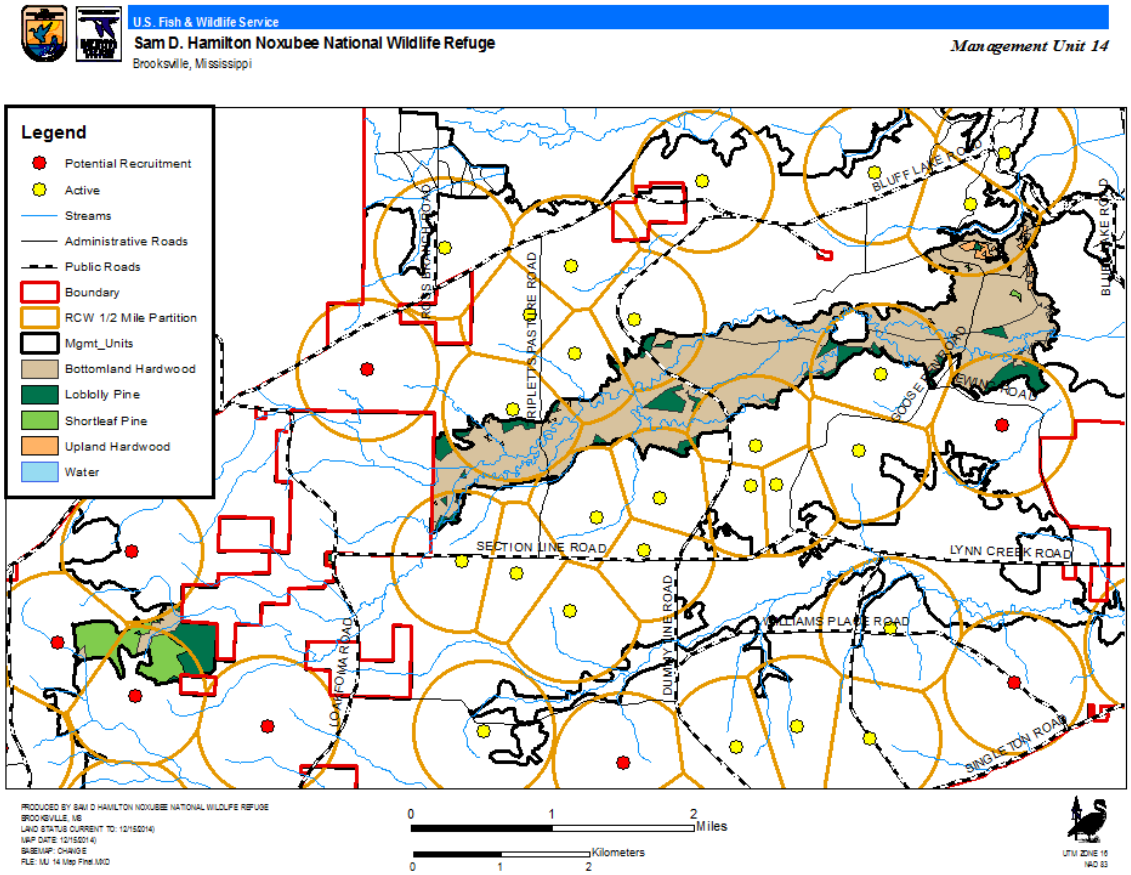
Administrative Use Lands

Open public and administrative roads within the unit may be maintained in a graveled state from ditch to ditch and will receive maintenance related activity throughout the year. Starting at the outside of the ditches, habitat will be maintained in the same manner as within the main unit. Vegetative barriers may be left along road edges to provide wildlife cover from road related disturbance and to deter road hunting activities, particularly where roads are adjacent to fields. Haul roads created to facilitate removal of timber will be abandoned, possibly replanted to forest and not maintained through time. The road profile of River Road will be reduced to match that of the surrounding landscape to encourage water flow and inhibit erosion of the road into the nearby streams. The road will be closed whenever water flows across the roads surface from Noxubee River. When possible, low water crossings will be used instead of culverts within roads to allow greater water flow and reduced maintenance. Roads within the unit will be maintained in a graveled state from ditch to ditch and will receive maintenance related activities throughout the year. Mowing activity and pass-through vehicle traffic will be kept to a minimum to deter further spread of exotic plants. Starting at the outside of the ditches, all vegetation will be maintained in the same manner as within the main unit. Invasive and exotic plants will receive spot treatments of herbicide. A continued effort will be made to contain and eradicate exotic bamboo. All levees will be mapped and any levees found to no longer serve a management function will be evaluated for hydrologic restoration potentials.

Adaptive Management:

- The primary habitat response variables will be forest overstory structure and composition, forest midstory and understory structure and bottomland hardwood forest health and productivity for wildlife as measured by forest inventory data.
- The primary wildlife response variable will be forest breeding bird species composition and abundance using breeding landbird surveys (point counts).
- The refuge will consider herptafauna survey (according to PARC guidelines and protocol) (http://www.parcplace.org/publications/inventory-and-monitoring-guide.html).
- Monitor the effects of forest management activities to maintain integrity of desired species composition, habitat structure, and forest health.

MANAGEMENT UNIT 14
(Loakfoma Creek Unit)



Resources of Concern:

Forest Breeding Birds (surrogates: Rusty blackbird and Yellow-throated warbler)

Species of Complimentary Need:

Wild turkey (*Meleagris gallopavo*)
White-tailed deer (*Odocoileus virginianus*)
Squirrel (*Sciurus carolinensis)*
Reptiles/Amphibians
Bats
Wood duck (*Aix sponsa*)

Habitat Objective: 2.1

Current Condition and Special Considerations:

Management Unit 14 consists of 1,872 acres of mixed hardwood primarily located along Loakfoma Creek, with fingers of SMZs extending to the surrounding unit on both the north and south sides of the creek. The unit is almost completely enclosed within Management Unit 11 to the north and Management Unit 17 to the south, and dissected by existing public use roads and existing fire lines that facilitate both administrative and public access and use of prescribed fire. Dummy Line Road, Triplett's Pasture Road, and Goose Pen Road bisect the unit, causing some disruption to the hydrology.

Over time the area has been indirectly treated with fire being used to control the hardwood midstory within Management Units 17 and 11. Fire lines have been established along the intersecting boundary with Management Units 17 and 11, but fire has been allowed to back into the bottomland hardwoods. Chemical hardwood control has not occurred within this unit but herbicides have been used to control exotics and invasive plants. Historic habitat analysis for this unit indicates the area as having the potential American sycamore (*Platanus occidentalis*), sugarberry (*Celtis laevigata*), pine - 3 habitat types, bald cypress (*Taxodium Distichum*), and red maple (*Acer Rubrum*) (LANDFIRE) along the creek, with loblolly pine habitat type at the higher elevation sections along the transition areas of the perimeter of the unit and the far west outlying section of the management unit. The westerly portion of this unit also historically showed an area of shortleaf pine, oaks type. The current habitat condition of the management unit appears of similar type. Japanese climbing fern (*Lygodium japonicum Thunb. Ex Murr.*), Japanese stilt grass (*Microstegium vimineum*), privet (*Ligustrum vulgare*), and cogon grass (*Imperata brasiliensis*) continue to be a threat and all or one of these pests have been spot treated in the past. Japanese stilt grass was recently found and treated along the creek and roadways within this unit. There are no private inholdings within the unit. The area also contains a series of out of condition hay fields (a.k.a. "Triplett's Pastures" and "Ewing Fields") that are occasionally mowed or disked every few years but shows advanced signs of regeneration into forest with significant sweetgum (*Liquidambar styraciflua*). The original management intent for these fields was to provide habitat for wild turkey.

River cane (*Arundinaria giganteais*) is associated throughout this unit and is well distributed but sparse in occurrence due to the forest condition. Due to increased soil wetness, prescribed fire carries less readily and hardwood regeneration occurs more readily. This unit serves as habitat for a suite of species including neotropical migratory birds, wild turkey, white-tailed deer, pileated woodpecker (*Dryocopus pileatus*), southern flying squirrel (*Glaucomys volans*) and numerous species of herpetofauna.

Unique Features:

There is the potential for numerous historical sites including old home sites, cisterns, and artifacts from Native Americans. Old road beds and one old home site can still be found along the Triplett's Pasture, Ewing, and Goose Pen roads. The unit is broken into three sections due to private inholdings and sixteenth section land (school board land). The unit contains Loakfoma Creek and many tributaries.

Management Prescriptions:

Habitat within Management Unit 14 will be managed to benefit forest breeding birds by providing complex vertical and horizontal structure for nesting and foraging. Canopy gaps will be intermixed with dominate, shade-intolerant trees with expansive, long-limbed crowns that overtop large, individual, shade tolerant trees. Canebrakes will be encouraged to develop with canopy gaps.

Forest Management

During the next 15-year period, the majority of the areas will likely be allowed to follow natural successional patterns with active management focused on exotic plant control. With time, the likely silvicultural method to be used in this habitat management will be free-thinning to reduce basal area and increase species composition within the forest. WSI practices will also be used to manage habitat to reach the desired habitat conditions. Regardless of method and timing of active management, the goal is to promote forest diversity and health that resemble historic conditions indicated by the NatureServe terrestrial ecological systems. The criteria for attaining these conditions will be based on overstory tree species composition being greater than 50 percent of the dominant species types according to NatureServe terrestrial ecological systems. In many areas conditions are not likely to be attained during the life of this plan, but significant efforts can be made to promote these conditions in habitats that have not drastically skewed from the historic conditions.

Triggers for prescribed silvicultural treatments will be:

(1) Overstory canopy cover: >70%
(2) Midstory cover: <25%
(3) Basal area: >70 square feet per acre
(4) More than 25% of basal area approaching biological maturity (i.e., senescence)
(5) Tree stocking >70%

Various silvicultural methods could be used to create canopy gaps to promote forest structure and an intermixed forest with dominate, shade-intolerant trees with expansive, long-limbed crowns that overtop large, individual, shade tolerant trees. Canebrakes will be encouraged to develop within canopy gaps.

The methods used for regeneration of the hardwood forest in this management unit could likely consist of patch cuts, single tree selection, group selection, shelterwood, irregular shelterwood, afforestation, and reforestation. The regeneration methods used will be site and habitat condition-dependent based on observed site conditions and proximate location to other feature within the unit. All decisions on location, frequency, and intensity of treatments will be determined by habitat conditions and needs of the resource of concern in the management unit. Trees having unique wildlife values (i.e., cavity and den trees) will be left throughout the unit.

All predominant pine acres within RCW partitions, which lie within this management unit, needed for foraging habitat or for future regeneration will be managed according to the RCW recovery plan in relation to the adjacent management unit that is being managed for RCWs.

The transition habitats found outside the areas defined as SMZs and along the perimeter of the management unit and within old fields will be managed to provide high density saplings, shrubs, canes, or vines. Old fields within the unit will continue to be managed as old fields with mowing and disking occurring on a 3-year rotation to the benefit species like the American woodcock.

Natural fire breaks will be favored to minimize the amount of artificial fire breaks installed or maintained between management units. Alternative firing techniques (e.g., backing fires) and the site's natural wetness will be used to ensure that habitats within Management Unit 14 receive only slight impact along the transition zones. Fire may damage hardwoods creating basal cavities which may be of later benefit to Rafinesque's big-eared bat (*Corynorhinus rafinesquii*).

Aquatic Management

SMZs will be protected based on stream order and the minimums defined previously. Prescribed fire will normally be allowed to burn into SMZs with site conditions (e.g., wetness) dictating burn extent into the zone. Fire will be excluded from SMZs when habitat conditions indicate impacts to regeneration, mortality of canopy trees, and increased soil erosion. Timber management may occur within the SMZs under guidelines within Mississippi's Best Management Practices for Forestry (2008), if needed to maintain the desired forest conditions.

Beaver ponds will be allowed to form naturally within the creek channels to benefit wood ducks, but beaver population and dam control actions will be used to keep beaver activity confined to the channels. All water managed by beavers that impacts live timber during the growing season will be removed and when needed beaver numbers controlled.

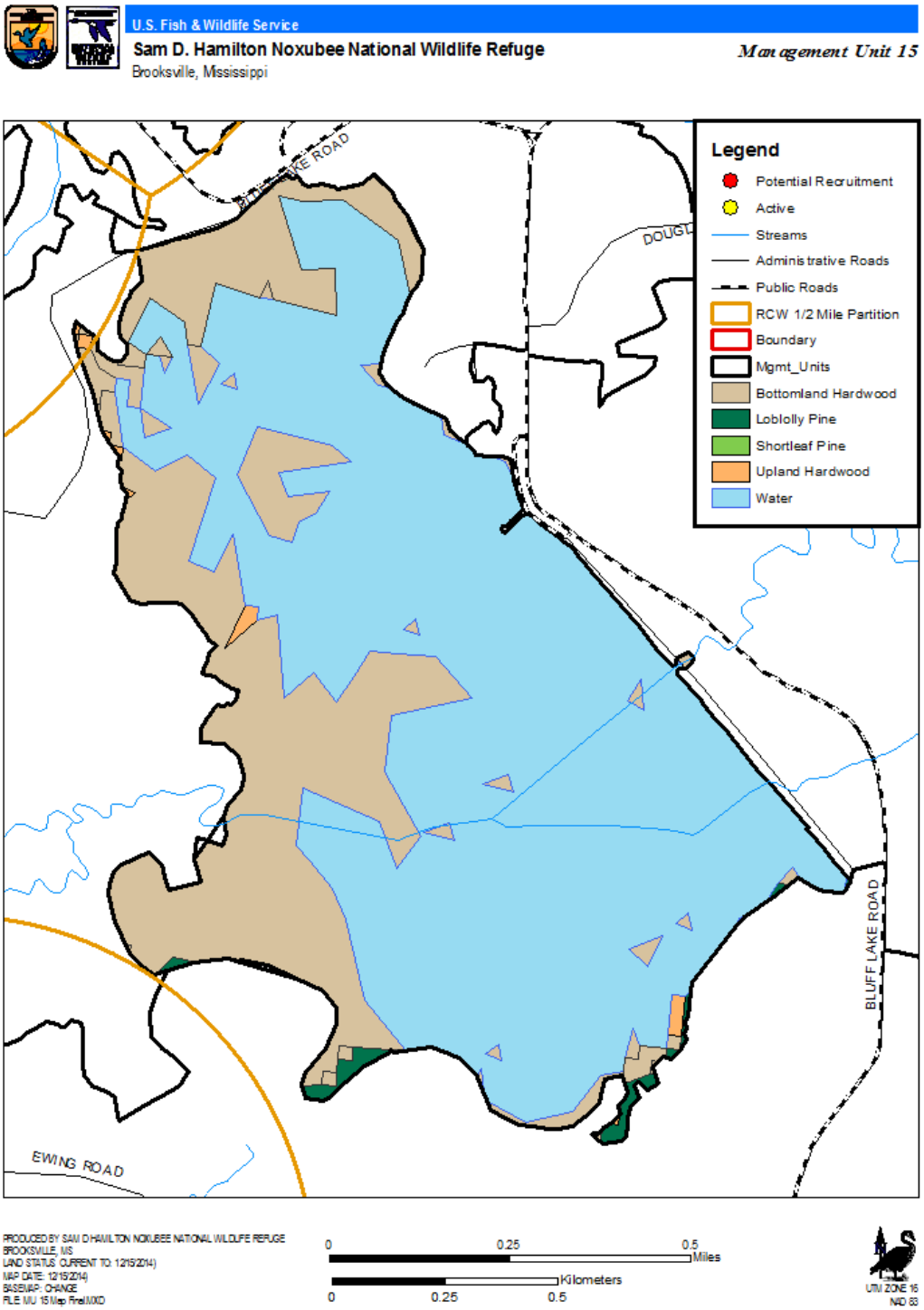
Administrative Use Lands

Open public and administrative roads within the unit may be maintained in a graveled state from ditch to ditch and will receive maintenance related activity throughout the year. Starting at the outside of the ditches, habitat will be maintained in the same manner as within the main unit. Vegetative barriers may be left along road edges to provide wildlife cover from road related disturbance and to deter road hunting activities, particularly where roads are adjacent to fields. Haul roads created to facilitate removal of timber will be abandoned, possibly replanted to forest and not maintained through time.

<u>Adaptive Management Monitoring Elements</u>:

- The primary habitat response variables will be forest overstory structure and composition, forest midstory and understory structure and bottomland hardwood forest health and productivity for wildlife as measured by forest inventory data.
- The primary wildlife response variable will be forest breeding bird species composition and abundance using breeding landbird surveys (point counts).
- The refuge will consider herpetofauna survey (according to PARC guidelines and protocol) (http://www.parcplace.org/publications/inventory-and-monitoring-guide.html).
- Monitor the effects of forest management activities to maintain integrity of desired species composition, habitat structure, and forest health.

MANAGEMENT UNIT 15
(Loakfoma Lake)



Resources of Concern:

Waterfowl

Species of Complimentary Need:

Wood duck (*Aix sponsa*)
Bass
Brim
Wood stork

Habitat Objectives: 3.1, 3.2

Current Condition and Special Considerations:

Management Unit 15 consists of 466 acres of shallow lake habitat located within Loakfoma Creek and surrounding edge habitats. The entire area in Management Unit 15 is estimated at 615 acres, when including levee, shore, and habitat near the main water control structure. The unit is adjacent to Management Units 11, 12, 13, 14 and 17 and hydrologically connected to Loakfoma Creek and Bluff Lake. A survey was conducted following a lake rehabilitation project in 2009 that contoured the lake's bottom and created deep water habitats. The survey documents water surface area at various stage levels. At low water (205' msl (mean sea level)) the water surface area is at 21.3 acres and consists at the level of mainly the created deep water habitats. At maximum designed pool level (212' msl) water surface area is at 453 acres. When water levels are at 212' msl, a 36-inch diameter culvert connects the water body with Bluff Lake at Doyle Arm. Below 212' msl in Loakfoma Lake, these two water bodies are disconnected. The opposite connection from Bluff Lake to Loakfoma Lake does not occur under normal lake conditions. During dry periods of the year, water flow in Loakfoma Creek can become intermittent, causing isolated pools to form within the creek's channel.

Prior to 2009, Loakfoma Lake and the surrounding habitats have been managed primarily for waterfowl. Each year an early spring drawdown (lowered to 211' msl) occurred to facilitate planting of crops on adjacent fields. The lake was returned to full pool once plantings were complete. In early July, water levels were again lowered by two feet (210' msl) to encourage production of native moist-soil plants within the lake's mud flats. The lake was brought back to full pool again by October 15. Since 2009, little active management of the lake's water levels has occurred, with levels remaining near full pool.

Unique Features:

The Larry Box Environmental Education Center is located on the north shore of the lake. The Morgan Hill Observation tower, located within the prairie demonstration area, overlooks the lake from the south. Public use facilities on the lake include a concrete boat launch, graveled parking areas, and a constructed peninsula with concrete sidewalk for use by recreational anglers. Rehabilitation to include deep water habitat and island habitat for other species has been completed in the lake.

Management Prescriptions:

Forest Management

Few prescribed silvicultural treatments (i.e., commercial timber harvest) may be used within the forested habitats located on the fringe of Loakfoma Lake. The existing forest will be allowed to follow natural successional stages and old fields may be replanted to establish the appropriate forest cover type. If silvicultural treatments are used, they would be used to maintain and encourage greater species composition. Loakfoma Creek, a third order stream inside the unit, will be managed with at least 98 m (295 feet) of a streamside management zone. Public fishing on the lake will be allowed and some habitat will be disturbed to create and improve parking and boat launch facilities along with access trails to the lake's shoreline.

Aquatic Management

Habitat within Management Unit 15 will be managed following the pre-2009 management practices used to benefit waterfowl. In early July, water levels will be lowered by two feet (210' msl), to encourage production of native moist-soil plants within the lake's mud flats. This same management regime will benefit wood stork by providing mud flats and shallow water habitat with stranded fish during the summer months. Beaver activity within the unit will be strictly controlled and kept outside the boundaries of the unit. The transition habitats found outside the lake will be defined as SMZs and provide habitat for brooding wood ducks and other wetland species. Moist-soil areas within the unit will continue to be managed for non-woody native plants, with mowing and disking occurring on a yearly basis to benefit waterfowl species.

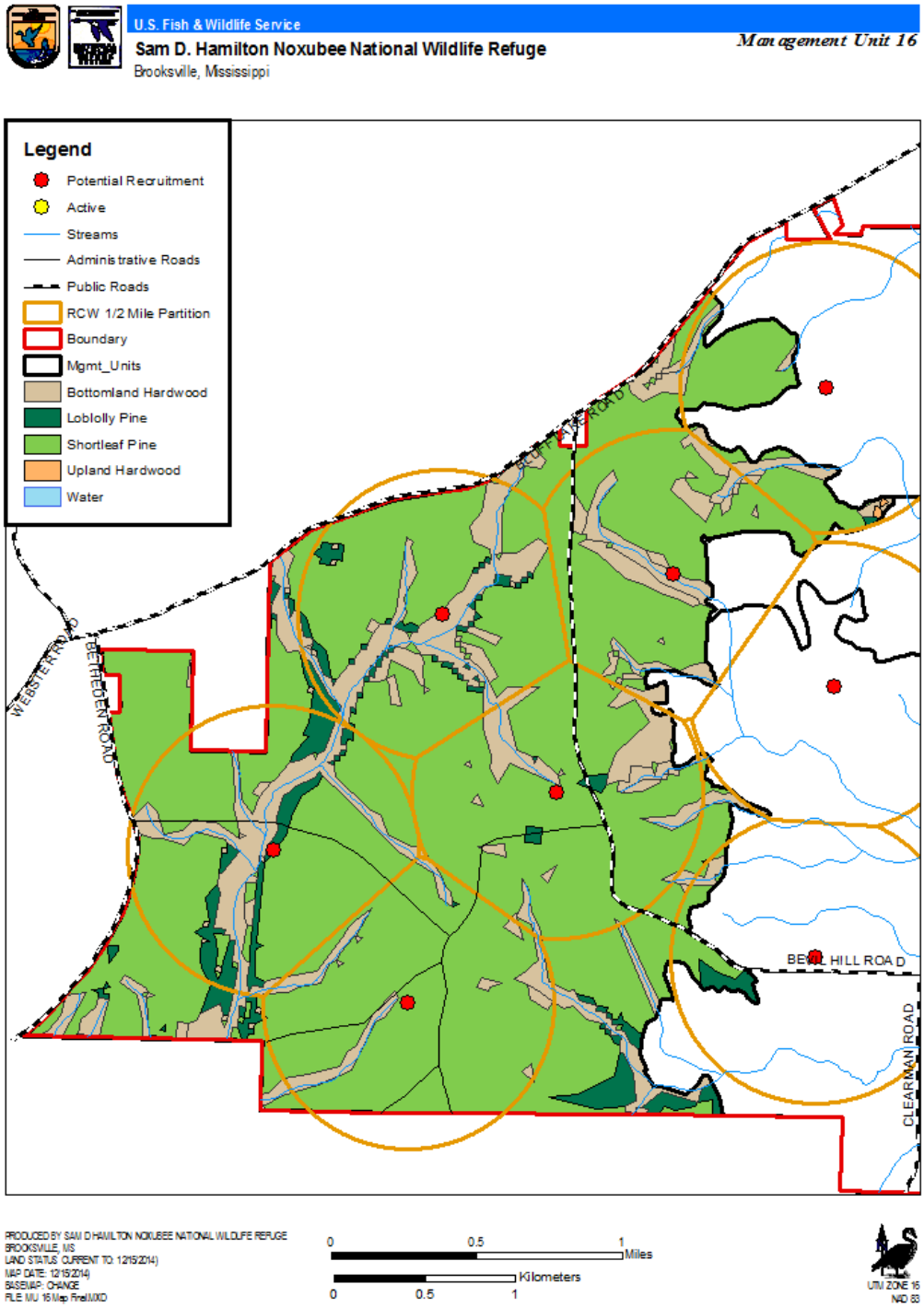
Island habitat and up to 10 percent (25 acres) of the shallow water habitats ($\geq$209' msl) will be allowed to develop woody vegetation as brooding habitat for waterfowl. Island habitats will be allowed to develop into trees, while the shallow water habitat is kept in the scrub/shrub stage. Mechanical treatments will be used to control the woody vegetation with the shallow water habitats.

The surface water will be maintained as greater than or equal to 75 percent (340 acres) open water. The remaining acreage will be allowed to vegetate with American lotus and other native aquatic plants. However, aquatic vegetation will be controlled once more than 25 percent (113 acres) of the lakes water surface is covered. Exotic vegetation will be controlled and, if possible, eradicated using spot-treatments.

Adaptive Management Monitoring Elements:

- The primary habitat response variable will be percent herbaceous cover measured by bi-weekly ocular estimates during the growing season from fixed photo point sites.
- Noxious plant surveys will be conducted periodically throughout the growing season.
- The primary wildlife response variable will be wintering waterfowl use measured by bi-weekly waterfowl counts from September 15 to April 1.

MANAGEMENT UNIT 16
(Bevil's Hill Unit)



Resources of Concern:

Red-cockaded Woodpecker (*Picoides borealis*)

Species of Complimentary Needs:

Wild turkey (*Meleagris gallopavo*)
Northern bobwhite (*Colinus virginianus*)
Bachman's sparrow (*Aimophila aestivalis*)
Brown-headed nuthatch (*Sitta pusilla*)

Current Condition and Special Considerations:

Management Unit 16 is unique in its topography and habitat type as compared to other areas on the refuge. The current habitat consists of 2,683 acres of loblolly, shortleaf, and longleaf pines, and an upland hardwood forest with numerous SMZs extending down along the unit's topographic draws with more than 200 feet elevation change. The upland hardwood component of this management unit is comprised of approximately 900 acres of primarily white oak, red oak, and mixed pine. The upland hardwood as described is an important and unique ecosystem on the refuge and surrounding lands. The current predominantly pine area has been treated with some prescribed fire but not enough to control hardwood midstory. Chemical hardwood control has been used on approximately 300 acres to control hardwood growth, but was a secondary benefit from controlling exotic bi-color lespedeza. Active forest management has been conducted at the stand level and the pine forest currently based on the latest information from stand inventories consists of the following age classes (1.8%, 0 – 10 years, 49 acres; 3.6%, 11 – 20 years, 96 acres; 3.2%, 21 – 30 years, 85 acres; .67%, 31 – 40 years, 18 acres; 0%, 41 – 50 years, 0 acres; 0%, 51 – 60 years, 0 acres; 23.7%, 61 – 70 years, 635 acres; 50.6%, 71 – 80 years, 1357 acres; 13.0%, 81 – 90 years, 350 acres; and 2.3%, 91 – 100 years, 62 acres (2.9% unknown, 31 acres)). Within the unit's northern boundary is a 3-acre sandpit located immediately adjacent to Bluff Lake Road. The sandpit's wall is endangered of collapsing with time and possibly causing damage to the Bluff Lake Road pavement. Habitat conditions for supporting RCWs are currently poor based most recent Forage Habitat Analysis and the area is currently disjointed from areas presently used by RCW. There are no active or inactive clusters located within the unit.

Historic habitat analysis for this unit indicates the area as having the potential shortleaf-longleaf pine habitat type, but current conditions overwhelmingly favor the loblolly pine. *Lespedeza bicolor*, Japanese climbing fern (*Lygodium japonicum Thunb. Ex Murr.*), and cogon grass (*Imperata brasiliensis*) are threats. Historic habitat analysis for this unit indicates the potential for historic conditions as having predominantly shortleaf pine-oaks (78%), and interspersed island habitats of loblolly pine-willow oak-1 (4%) along the lower slopes of the hills. The drain bottoms or drainages were comprised of American sycamore (*Platanus occidentalis*), sugarberry (*Celtis laevigata*), pine - 3 (14%), and beech-cherrybark oak-tulip tree (4%) habitat types (LANDFIRE). The current habitat condition of the management unit appears of similar

type with past forest prescriptions. Several private inholdings exist at the western end of the unit.

The unit contains many first order streams and Dry Creek, a second order stream. SMZs within Management Unit 16 consist of the red oak type. These areas have been included previously in forest management and protected following Mississippi's Best Management Practices for Forestry (2008). Several natural springs occur within this unit with several being modified by the public for personal consumption of water. A developed recreational hiking trail consisting of a 1-mile loop trail extends eastward from the Bevill's Hill Road. The historic Robinson Road is also associated with the northern border of the management unit and is still noticeable in several places in proximity to the paved Bluff Lake Road. This unit with its topography and interspersed hardwoods provide habitat components for a suite of species including wild turkey, white-tailed deer, pileated woodpecker (*Dryocopus pileatus*), southern flying squirrel (*Glaucomys volans*), and numerous species of herpetofauna. The hardwood SMZs will be protected from commercial logging disturbance based on the standards exceeding the Mississippi Best Management Practices document, but prescribed fire will be allowed to enter these zones. There is potential for historical sites including old home sites, cisterns, dipping troughs, and artifacts of Native Americans. A remnant of a large sawdust pile is from the 1970s Montgomery Sawmill is still present on the east end of Coleman Road.

Unique Features:

Topography is unique because the habitat changes from interior flatwoods to mixed pine hardwood uplands. Multiple natural springs are found in the area. There are abundant shortleaf pines mixed in stands of hardwoods. The sandpit's wall is endangered of collapsing with time and possibly causing damage to the Bluff Lake Road pavement.

Management Prescriptions:

Habitat within Management Unit 16 will be primarily directed toward providing for the future potential needs of the federally listed endangered RCW. If determined necessary, up to eight potential recruitment cluster partitions may be created within this unit. The site index for both pine and hardwood tree species within this unit is more than 60. The forest will be managed to provide at least 120 acres of GQFH per RCW cluster. Individual hardwood trees having particular wildlife value (i.e., den trees, cavity trees, and other unique characters) may be left growing throughout the pine dominated forest, but canopy hardwoods will be kept to below 30 percent of canopy.

Forest Management

During the next 15-year period, this management unit is expected to remain unoccupied by red-cockaded woodpeckers and the majority of the areas will likely be allowed to follow natural successional patterns with active management focused on exotic plant control and use of prescribed fire for the encouragement of regeneration of shortleaf and longleaf pine that naturally occurs within the unit. With time, the likely silvicultural method to be used in this habitat management will be free-thinning to reduce basal area and increase species

composition within the forest. WSI practices will also be used to manage habitat to reach the desired habitat conditions. Regardless of method and timing of active management, the goal is to promote forest diversity and health that resemble historic conditions. In areas of the management unit that are similar to historic conditions, forest regeneration methods such as seed tree, shelterwood, irregular shelterwood, group selection or single-tree selection may be used to sustain the habitat and historic condition across time. In many areas conditions are not likely to be attained during the life of this plan, but significant efforts can be made to promote these conditions in habitats that have not drastically skewed from the historic conditions.

Any future recruitment cluster established within this unit will need contain at least 300 acres of pine habitat. A minimum of 120 acres of mature pine forest within the recruitment cluster partition will need treatment to reduce basal area and midstory to strive for GQFH. Mature pine forest located outside of the 120 acres needed for GQHF may be used toward regeneration of pine for providing GQFH into the future.

Triggers for prescribed silvicultural treatments will be:

(1) Overstory canopy cover: >70%
(2) Midstory cover: <25%
(3) Basal area: >70 square feet per acre
(4) More than 25% of basal area approaching biological maturity (i.e., senescence)
(5) Tree stocking >70%

The upland hardwood is primarily located along the top, slope, and transitional areas into the interior flatwoods region of the refuge. Due to topography, presence of many drains, and lack of accessibility, many of these areas may not be conducive to logging and play an important part to local ecosystems as they exist. The upland hardwood areas are potentially a representation of historic conditions of shortleaf-oak habitat types.

Where and when site conditions are favorable, longleaf and shortleaf pine will be encouraged over that of loblolly pine. Management may include harvest of loblolly pine to encourage growth of shortleaf and longleaf pine. Since the longleaf pine and shortleaf pine are fire tolerant if not dependent, fire will continue to be a management tool in this unit to promote historic like conditions. Existing fire lines will be maintained to contain fire and new lines will be established to protect regenerating tree species. Natural fire breaks will be favored to minimize the amount of artificial fire breaks installed or maintained between management units. Longleaf pine may be planted in suitable openings to further encourage its representation within the overstory. The refuge will protect groundwater and surface water from development, withdrawal, and disturbance. Invasive and exotic plants will receive spot treatments of herbicide.

Aquatic Management

SMZs will be protected based on stream order and the minimums defined previously. Prescribed fire will normally be allowed to burn into SMZs with site conditions (e.g., wetness) dictating burn extent into the zone. Fire will be excluded from SMZs when habitat conditions

indicate impacts to regeneration, mortality of canopy trees, and increased soil erosion. Timber management may occur within the SMZs under guidelines within Mississippi's Best Management Practices for Forestry (2008), if needed to maintain the desired forest conditions.

The natural springs within the unit will be protected from further human-caused modifications. The springs that have had pipes installed to allow for human consumption of the water will be closed and rehabilitated to restore and protect the water supply. One of the developed springs is associated with the Scattertown Loop Trail. No permanent new roads or recreational trails will be developed within the area, but those already existing will be maintained.

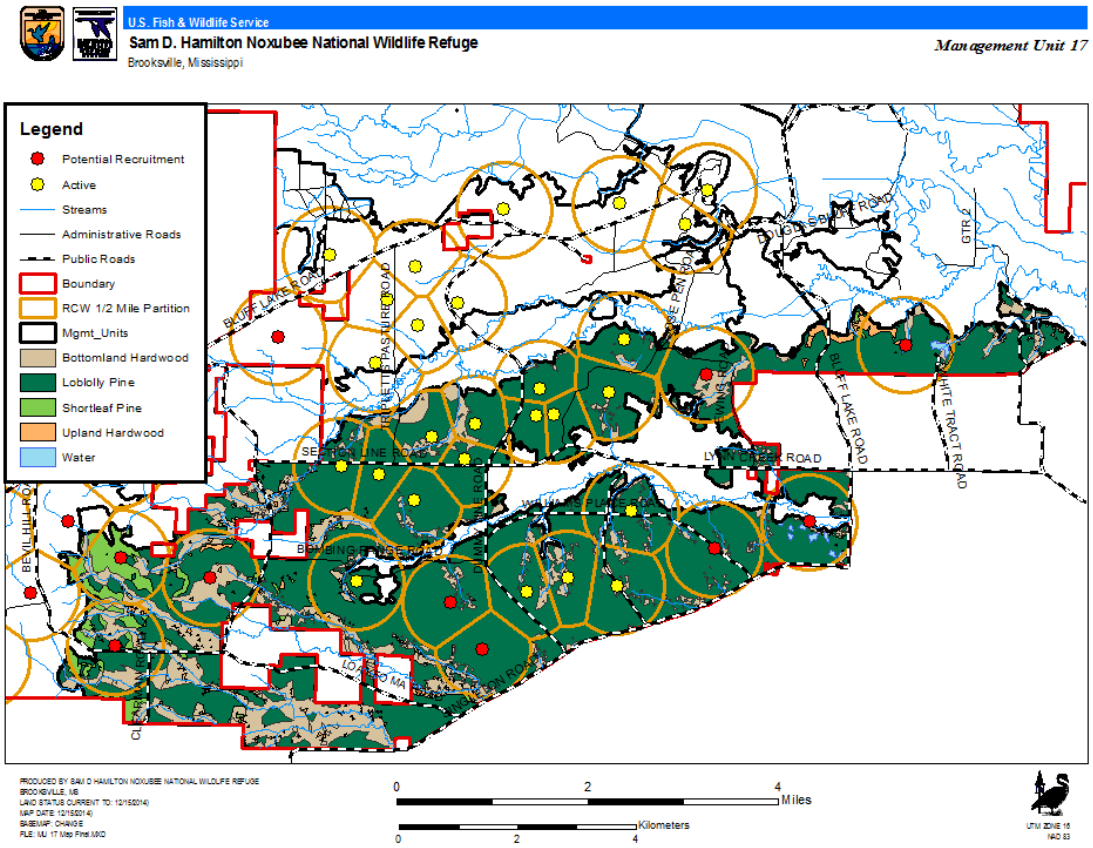
Administrative Use Lands

Open public and administrative roads within the unit may be maintained in a graveled state from ditch to ditch and will receive maintenance related activity throughout the year. Starting at the outside of the ditches, habitat will be maintained in the same manner as within the main unit. Vegetative barriers may be left along road edges to provide wildlife cover from road related disturbance and to deter road hunting activities, particularly where roads are adjacent to fields. Haul roads created to facilitate removal of timber will be abandoned, possibly replanted to forest and not maintained through time. Sections of the Historic Robinson Road that are visible should be protected from disturbance to maintain the integrity of the old road bed. The sawdust pile on Coleman Road will be protected from prescribed fire and will not be disturbed by habitat management techniques.

Adaptive Management Monitoring Elements:

- The primary habitat response variables will be forest overstory structure and composition, forest midstory and understory structure, and bottomland hardwood forest health and productivity for wildlife as measured by forest inventory data.
- Until RCW occupy the area, the primary wildlife response variable will be based on those species of complimentary needs to include bird species composition and abundance using breeding landbird surveys (point counts).
- The refuge will consider herptafauna survey (according to PARC guidelines and protocol) (http://www.parcplace.org/publications/inventory-and-monitoring-guide.html).
- Monitor the effects of forest management activities to maintain integrity of desired species composition, habitat structure, and forest health.

MANAGEMENT UNIT 17
(Section Line Road Unit)



Resources of Concern:

Red-cockaded Woodpecker (*Picoides borealis*)

Species of Complimentary Needs:

Wild turkey (*Meleagris gallopavo*)
Northern bobwhite (*Colinus virginianus*)
Bachman's sparrow (*Aimophila aestivalis*)
Brown-headed nuthatch (*Sitta pusilla*)

Habitat Objectives: 1.1, 1.2

Current Condition and Special Considerations:

Management Unit 17 consists primarily of loblolly pine with numerous streamside management zones and is partially bisected by a red oak hardwood bottom (Management Unit 18). From 2010 to 2013, approximately 15,331 acres were treated with prescribed fire equating to more

than 60 percent of the area. Over this same time period, herbicides were used on more than 633 acres to control hardwoods in the midstory. Within the unit are three small (<3-acre) research demonstration plots where midstory hardwoods were either left untreated, treated with prescribed fire, or treated with herbicides. Although there is no formal study design associated with these plots, these plots are frequented by educational groups interested in understanding the influence of fire on forested habitat. The management unit is bounded and dissected by refuge public use roads and maintained fire lines. Throughout the history of the refuge, active forest management started with plantings of trees in the late 1940s as part of stand level restoration activities. Less than 25 percent of the forest within the management unit is less than 60 years old. The majority of the pine forest are 60 to 80 years of age (Figure 14).

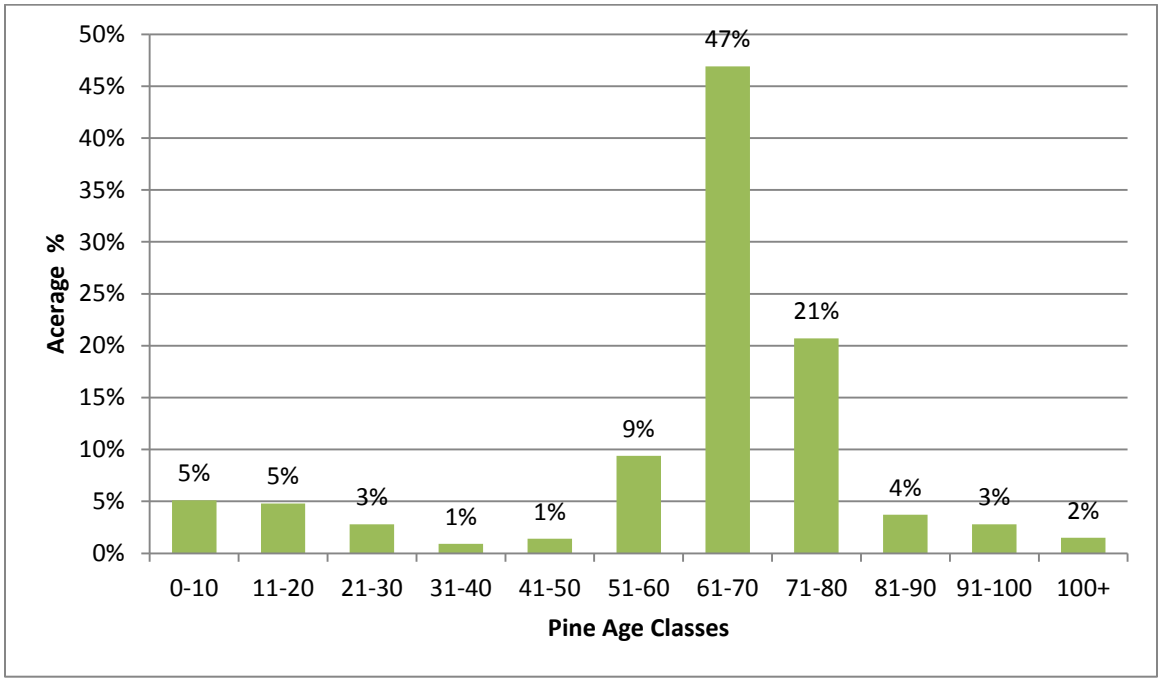


Figure 14. Age class distribution for pine within Management Unit 17 as determined by stand inventories, 2012.

Historic habitat analysis for this unit indicates the area as having the potential pine habitat type (LANDFIRE) and current conditions are similar. *Lespedeza bicolor*, Japanese climbing fern (*Lygodium japonicum Thunb. Ex Murr.*), and cogon grass (*Imperata brasiliensis*) are a threat and some or all of these pests have been treated on 93 acres within this unit. Several large private inholdings exist at the western end of the unit, causing some fragmentation of pine habitat. The area also contains several refuge managed out-of-condition hay fields mowed or disked every few years. Today, all these fields show signs of regeneration into forest with significant sweet gum (*Liquidambar styraciflua*) growth. The original management intent for the fields was to provide habitat for wild turkey and northern bobwhite.

The unit contains first, second, and third order streams. The habitat along these SMZs within Management Unit 17 consists of the red oak type. These areas have been included previously in various levels of forest management but remained protected following Mississippi's Best

Management Practices for Forestry (2008). Yellow Creek, Horse Creek, and the upper fingers of Loakfoma Creek are named creeks within this unit. Numerous other small perennial and intermittent streams along with drains are distributed throughout the unit. River cane is associated within these zones and well distributed but sparse in occurrence. Within these SMZs, a shift in community type from pine to hardwood occurs. Pine is frequently represented within the overstory within these zones due to the increased soil wetness, prescribed fire carries less readily, and hardwood regeneration occurs more readily and prevents these areas from becoming a pine dominated stand. These irregular zones provide habitat components for a suite of species including wild turkey, white-tailed deer, pileated woodpecker (*Dryocopus pileatus*), southern flying squirrel (*Glaucomys volans*), and numerous species of herpetofauna.

Within the 1995 Forest Management Plan, the refuge established goals to manage this management unit and all habitats within it for RCW. As of 2012, twenty four clusters were established within the unit. Of these 24 clusters, 10 clusters were natural starts with the other 14 being artificially created by staff. Today, 16 of the 24 clusters remain active. A seventeenth cluster has been inactive for less than 5 years and the remaining seven clusters are considered abandoned and no longer viable RCW clusters. The most recent examination of habitat for the 17 clusters reveals each is lacking sufficient GQFH. All the cluster partitions listed below are not meeting GQFH criterion due to presence and abundance hardwood midstory greater than 7 feet tall, pine basal area greater than 80 square feet per acre, and groundcover being comprised of less than 40 herbaceous cover. Also some of these cluster partitions cannot meet GQFH due to current acreage constraints based on available pine acres. The only criteria that the partitions currently meet is at least 18 stems per acre of pine greater than the 14 inches DBH that are greater than 60 years of age and prescribed fire interval of less than 5 years carried by fuels other than herbaceous ground cover.

Cluster 94 - This cluster is bordered by Cluster 23 to the east. The cluster partition is made up of 390 acres. A total of 315 (81 percent) of the 390 acres is pine dominated habitat.

Cluster 23 - This cluster is bordered by Cluster 112 to the east, Cluster 94 to the west, and recruitment cluster 118 to the north. The cluster partition is made up of 273 total acres and 262 (96 percent) of the 273 acres are pine dominated habitat.

Cluster 112 - This cluster is bordered by Cluster 117 to the north and Cluster 23 to the west. The cluster partition is made up of 381 total acres and 381 (100 percent) of the 381 acres are pine dominated habitat.

Cluster 117 - This cluster is bordered by Cluster 112 to the south and recruitment Cluster 118 to the west. The cluster partition is made up of 368 total acres and 280 (76 percent) of the 368 acres are pine dominated habitat.

Cluster 118 (recruitment) - This cluster is bordered by Cluster 23 to the south and recruitment Cluster 117 to the east. The cluster partition is made up of 365 total acres and 209 of the 365 acres are pine dominated habitat.

Cluster 27 - This cluster is bordered by Cluster 110 to the east, Cluster 37 to the northeast, Cluster 114 to the south, and Cluster 7 to the west. The cluster partition is made up of 258 total acres and 214 of the 258 acres are pine dominated habitat

Cluster 7 - This cluster is bordered by Cluster 27 to the northeast, Cluster 114 to the southeast, Cluster 100 to the south, and Cluster 8 to the southwest. The cluster partition is totals 268 total acres and 203 (76 percent) of the 268 acres are pine dominated habitat.

Cluster 114 - This cluster is bordered by Cluster 27 to the north, Cluster 7 to the south, and Cluster 100 to the southwest. The cluster partition is made up of 257 total acres and 214 (83 percent) of the 257 acres are pine dominated habitat.

Cluster 100 - This cluster is bordered by Cluster 7 to the north, Cluster 114 to the northeast, and Cluster 8 to the northwest. The cluster partition is made up of 335 total acres and 331 (99 percent) of the 335 acres are pine dominated habitat.

Cluster 8 - This cluster is bordered by Cluster 7 to the northeast, Cluster 100 to the southeast, and Cluster 113 to the west. The cluster partition is made up of 233 total acres and 216 (93 percent) of the 233 acres are pine dominated habitat.

Cluster 113 - This cluster is bordered by Cluster 8 to the east. The cluster partition is made up of 326 total acres and 275 (84 percent) of the 326 acres are pine dominated habitat.

Cluster 122 - This cluster is bordered by recruitment Cluster 88 to the west. The cluster partition is made up of 502 total acres and 418 (83 percent) of the 502 acres are pine dominated habitat

Cluster 88 (recruitment) - This cluster is bordered by Cluster 122 to the east. This 345-acre recruitment cluster will be moved approximately 0.25-mile to the west. At the current time, 66 percent (226 acres) of the partition is of pine habitat.

Cluster 106 - This cluster is bordered by Cluster 116 to the south and forms a 422-acre partition. This cluster does not border any additional clusters to the north, east, or west. Currently, Cluster 106 provides 230 acres (55 percent) of pine habitat within the partition. Fields and bottomland hardwood make of the remaining acres.

Cluster 116 - This cluster is bordered by Cluster 106 to north, Cluster 17 to the southwest, and Cluster 37 to the northwest, and is compressed to a foraging partition of 350 acres. The cluster partition is made up of 317 acres (91 percent) of pine habitat.

Cluster 17 - This cluster is bordered by Cluster 37 to north, Cluster 116 to the east, and Cluster 110 to the west. The cluster partition totals 189 acres and 159 acres (84 percent) are pine habitat. This cluster falls below the minimum acres (200 acres) needed to support GQFH for the life of the cluster once forestry practices are implemented, but sufficient acres exist to manage the habitat for GQFH.

Cluster 110 - This cluster is bordered by Cluster 37 to north, Cluster 17 to the east, and Cluster 27 to the west. The cluster partition totals 168 total acres and 137 acres (82 percent) are pine habitat. This cluster falls below the minimum acres (200) needed to support GQFH for the life of the cluster once forestry practices are implemented.

Cluster 37 - This cluster is bordered by Cluster 17 to the southeast, Cluster 110 to the southwest, and Cluster 116 to the east. The cluster partition totals 279 acres and 210 acres (75 percent) are pine habitat. The remaining acres are bottomland hardwoods.

Unique Features:

Dummyline Road runs through the area perpendicular to Lynn Creek and was originally a route utilized by a railroad company for timber transport. The Morgan Hill Demonstration Prairie area, located at the unit's east end, consists of 33 acres of open field that have been managed to replicate a prairie-like condition by using fire and mechanical means. The prairie area contains 0.68-mile of walking trail and an overlook tower for use by visitors. The unit borders Loakfoma Lake to the north and west, Bluff Lake road to the east, and CA Barge Timberlands Company to the south. This area is divided by Lynn Creek, Management Unit 18. There are numerous privately owned inholdings and historical sites, including a historic World War II practice bombing range, old home sites, cisterns, and saw dust piles located within the unit. Saw dust piles and inholdings are protected from fire by fire lines. The private inholdings are mostly cleared fields, causing fragmentation of pine habitats.

Management Prescriptions:

Habitat within Management Unit 17 will be primarily directed toward providing for the needs of the federally listed endangered RCW. In addition to the 16 currently active partitions, up to seven recruitment clusters may be created within the unit. The site index for both pine and hardwood tree species within this unit is more than 60. The forest will be managed to provide at least 120 acres of GQFH per RCW cluster. Individual hardwood trees having particular wildlife value (i.e., den trees, cavity trees, and other unique characters) may be left growing throughout the pine dominated forest, but canopy hardwoods will be kept to below 30 percent of canopy. To accomplish the habitat management objectives for RCW within this unit, it will be necessary to manage clusters and their locations to provide a target 300 acres of sustainable pine habitat per partition.

Cluster 94 - Over a 60-year period, this cluster will be shifted to the west approximately 0.25-mile to allow Cluster 23 more partition acres. Even with the shift, this cluster will continue to provide ample acres to perpetually support GQFH for the life of the cluster once forestry practices are implemented. A minimum of 120 acres of mature pine forest within the cluster partition will need treatment to reduce basal area and midstory to strive for GQFH. This cluster has 195 acres of mature pine forest available for regeneration to provide future GQFH.

Cluster 23 - Over a 60-year period, this cluster will be shifted to the west approximately 0.25-mile to provide an additional 40 to 100 partition acres. Currently without the shift, this cluster does not provide ample acres to perpetually support GQFH. A minimum of 120 acres of mature

pine forest within the cluster partition will need treatment to reduce basal area and midstory to strive for GQFH. This cluster has approximately 142 acres of mature pine forest within the partition for use in regenerating future GQFH.

Cluster 112 - This cluster provides ample acres to perpetually support GQFH for the life of the cluster once forestry practices are implemented. A minimum of 120 acres of mature pine forest within the cluster partition will need treatment to reduce basal area and midstory to strive for GQFH. This cluster has approximately 261 acres of mature pine forest within the partition for use in regenerating future GQFH.

Cluster 117 - This cluster does provide ample acres to perpetually support GQFH for the life of the cluster once forestry practices are implemented. A potential southeastern shift of 0.125- to 0.25- mile to the southeast over time will provide more acres for this cluster and recruitment Cluster 118. This shift will provide approximately 20-60 additional pine acres for each partition. A minimum of 120 acres of mature pine forest within the cluster partition will need treatment to reduce basal area and midstory to strive for GQFH. This cluster currently has approximately 160 acres of mature pine forest within the partition for use in regenerating future GQFH.

Cluster 118 (recruitment) - This cluster has sufficient acres to be managed for GQFH within the short term. This cluster would gain additional acres once Cluster 117 shifts 0.125- to 0.25-mile to the southeast. This shift will provide approximately 20-60 additional pine acres for each partition. This cluster currently has approximately 89 acres of mature pine forest within the partition for use in regenerating future GQFH.

Cluster 106 - The 32 acres of fields will be afforested to pine habitat increasing the pine habitat to 262 acres of pine (62 percent) with the partition. A total of 120 acres of mature pine forest within Cluster 106 will need treatment to reduce basal area and midstory to meet GQFH. This cluster has approximately 110 acres of mature pine forest within the partition for use in regenerating future GQFH. By treating the existing forest and developing a replacement forest, this partition should possess a minimum of 120 acres of potential GQFH well into the future.

Cluster 116 - This cluster provides ample acres to perpetually support GQFH for the life of the cluster once forestry practices are implemented. A total of 120 acres of mature pine forest within Cluster 116 will need treatment to reduce basal area and midstory to strive for GQFH. This cluster has approximately 197 acres of mature pine forest within the partition for use in regenerating future GQFH.

Cluster 17 - This cluster falls below the minimum acres needed to perpetually support GQFH for the life of the cluster. A total of 120 acres of mature pine forest within the partition will need treatment to reduce basal area and midstory to strive for GQFH. This cluster has approximately 39 acres of mature pine forest within the partition for use in regenerating future GQFH. In the long term, this cluster needs to merge with Cluster 110 and slightly shift 0.125- to 0.25-mile to the south to provide approximate partition acreage of approximately 300 acres, after merging. The combination if these clusters could eventually happen due to the lack of available foraging

acres within each partition and the proximity of nest trees. These clusters nest within several hundred yards of one another and spend time and energy defending their territories.

Cluster 110 - This cluster falls below the minimum acres needed to perpetually support GQFH for the life of the cluster. Approximately 120 acres of mature pine forest within the partition will need treatment to reduce basal area and midstory to strive for GQFH. This cluster has approximately 17 acres of mature pine forest within the partition for use in regenerating future GQFH.

In the long term, this cluster needs to merge with Cluster 17 and a migration of the cluster center of 0.125- to 0.25-mile to the south over time to provide total partition acreage of approximately 300 acres of pine habitat after merging. The combination if these clusters should eventually happen due to the lack of available foraging acres within each partition and the proximity of nest trees. These clusters nest within several hundred yards of one another and spend time and energy defending their territory. By combining partitions, treating the forest and developing a replacement forest, this larger partition should possess a minimum of 120 acres of potential GQFH well into the future.

Cluster 37 - This cluster falls below the minimum acres needed to perpetually support GQFH for the life of the cluster. Approximately 120 acres of mature pine forest within the partition will need treatment to reduce basal area and midstory to strive for GQFH. This cluster has approximately 90 acres of mature pine forest within the partition for use in regenerating future GQFH.

In the long term, this cluster needs Clusters 17 and 110 to merge and move to the south approximately 0.125- to 0.25-mile over the next 60 years to provide total partition acreage of approximately 300 acres of pine habitat after merging. This cluster could sustain GQFH if the above mentioned goals are met, but potentially could never meet minimum needs for GQFH.

Cluster 27 - This cluster may provide the minimum acres needed to perpetually support GQFH for the life of the cluster, but could gain acreage with the potential merger of 114 and 7. Cluster 27 could add additional 40-80 total partition acres. A minimum of 120 acres of mature pine forest within the cluster partition will need treatment to reduce basal area and midstory to strive for GQFH. This cluster has approximately 94 acres of mature pine forest within the partition for use in regenerating future GQFH. This cluster should gain acreage with the merger of the above mentioned clusters, potentially providing 120 acres of GQFH within the future partition boundary for the life of the partition.

Cluster 7 - This cluster may provide the minimum acres needed to perpetually support GQFH for the life of the cluster, but could gain acreage with the potential merger of Cluster 114. This partition contains 55 (21 percent) acres of fields that will be regenerated for future RCW habitat and could potential gain an additional 20-60 acres of pine habitat with the shift of the westerly adjoining clusters. A minimum of 120 acres of mature pine forest within the cluster partition will need treatment to reduce basal area and midstory to strive for GQFH. In addition to the fields, this cluster has approximately 83 acres of mature pine forest within the partition for use in

regenerating future GQFH. This cluster should gain acreage with the merger and shift of the above mentioned clusters, potentially providing 120 acres of GQFH within the future partition boundary for the life of the partition.

Cluster 114 - This cluster may provide the minimum acres needed to perpetually support GQFH for the life of the cluster, but could gain acreage with the potential merger of Cluster 7. This cluster partition has the potential to gain approximately 20 acres of pine habitat with the shift of the westerly adjoining clusters. A minimum of 120 acres of mature pine forest within the cluster partition will need treatment to reduce basal area and midstory to strive for GQFH. This cluster has approximately 94 acres of mature pine forest within the partition for use in regenerating future GQFH. This cluster should gain acreage with the merger and shift of the above mentioned clusters, potentially providing 120 acres of GQFH within the future partition boundary for the life of the partition.

Cluster 100 - This cluster has ample pine acreage to perpetually sustain GQFH through the life of the cluster. Ideally within the next 60 years this cluster should shift slightly (0.125- to 0.25-mile) to the southwest; this would allow clusters 114 and 7 to gain approximately 20 acres each of pine habitat within the partitions. Clusters 8 and 113 would also need to slightly shift to the west/ southwest as well to optimize pine acres within all adjoining partitions (discussed in clusters 8 and 113).

A minimum of 120 acres of mature pine forest within the cluster partition will need treatment to reduce basal area and midstory to strive for GQFH. This cluster has approximately 211 acres of mature pine forest within the partition for use in regenerating future GQFH.

Cluster 8 - Ideally within the next 60 years this cluster should shift slightly (0.125- to 0.25-mile) to the west/southwest; this would allow this cluster to gain approximately 40-80 acres of pine habitat within the partition. This will be possible with the movement of Cluster 113 to the west approximately 0.25-mile to the west. Cluster 113's potential movement to the west/southwest will be the key factor to free up additional pine acres for the adjacent cluster to the east (discussed in clusters 7, 27, 100, 113 and 114).

A minimum of 120 acres of mature pine forest within the cluster partition will need treatment to reduce basal area and midstory to strive for GQFH. This cluster has approximately 96 acres of mature pine forest within the partition for use in regenerating future GQFH.

Cluster 113 - This cluster will have ample pine acreage to perpetually sustain GQFH through the life of the cluster if the open fields are replanted, but needs to shift slightly (0.125- to 0.25-mile) to the west/southwest to provide more acres to the chain of clusters immediately to the east. A minimum of 120 acres of mature pine forest within the cluster partition will need treatment to reduce basal area and midstory to strive for GQFH. This cluster has approximately 155 acres of mature pine forest within the partition for use in regenerating future GQFH.

Cluster 122 - This cluster provides ample acres to perpetually support GQFH for the life of the cluster once forestry practices are implemented. Cluster 88 is shown on the map as taking a portion of the overall partition acreage, but since it is a recruitment site those acreages currently

belong to Cluster 122. Recruitment site 88 will be moved approximately 0.25-mile to the west if not occupied, to optimize the acreage for both partitions.

A minimum of 120 acres of mature pine forest within the cluster partition will need treatment to reduce basal area and midstory to strive GQFH. This cluster has approximately 298 acres of mature pine forest within the partition for use in regenerating future GQFH.

Any future recruitment cluster established within this unit will need contain at least 300 acres of pine habitat. A minimum of 120 acres of mature pine forest within the recruitment cluster partition will need treatment to reduce basal area and midstory to strive for GQFH. Mature pine forest located outside of the 120 acres needed for GQHF may be used toward regeneration of pine for providing GQFH into the future.

The use of free-thinnings, pre-commercial thinnings, and WSI methods will be tools in managing the forest to meet the habitat criteria for RCW. The most common silvicultural method, free-thinning, will be used to reduce pine basal area and remove hardwood midstory trees to improve GQFH. WSI practices will also be used to manage tree species diversity to reach the desired habitat conditions for areas not suitable for commercial harvest. Other methods may be used to remove unwanted understory or to reduce basal within stands including manual or mechanized pre-commercial thinning, commercial biomass thinning, mulching, or permitted firewood cutting of hardwoods. Alone or in combination, prescribed fire, mechanical control methods, and use of herbicides may be widely used to control hardwood growth and create the desired understory and ground characteristics needed to produce insects for use by the woodpeckers. Regardless of the method, the goal would be to promote GQFH in stands that have become over-stocked with trees or contain high amounts of hardwoods within the midstory component.

Irregular shelterwood silvicultural techniques will be used for regeneration of the forest within the partitions where the foraging habitats are constrained (i.e., proximity to other partition, acreage, and potential dispersal corridors). Irregular shelterwood will minimize foraging habitat fragmentation, allow for the residual stem to be available for future cavity trees, and provide an age structure that could expedite potential suitable GQFH in the regenerated stand.

Thinning, irregular shelterwood, or seedtree may be used in stands of habitat within Management Unit 17 that is currently mixed pine-hardwood to promote a greater pine component. In areas where the habitat constraints mentioned above are not present, the use of shelterwood, irregular shelterwood, seedtree harvest, patch cuts, afforestation, and reforestation may all be viable options to promote a sustainable pine-hardwood forest habitat. The exact regeneration methods used will be site and habitat condition-specific based on observed site conditions and proximate location to the existing GQFH within the partition.

Existing fire lines will be maintained to contain fire and new lines will be established to protect regenerating tree species. All decisions on location, frequency, and intensity of treatments will be determined by habitat condition and needs of the RCW for foraging habitat. Natural fire breaks and temporary hand-lines will be favored to minimize the amount of artificial fire breaks

installed or maintained between management units. Administrative UTV trails may be improved to prevent soil erosion and protect water quality. Improvements may include use of erosion control fabric, gravel, and small bridges.

All old field locations determined to be needed for RCW management within Management Unit 17 will be reforested in pine species (i.e., loblolly, short-leaf pine, and long-leaf pine) that best represent historical forest and site conditions and facilitate the management of the habitat for RCWs. Seedlings will be planted using either natural reseeding or manual replanting of seedlings. These same species and techniques may also be used to regenerate damaged habitats within forest openings such as those caused by southern pine beetle, ips, or storms. All habitat management activity will occur when site and species conditions are favorable for the management activity to happen and minimally impact the habitat or resource of concern. The forest management operations within RCW areas will adhere to the RCW Recovery Plan Guidelines.

Aquatic Management

SMZs will be protected based on stream order and the minimums defined previously (pages 77-78). Prescribed fire will normally be allowed to burn into SMZs with site conditions (e.g., wetness), dictating burn extent into the zone. Fire will be excluded from SMZs when habitat conditions indicate undesirable impacts to regeneration, mortality of canopy trees, and increased soil erosion. Timber management may occur within the SMZs under guidelines within Mississippi's Best Management Practices for Forestry (2008), if needed to maintain the desired forest conditions.

Administrative Use Lands

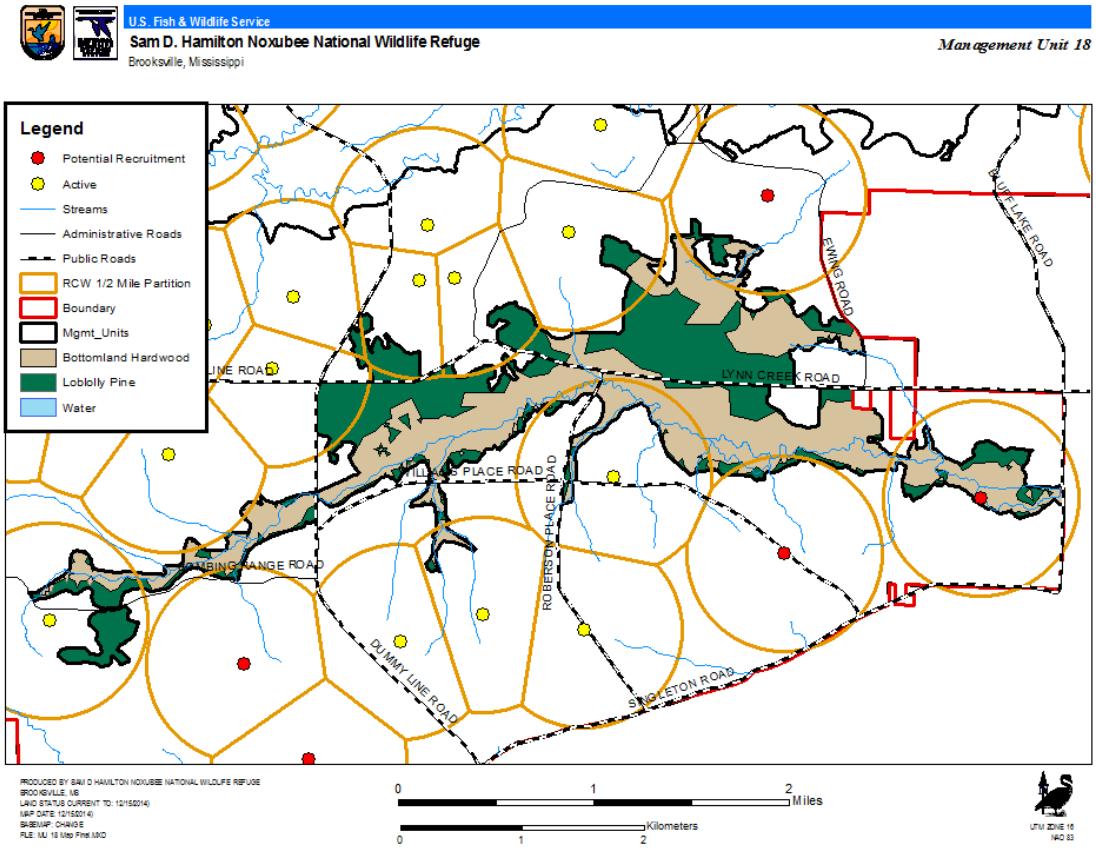
Open public and administrative roads within the unit may be maintained in a graveled state from ditch to ditch and will receive maintenance related activity throughout the year. Vehicle access into the unit will be limited to Dummy Line Road to prevent the spread of exotic species. Road maintenance, starting at the outside of the drainage ditches, will allow habitat to be maintained in the same manner as within the main forested unit. Vegetative barriers may be left along road edges to provide wildlife cover from road related disturbance and to deter road hunting activities, particularly where roads are adjacent to fields. Temporary haul roads created to facilitate removal of timber will be abandoned, possibly replanted to forest, and not maintained as a road through time. Administrative UTV access trails may need to be created to facilitate the monitoring of birds at individual cluster locations. These trails will not be highly developed but may be improved to provide year-round UTV access without damage to soil or water quality.

<u>Adaptive Management Monitoring Elements</u>:

- Conduct RCW monitoring according to the 2003 RCW Recovery Plan.
- The primary habitat response variables will be forest overstory structure and composition, forest midstory and understory structure within RCW partitions as measured by forest inventory data.

- The primary wildlife response variable will be forest breeding bird species composition and abundance using breeding landbird surveys (point counts).
- The refuge will consider herptafauna survey (according to PARC guidelines and protocol) (http://www.parcplace.org/publications/inventory-and-monitoring-guide.html).
- Monitor the effects of forest management activities to maintain integrity of desired species composition, habitat structure, and forest health.

MANAGEMENT UNIT 18
(Lynn Creek Unit)



Resources of Concern:

Forest Breeding Birds (Prothonotary Warbler and Rusty Blackbird)

Species of Complimentary Need:

Wild turkey (*Meleagris gallopavo*)
White-tailed deer (*Odocoileus virginianus*)
Squirrel (*Sciurus carolinensis)*
Reptiles/Amphibians
Bats
Wood duck (*Aix sponsa*)

Habitat Objective: 2.1,

Current Condition and Special Considerations:

Management Unit 18 consists of 1,491 acres of mixed hardwood primarily located along Lynn Creek, with fingers of stream side management zones extending to the surrounding unit on both the north and south sides of the creek. The unit is almost completely enclosed within Management Unit 17 and dissected by existing public use roads and existing fire lines that facilitate both administrative and public access and use of prescribed fire. Timber on the north side of Lynn Creek appears older than that to the south. Previous farming activity on the southeast side may account for much of this difference. Section line and Dummy Line Roads bisect the unit causing some disruption to the hydrology. Ponding issues are of particular concern to the north of Section Line Road. Over time the area has been indirectly treated with fire being used to control the hardwood midstory within Management Unit 17. Fire lines have been established along the intersecting boundary with Management Unit 17 for about 5 miles of the 27 miles of its perimeter. Chemical hardwood control has not occurred within this unit, but herbicides have been used to control exotics and invasive plants.

Historic habitat analysis for this unit indicates the area as having the potential for American sycamore (*Platanus occidentalis*), sugarberry (*Celtis laevigata*), and pine - 3 habitat types (LANDFIRE) along the creek, with loblolly pine habitat type at the wider northern sections within the eastern end of the unit. The current habitat condition of the management unit appears of similar type. Japanese climbing fern (*Lygodium japonicum Thunb. Ex Murr.*), Japanese stilt grass (*Microstegium vimineum*), privet (*Ligustrum vulgare*), and cogon grass (*Imperata brasiliensis*) continue to be a threat and all or one of these pests have been spot treated in the past. Japanese stilt grass was recently found and treated along the creek and roadways within this unit. Two small private inholdings exist adjacent toward the eastern end of the unit. The area also contains one 27-acre and one 6-acre out of condition hay fields (a.k.a. “Counter Fields”) occasionally mowed or disked every few years, but shows advanced signs of regeneration into forest with significant sweetgum (*Liquidambar styraciflua*). The original management intent for these fields was to provide habitat for wild turkey.

River cane (*Arundinaria giganteais*) is associated throughout this unit and is well distributed but sparse in occurrence due to the forest condition. Due to increased soil wetness, prescribed fire carries less readily and hardwood regeneration occurs more readily. This unit serves as habitat for a suite of species including neotropical migratory birds, wild turkey, white-tailed deer, pileated woodpecker (*Dryocopus pileatus*), southern flying squirrel (*Glaucomys volans*), and numerous species of herpetofauna.

Unique Features:

A large beaver dam is found about 0.25-mile up the creek from Singleton Road. The dam is approximately 100-200 feet wide to its east and narrows down to a channel about 75 feet wide to the west. The beaver pond is approximately 200 yards long and 2-3 acres in area.

There is the potential for numerous historical sites including old home sites, cisterns, and artifacts from Native Americans. Old road beds and one old home site can still be found south

of Lynn Creek toward the western end of the unit. Lynn Creek itself may have been straightened and channelized in the immediate area of the old home site. An abandoned bus-campsite also exists on the north side of Lynn Creek in the same area as the old home site. Approximately 800 feet of drainage ditches extend from Unit 18 toward Lynn Creek in the area between the two private inholdings.

Management Prescriptions:

Habitat within Management Unit 18 will be managed to benefit forest breeding birds by providing complex vertical and horizontal structure for nesting and foraging. Canopy gaps will be intermixed with dominate, shade-intolerant trees with expansive, long-limbed crowns that overtop large, individual, shade tolerant trees. Canebrakes will be encouraged to develop with canopy gaps.

The desired forest condition will follow that recommended by the LMVJV Restoration, Management, and Monitoring of Forest Resources in the Mississippi Alluvial Valley: Recommendations for Enhancing Wildlife Habitat 2007. Timber management including WSI techniques may occur within the SMZs under guidelines within Mississippi's Best Management Practices for Forestry (2008), if needed to maintain the desired forest conditions. Forest management will be conducted to favor shade-intolerant species and the establishment of large, over mature trees within the forest for the benefit of numerous wildlife species including bats and wood duck.

During the next 15-year period, the majority of the areas will likely be allowed to follow natural successional patterns with active management focused on exotic plant control. With time, the likely silvicultural method to be used in this habitat management will be free-thinning to reduce basal area and increase species composition within the forest. WSI practices will also be used to manage habitat to reach the desired habitat conditions. Regardless of method and timing of active management, the goal is to promote forest diversity and health that resemble historic conditions indicated by the NatureServe terrestrial ecological systems. The criteria for attaining these conditions will be based on the basal area of tree species composition being greater than 50 percent of the predominant species types according to NatureServe (Nature Serve 2011) terrestrial ecological systems. In many areas condition are not likely to be attained during the life of this plan, but significant efforts can be made to promote these condition in habitats that have not drastically skewed from the historic conditions.

Triggers for prescribed silvicultural treatments will be:

1. Overstory canopy cover: >70%
2. Midstory cover: <25%
3. Basal area: >70 square feet per acre
4. More than 25% of basal area approaching biological maturity (i.e., senescence)
5. Tree stocking >70%

Various silvicultural methods could be used to create canopy gaps to promote forest structure and an intermixed forest with dominate, shade-intolerant trees with expansive, long-limbed

crowns that overtop large, individual, shade tolerant trees. Canebrakes will be encouraged to develop within canopy gaps. Pine dominated habitats may be managed for GQFH if these stand are important to active RCW clusters.

The methods used for regeneration of the hardwood forest in this management unit could likely consist of patch cuts, single tree selection, group selection, shelterwood, irregular shelterwood, afforestation, and reforestation. The regeneration methods used will be site and habitat condition-dependent based on observed site conditions and proximate location to other feature within the unit. All decisions on location, frequency, and intensity of treatments will be determined by habitat condition and needs of the resource of concern in the management unit. Trees having unique wildlife values (i.e., cavity and den trees) will be left throughout the unit.

Prescribed fire may not be a major management tool in this unit but may be used in various places to remove unwanted vegetation or to remove debris. Natural fire breaks will be favored to minimize the amount of artificial fire breaks installed or maintained between management units. Alternative firing techniques (e.g., backing fires) and the sites natural wetness will be used to ensure habitats within Management Unit 2 receive only slight impact along the transition zones. Fire may damage hardwoods creating basal cavities which may be of later benefit to Rafinesque's big-eared bat (*Corynorhinus rafinesquii*).

Aquatic Management

SMZs will be protected based on stream order and the minimums defined previously (pages 77-78). Prescribed fire will normally be allowed to burn into SMZs with site conditions (e.g., wetness) dictating burn extent into the zone. Fire will be excluded from SMZs when habitat conditions indicate undesirable impacts to regeneration, mortality of canopy trees, and increased soil erosion. Timber management may occur within the SMZs under guidelines within Mississippi's Best Management Practices for Forestry (2008), if needed to maintain the desired forest conditions.

Beaver ponds will be allowed to form naturally within the creek channels to benefit wood ducks, but beaver population and dam control actions will be used to keep beaver activity confined to the channels. All water managed by beavers that impacts live timber during the growing season will be removed and when needed beaver numbers controlled.

Administrative Use Lands

Open public and administrative roads within the unit may be maintained in a graveled state from ditch to ditch and will receive maintenance related activity throughout the year. Starting at the outside of the ditches, habitat will be maintained in the same manner as within the main unit. Vegetative barriers may be left along road edges to provide wildlife cover from road related disturbance and to deter road hunting activities, particularly where roads are adjacent to fields. Haul roads created to facilitate removal of timber will be abandoned, possibly replanted to forest, and not maintained through time. Hydrological restoration activities will be planned to correct the ponding issue for the habitat located on north side of Section Line Road. One or

more low water crossings or culverts may be installed within roads to allow greater water flow toward Lynn Creek.

Adaptive Management Monitoring Elements:

- The primary habitat response variables will be forest overstory structure and composition, forest midstory and understory structure, and bottomland hardwood forest health and productivity for wildlife as measured by forest inventory data.
- The primary wildlife response variable will be forest breeding bird species composition and abundance using breeding landbird surveys (point counts).
- The refuge will consider herpetofauna survey (according to PARC guidelines and protocol) (http://www.parcplace.org/publications/inventory-and-monitoring-guide.html).
- Monitor the effects of forest management activities to maintain integrity of desired species composition, habitat structure, and forest health.

MANAGEMENT STRATEGY DOCUMENTS

DOCUMENTATION OF SPECIAL USES – Note: See Sam D. Hamilton Noxubee NWR Comprehensive Conservation Plan 2014.

DOCUMENTATION OF COMPLIANCE – Note: See Sam D. Hamilton Noxubee NWR Comprehensive Conservation Plan 2014.

CHAPTER VI. LITERATURE CITATIONS

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APPENDIX A. GLOSSARY

Adaptive Management: Refers to a process in which policy decisions are implemented within a framework of scientifically driven experiments to test predictions and assumptions inherent in a management plan. Analysis of results helps managers determine whether current management should continue as is or whether it should be modified to achieve desired conditions.

Alluvial: Sediment transported and deposited in a delta or riverbed by flowing water.

Alternative: 1. A reasonable way to fix the identified problem or satisfy the stated need (40 CFR 1500.2). 2. Alternatives are different sets of objectives and strategies or means of achieving refuge purposes and goals, helping fulfill the Refuge System mission, and resolving issues (Service Manual 602 FW 1.6B).

Anadromous: Migratory fishes that spend most of their lives in the sea and migrate to fresh water to breed.

Basal Area: The area of a horizontal cross section of a tree's stem, generally measured at breast height.

Biological Diversity: The variety of life and its processes, including the variety of living organisms, the genetic differences among them, and the communities and ecosystems in which they occur (Service Manual 052 FW 1. 12B). The System's focus is on indigenous species, biotic communities, and ecological processes. Also referred to as biodiversity.

Carrying Capacity: The maximum population of a species able to be supported by a habitat or area.

Categorical Exclusion: A category of actions that does not individually or cumulatively have a significant effect on the human environment and have been found to have no such effect in procedures adopted by a federal agency pursuant to the National Environmental Policy Act (40 CFR 1508.4).

CFR: Code of Federal Regulations.

Compatible Use: A proposed or existing wildlife-dependent recreational use or any other use of a national wildlife refuge that, based on sound professional judgment, will not materially interfere with or detract from the fulfillment of the National Wildlife Refuge System mission or the purpose(s) of the national wildlife refuge [50 CFR 25.12 (a)]. A compatibility determination supports the selection of compatible uses and identifies stipulations or limits necessary to ensure compatibility.

Comprehensive Conservation Plan: A document that describes the desired future conditions of a refuge or planning unit and provides long-range guidance and management direction to achieve the purposes of the refuge; helps fulfill the mission of the Refuge System; maintains and, where appropriate, restores the ecological integrity of each refuge and the Refuge System; helps achieve the goals of the National Wilderness Preservation System; and meets other mandates (Service Manual 602 FW 1.6 E).

Concern: See Issue

Cover Type: The present vegetation of an area.

Cultural Resource Inventory: A professionally conducted study designed to locate and evaluate evidence of cultural resources present within a defined geographic area. Inventories may involve various levels, including background literature search, comprehensive field examination to identify all exposed physical manifestations of cultural resources, or sample inventory to project site distribution and density over a larger area. Evaluation of identified cultural resources to determine eligibility for the National Register follows the criteria found in 36 CFR 60.4 (Service Manual 614 FW 1.7).

Cultural Resource Overview: A comprehensive document prepared for a field office that discusses, among other things, its prehistory and cultural history, the nature and extent of known cultural resources, previous research, management objectives, resource management conflicts or issues, and a general statement on how program objectives should be met and conflicts resolved. An overview should reference or incorporate information from a field office's background or literature search described in Section VIII of the Cultural Resource Management Handbook (Service Manual 614 FW 1.7).

Cultural Resources: The remains of sites, structures, or objects used by people in the past.

Designated Wilderness Area: An area designated by the U.S. Congress to be managed as part of the National Wilderness Preservation System (Draft Service Manual 610 FW 1.5).

Duck Energy Day (DED)s: Duck-energy days are the number of dabbling ducks (tribe: Anatini) that potentially can be sustained energetically in a wetland for a specified duration.

Disturbance: Significant alteration of habitat structure or composition. May be natural (e.g., fire) or human-caused events (e.g., aircraft overflight).

Ecosystem: A dynamic and interrelating complex of plant and animal communities and their associated non-living environment.

Ecosystem Management: Management of natural resources using system-wide concepts to ensure that all plants and animals in ecosystems are maintained at viable levels in native habitats and basic ecosystem processes are perpetuated indefinitely.

Endangered Species (Federal): A plant or animal species listed under the Endangered Species Act that is in danger of extinction throughout all or a significant portion of its range.

Endangered Species (State): A plant or animal species in danger of becoming extinct or extirpated in the state within the near future if factors contributing to its decline continue. Populations of these species are at critically low levels or their habitats have been degraded or depleted to a significant degree.

Environmental Assessment (EA): A concise public document, prepared in compliance with the National Environmental Policy Act, that briefly discusses the purpose and need for an action, alternatives to such action, and provides sufficient evidence and analysis of impacts to determine whether to prepare an environmental impact statement or finding of no significant impact (40 CFR 1508.9).

Environmental Impact Statement (EIS): A detailed written statement required by section 102(2)(C) of the National Environmental Policy Act, analyzing the environmental impacts of a proposed action, adverse effects of the project that cannot be avoided, alternative courses of action, short-term uses of the environment versus the maintenance and enhancement of long-term productivity, and any irreversible and irretrievable commitment of resources (40 CFR 1508.11).

Estuary: The wide lower course of a river into which the tides flow. The area where the tide meets a river current.

Finding of No Significant Impact (FONSI): A document prepared in compliance with the National Environmental Policy Act, supported by an environmental assessment, that briefly presents why a federal action will have no significant effect on the human environment and for which an environmental impact statement, therefore, will not be prepared (40 CFR 1508.13).

Goal: Descriptive, open-ended, and often broad statement of desired future conditions that conveys a purpose but does not define measurable units (Service Manual 620 FW 1.6J).

Habitat: Suite of existing environmental conditions required by an organism for survival and reproduction. The place where an organism typically lives.

Habitat Restoration: Management emphasis designed to move ecosystems to desired conditions and processes, and/or to healthy ecosystems.

Habitat Type: See Vegetation Type.

Improvement Act: The National Wildlife Refuge System Improvement Act of 1997.

Informed Consent: The grudging willingness of opponents to “go along” with a course of action that they actually oppose (Bleiker).

Issue: Any unsettled matter that requires a management decision [e.g., an initiative, opportunity, resource management problem, threat to the resources of the unit, conflict in uses, public concern, or other presence of an undesirable resource condition (Service Manual 602 FW 1.6K)].

Management Alternative: See Alternative

Management Concern:	See Issue
Management Opportunity:	See Issue
Migration:	The seasonal movement from one area to another and back.
Mission Statement:	Succinct statement of the unit's purpose and reason for being.
Monitoring:	The process of collecting information to track changes of selected parameters over time.
National Environmental Policy Act of 1969 (NEPA):	Requires all agencies, including the Service, to examine the environmental impacts of their actions, incorporate environmental information, and use public participation in the planning and implementation of all actions. Federal agencies must integrate NEPA with other planning requirements, and prepare appropriate NEPA documents to facilitate better environmental decision-making (40 CFR 1500).
National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57):	Under the Refuge Improvement Act, the Fish and Wildlife Service is required to develop 15-year comprehensive conservation plans for all national wildlife refuges outside Alaska. The Act also describes the six public uses given priority status within the Refuge System (i.e., hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation).
National Wildlife Refuge System Mission:	The mission 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.

National Wildlife Refuge System: Various categories of areas administered by the Secretary of the Interior for the conservation of fish and wildlife, including species threatened with extinction; all lands, waters, and interests therein administered by the Secretary as wildlife refuges; areas for the protection and conservation of fish and wildlife that are threatened with extinction; wildlife ranges; game ranges; wildlife management areas; or waterfowl production areas.

National Wildlife Refuge: A designated area of land, water, or an interest in land or water within the Refuge System.

Native Species: Species that normally live and thrive in a particular ecosystem.

Natural Resource: Materials and components that can be found within the environment. A natural resource may exist as a separate entity such as water or air, or as a living organism such as a salamander.

Noxious Weed: A plant species designated by federal or state law as generally possessing one or more of the following characteristics: aggressive or difficult to manage; parasitic; a carrier or host of serious insect or disease; or non-native, new, or not common to the United States. According to the Federal Noxious Weed Act (P.L. 93-639), a noxious weed is one that causes disease or had adverse effects on man or his environment and therefore is detrimental to the agriculture and commerce of the United States and to the public health.

Objective: A concise statement of what we want to achieve, how much we want to achieve, when and where we want to achieve it, and who is responsible for the work. Objectives derive from goals and provide the basis for determining strategies, monitoring refuge accomplishments, and evaluating the success of strategies. Making objectives attainable, time-specific, and measurable (Service Manual 602 FW 1.6N).

RCW Partition: Partitions are spatially created by 0.25 mile and 0.5 mile radius circles drawn around the cluster centers.

Plant Association: A classification of plant communities based on the similarity in dominants of all layers of vascular species in a climax community.

Plant Community: An assemblage of plant species unique in its composition; occurs in particular locations under particular influences; a reflection or integration of the environmental influences on the site such as soils, temperature, elevation, solar radiation, slope, aspect, and rainfall; denotes a general kind of climax plant community.

Preferred Alternative: This is the alternative determined (by the decision-maker) to best achieve the refuge purpose, vision, and goals; contributes to the Refuge System mission, addresses the significant issues; and is consistent with principles of sound fish and wildlife management.

Prescribed Fire: The application of fire to wildland fuels to achieve identified land use objectives (Service Manual 621 FW 1.7). May occur from natural ignition or intentional ignition.

Priority Species: Fish and wildlife species that require protective measures and/or management guidelines to ensure their perpetuation. Priority species include the following: (1) State-listed and candidate species; (2) species or groups of animals susceptible to significant population declines within a specific area or statewide by virtue of their inclination to aggregate (e.g., seabird colonies); and (3) species of recreation, commercial, and/or tribal importance.

Public Involvement Plan: Broad long-term guidance for involving the public in the comprehensive conservation planning process.

Public Involvement: A process that offers impacted and interested individuals and organizations an opportunity to become informed about, and to express their opinions on Service actions and policies. In the process, these views are studied thoroughly and thoughtful consideration of public views is given in shaping decisions for refuge management.

Public: Individuals, organizations, and groups; officials of federal, state, and local government agencies; Indian tribes; and foreign nations. It may include anyone outside the core planning team. It includes those who may or may not have indicated an interest in service issues and those who do or do not realize that Service decisions may affect them.

Purposes of the Refuge: "The purposes specified in or derived from the law, proclamation, executive order, agreement, public land order, donation document, or administrative memorandum establishing, authorizing, or expanding a refuge, refuge unit, or refuge sub-unit." For refuges that encompass congressionally designated wilderness, the purposes of the Wilderness Act are additional purposes of the refuge (Service Manual 602 FW 106 S).

Recommended Wilderness: Areas studied and found suitable for wilderness designation by both the Director of the Fish and Wildlife Service and the Secretary of the Department of the Interior, and recommended for designation by the President to Congress. These areas await only legislative action by Congress in order to become part of the Wilderness System. Such areas are also referred to as "pending in Congress" (Draft Service Manual 610 FW 1.5).

Record of Decision (ROD): A concise public record of decision prepared by the federal agency, pursuant to NEPA, that contains a statement of the decision, identification of all alternatives considered, identification of the environmentally preferable alternative, a statement as to whether all practical means to avoid or minimize environmental harm from the alternative selected have been adopted (and if not, why they were not), and a summary of monitoring and enforcement where applicable for any mitigation (40 CFR 1505.2).

Refuge Goal: See Goal

Refuge Purposes: See Purposes of the Refuge

Songbirds: (Also Passerines) — A category of birds that is medium to small, perching landbirds. Most are territorial singers and migratory.

Step-down Management Plan: — A plan that provides specific guidance on management subjects (e.g., habitat, public use, fire, and safety) or groups of related subjects. It describes strategies and implementation schedules for meeting CCP goals and objectives (Service Manual 602 FW 1.6 U).

Strategy: — A specific action, tool, technique, or combination of actions, tools, and techniques used to meet unit objectives (Service Manual 602 FW 1.6 U).

Study Area: — The area reviewed in detail for wildlife, habitat, and public use potential. For purposes of this CCP, the study area includes the lands within the currently approved refuge boundary and potential refuge expansion areas.

Threatened Species (Federal): — Species listed under the Endangered Species Act that are likely to become endangered within the foreseeable future throughout all or a significant portion of their range.

Threatened Species (State): — A plant or animal species likely to become endangered in the state within the near future if factors contributing to population decline or habitat degradation or loss continue.

Teiring: — The coverage of general matters in broader environmental impact statements with subsequent narrower statements of environmental analysis, incorporating by reference, the general discussions and concentrating on specific issues (40 CFR 1508.28).

U.S. Fish and Wildlife Service Mission: — The mission of the U.S. Fish and Wildlife Service is working with others to conserve, protect, and enhance fish and wildlife and their habitats for the continuing benefit of the American people.

Unit Objective: — See Objective

Vegetation Type, Habitat Type, Forest Cover Type: A land classification system based upon the concept of distinct plant associations.

Vision Statement: A concise statement of what the planning unit should be, or what we hope to do, based primarily upon the Refuge System mission and specific refuge purposes, and other mandates. We will tie the vision statement for the refuge to the mission of the Refuge System; the purpose(s) of the refuge; the maintenance or restoration of the ecological integrity of each refuge and the Refuge System; and other mandates (Service Manual 602 FW 1.6 Z).

Wilderness Study Areas: Lands and waters identified through inventory as meeting the definition of wilderness and undergoing evaluation for recommendation for inclusion in the Wilderness System. A study area must meet the following criteria:

- Generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable;
- Has outstanding opportunities for solitude or a primitive and unconfined type of recreation; and
- Has at least 5,000 contiguous roadless acres or is sufficient in size as to make practicable its preservation and use in an unimpaired condition (Draft Service Manual 610 FW 1.5).

Wilderness: See Designated Wilderness

Wildfire: A free-burning fire requiring a suppression response; all fire other than prescribed fire that occurs on wildlands (Service Manual 621 FW 1.7).

Wildland Fire: Every wildland fire is either a wildfire or a prescribed fire (Service Manual 621 FW 1.3

ACRONYMS AND ABBREVIATIONS

BCC	Birds of Conservation Concern
BRT	Biological Review Team
CCP	Comprehensive Conservation Plan
CFR	Code of Federal Regulations
cfs	cubic feet per second
DOI	Department of the Interior
DU	Ducks Unlimited
EA	Environmental Assessment
EE	environmental education
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FR	Federal Register
FTE	full-time equivalent
FY	Fiscal Year
GIS	Global Information System
NEPA	National Environmental Policy Act
NRHP	National Register of Historic Places
NWR	National Wildlife Refuge
NWRS	National Wildlife Refuge System
PFT	Permanent Full Time
PUNA	Public Use Natural Area
RM	Refuge Manual
RNA	Research Natural Area

ROD Record of Decision

RONS Refuge Operating Needs System

RRP Refuge Roads Program

FWS U.S. Fish and Wildlife Service (also Service)

TFT Temporary Full Time

USC United States Code

APPENDIX B. RELEVANT LEGAL MANDATES AND EXECUTIVE ORDERS

(Note: See 2014 CCP Appendix C)

APPENDIX C. PUBLIC INVOLVEMENT

(Note: See 2014 CCP Appendix D)

APPENDIX D. APPROPRIATE USE DETERMINATIONS

(Note: See 2014 CCP Appendix E)

APPENDIX E. COMPATIBILITY DETERMINATIONS

(Note: See 2014 CCP Appendix F)

APPENDIX F. INTRA-SERVICE SECTION 7 BIOLOGICAL EVALUATION

(Note: See 2014 CCP Appendix G)

APPENDIX G. REFUGE BIOTA

(Note: See 2014 CCP Appendix I)

APPENDIX H: The Commercial Sale Of Timber

Execution of Timber Harvest

Cruising and Marking Timber

Habitat inventory evaluations may be conducted using fixed plot and point sampling techniques. Most cruise sampling will be done using a fixed radius plot of 1/5-acre for saw timber, 1/20-acre plots acre plots for pulpwood, and 1/100-acre plots for regeneration and herbaceous ground cover. Point samples utilizing 10, 15, or 20 factor prisms may be used at various times for collecting habitat data. The following data will be collected during each management unit cruise:

1. Timber volumes including basal area for sawtimber and pulpwood;

2. Species composition of woody vegetation;

3. Tree ages;

4. Canopy presence and conditions;

5. Presence of vines and switchcane;

6. Herbaceous ground cover;

7. Number and size of den, cavity, and cull trees per acre;

8. Tree and shrub species regeneration;

9. Species composition of each canopy layer (overstory, midstory, understory, and ground cover);

10. Presence of woody debris;

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

Cruise data will be compared to target conditions (habitat objectives) for the unit, and a condition-specific treatment prescription will be developed. Treatment prescriptions may 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 historic vegetation cover, current habitat

condition, and other physiological features;

4. Timber data including tree species composition, sawtimber, and pulpwood

Volumes; stocking, age, condition, and basal area;

5. Wildlife habitat parameters including plant composition and abundance of overstory, misdstory and understory; number of cavity and den trees; presence of vines and switchcane; number of dead snags; presence of woody debris; and evidence of wildlife activity (e.g., bird nests, browsing of plants, wildlife tracks, etc.);

6. Composition of woody plant regeneration;

7. Prescription of silvicultural treatment to be conducted in the management unit;

8. Description of desired results;

9. Map of treatment area;

10. Timber data for the treatment area showing approximately 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 and operator select harvest, many factors are considered before selecting a tree for removal. These include species composition of the management unit, tree health and vigor, present regeneration, potential regeneration, canopy structure, number of cavities within the area, habitat value of the tree, mast production, and objectives of the management unit prescription. The management unit prescription designates how much timber volume or basal area to remove during a treatment, but the application of the prescription occurs during timber marking or during operator selection harvest.

To determine which trees are designated for removal, the forester will follow sound silvicultural procedures prescribed in the management unit prescription. As the forester determines which trees are to be removed in a marked sale, 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. The method of operator selection may also be used to select trees under close supervision of the refuge forester or his designee. In an operator-select method, the tree to be selected will be selected by the operator according to the guidance of the forest prescription and the refuge staff overseeing the operation.

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.

Logging Operations

Permanent roads for commercial timber harvest operations will be limited to existing

roads only. Temporary roads will be abandoned and rehabilitated if required. Rehabilitation can include the installation of water bars and/or the redistribution of disturbed soil. This will help reduce fragmentation of the habitat and limit disturbance to soil and plants throughout the refuge.

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 with large tops may have the tops and all limbs removed before skidding. (i.e., hardwoods with large crowns). 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 or negotiated operator for the timber sale.

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 when they are completed.

Close inspection and supervision of all timber sales are 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.

Monitoring

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

Monitoring of impacts of forest management activities on the red-cocked woodpecker will be achieved through the yearly evaluation of the nest and roost cavities, nesting productivity, and individual bird observations. To monitor the impact of forest management activities on migratory birds, a bird-monitoring program has been developed in cooperation with the Lower Mississippi Valley Joint Venture office. The information gathered from the bird-monitoring system assists in identifying the impacts of timber harvest on bird populations, as well as other wildlife species, before and after treatment. This information will help adapt forest management activities to the needs of the many plant and animal species utilizing the forested habitat of the refuge.

A Geographical Information System (GIS) and Global Positioning System (GPS) database is currently being developed on the refuge. The current refuge GIS database consists of various image files including Digital Orthophoto Quarter Quads (DOQQ's), Digital Raster Graphs (DRG's) of U.S. Geological Survey topographic quad maps, aerial photos, and various resolution satellite images. Feature classes, from a variety of different state and federal agencies, provide mapping layers for federal and state highways, local roads, county 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.

Archaeological and Cultural Resources

The Archaeological Resources Protection Act of 1979 obligated the refuges to protect all sites of archaeological and historical significance.

It is possible that forest management activities on the refuge could disturb some unknown archaeological 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 archaeologist for approval prior to the start of any logging activities;

2. Logging will be limited to dry soil conditions, thus limiting soil disturbance and erosion;

3. Limit new road construction to reduce the chance of disturbance;

4. Cease logging operations and flag any suspected archaeological sites that may be discovered during logging operations;

5. Contact the regional archaeologist if any suspected archaeological sites are discovered and follow instructions given by the regional archaeologist to protect the site until a thorough investigation of the site can be conducted.

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. Keep logging slash piles away from designated hiking trails;

3. Limit height of slash piles to less than 4 feet in logging areas and loader sets, unless otherwise directed for wildlife habitat improvement purposes;

4. Ensure all logging access roads are maintained and free of litter and debris while logging activities are in progress;

Forest Openings

Forest openings on the refuge will be managed as temporary openings. These are openings created during logging operations either as patchcuts or loader sets. The patchcuts, 1-3 acres in size, are designated during timber marking to develop temporary openings in the forest canopy large enough to encourage the development of shade intolerant plant species. Loader sets are areas opened up by the logging contractor for the loading of forest products onto trucks. Loader sets usually range in size from .25-acre to 2 acres in size and soil disturbance is greater in these areas than any other areas within the timber sale. In an effort to lessen the risk of soil erosion during wet periods in loader sets, these areas may be planted with winter grasses to serve as a temporary vegetative cover until normal vegetation has a chance to reclaim the site. Rotation of timber harvest areas between the forest management units will allow for temporary openings to be created throughout the refuge on a continual basis to replace older forest openings as they close up.

Insect and Disease

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

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

Upon entry into a management unit, insect and disease damage will be evaluated and taken into consideration as part of the management unit cruise. In situations where insect and/or disease conditions are considered severe, the refuge forester will try to identify the problem and consult with the Forest Health Unit of the USDA Forest Service's 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. The formal bidding process for such treatments may be scaled back in order to expedite the treatment.

Timber Salvage and Emergency 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 Sam D. Hamilton Noxubee 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 forested habitat due to outbreaks of insects or disease. If an outbreak of insects or diseases should occur, it may be necessary to enter into a management unit ahead of the entry cycle to stop or slow the outbreak.

Threatened and Endangered Species

The refuge currently has the endangered red-cockaded woodpecker on the upland pine forests within the refuge. An Intra-service Section 7 Consultation will be conducted for any timber operation that may negatively affect either species.

Administration of Sales

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 GIS maps, sale area GIS maps, timber sale contracts and special use permits, management unit timber volume tables, order of entry plan and progress reports, non-commercial treatments, wildlife information gathered by management unit, and data collected from bird counts conducted throughout the length of the HMP.

Sale Folders

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

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 Sam D. Hamilton Noxubee NWR CCP, Sam D. Hamilton Noxubee NWR Habitat Management Plan, and management unit prescriptions.

The refuge forester will make a reasonable effort to obtain at least three bids from potential buyers on sales excluding emergency harvest sales. These bids will be documented and a permit will be issued to the successful bidder. Invitations to bid will be prepared and administered by refuge personnel. Formal bid invitations will be mailed to all prospective bidders (Exhibit 2). Bid invitations will contain the following information:

1. A formal Bid Information Form containing sales and estimated volume information;

2. A bid form, which the bidder fills out, signs, and returns to the refuge;

3. Maps giving general sales location information and detailing all sales units;

4. General conditions applicable to harvest of forest products;

5. Special conditions applicable to the timber sale;

6. Certificate of Independent Price Determination;

7. Equal Employment Opportunity Clause (Form 3-176);

8. Information on dates when prospective bidders can evaluate sales areas before bid opening.

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 or money order made out to the U.S. Fish and Wildlife Service must accompany all bids received through the formal bid process. The deposit amount will reflect the size of the sale and potential for damage. The amount of the deposit will be stipulated in the bid invitation. This deposit is to ensure the sincerity of the bidder's intention to purchase the offered sale at the bid price. In the event the successful bidder chooses not to purchase the offered timber, the bid deposit will be forfeited to the Federal 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 Federal 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.

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.

Payment for Forest Products and Administration of Receipts

The permittee will have 10 business days after notification of award of bidding to make total or partial payment (according to what is specified in the special use permit). Under no circumstances will harvest operations begin prior to receipt of payment. The purpose of an advance payment is to encourage the permittee to begin harvesting operations as quickly as possible. All payments will be in the form of a cashier's check or money order payable to the U.S. Fish and Wildlife Service.

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

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

1. Authority which allows the Service to exchange timber for lands: National

Wildlife Refuge System Administration Act of 1966 (16 USC 668dd-ee), as amended by the National Wildlife Refuge System Improvement Act of 1997;

2. Lands acquired must be located within the approved refuge acquisition boundary. No preliminary project proposal or any other studies are required. The merit of the acquisition is a judgment call by the refuge manager;

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

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

5. The Service receives compensation for the timber when the third party acquires the subject property and conveys it to the Federal Government;

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

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

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

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

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

3. If seller is willing to sell, the refuge manager notifies the Service's Regional Office,

(District Manager and Division of Realty);

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

5. If the landowner is willing to sell, the Division of Realty advises the refuge manager;

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

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

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

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

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

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

12. The third party conveys the subject property to the Federal Government via a warranty deed. A special use permit is issued by the refuge manager, which specifies the requirements that must be followed by the third party while cutting on the refuge. The special use permit becomes part of the closing documents;

13. The third party completes logging operation within the specified time frame, as detailed in the special use permit.

EXHIBIT 1: SAM D. HAMILTON NOXUBEE NWR TIMBER SALE 200X-XX

Special Conditions for Timber Harvest:

1. A pre-entry conference with permittee and his loggers will be held prior to any work being done on the sale area or haul roads associated with the sale area. A pre-entry meeting will be held before initiation of activity within each new compartment and stand. The refuge manager or his representative retains authority to stop logging operations at any time if road, weather, water, or other unsatisfactory conditions exist.

2. The permittee will maintain any refuge road or easement used. In addition, permittee will repair any damages to the haul roads, primary graveled roads or paved roads, resulting from logging operations to standards specified by the refuge manager. This may include, but is not limited to, grading, graveling, or rocking. The expense of work on dirt roads within the sale area is the sole responsibility of the permittee.

3. The location of loading decks and logging roads will be mutually agreed to by permittee (or his representative) and refuge manager or his designee prior to their placement. All primary haul roads used by permittee will be left in good condition or blocked after operations are completed by placing logging slash and/or dirt mounds across all entrance points as directed by refuge manager or his designee. Those roads to be left open will be built up enough so that the road will not hold standing water any more than the adjacent area. This will require the use of equipment such as a bulldozer and/or road grader. If required as determined by the refuge manager or his designee, blocked roads will be reseeded with refuge-approved grasses to prevent erosion.

4. In forestry operations, no trees planned to be left (leave trees) following the operation will be cut or excessively damaged. The trees to be left are marked in Blue Tree Marking paint. Signs of possible excessive damage may appear as: (1) bole damage that exposes more than 36 square inches of cambium (in any dimension), and (2) crown damage of 1/3 or more of the crown. As determined by the refuge manager or his designee, excessive damage to leave trees will be assessed at three times stumpage price paid for the harvested merchantable timber.

5. Trees shall be cut so as to leave a stump not less than 4 inches high and no more than 12 inches high on the side adjacent to the highest ground. Ground level paint spot must be visible after the tree has been cut.

6. Skid trails with turn trees should be planned to prevent the damage to leave trees. Turn trees shall consist of trees being harvested and should be removed only after use of skid trails ends.

7. All logging operations shall be conducted during daylight hours.

8. Trees and tops cut shall not be left hanging or supported by any other living or dead tree or brush and shall be pulled down immediately after falling.

9. Tops and logging debris shall be kept pulled back 50 feet from highways, county roads, refuge roads, and trees with basal cavities. All openings and fields must be kept clear of tops and debris. The permittee and his employees will do all in their power to prevent and suppress fires; shall pay the Federal Government for any unnecessary damage to roads, fields, openings, and ditches resulting from operations.

10. Logging operations will be allowed only when site conditions are favorable. Logging will not be allowed when ground is subject to rutting or severe soil compaction. Excessive rutting can be a reason for the permit to be revoked.

11. The refuge manager or his designee shall have the authority to temporarily close down all or any part of the operation during a period of high fire danger, inclement weather, refuge hunts, safety reasons, or any other reason deemed necessary. Extensions to the special use permit time period equal to the closed period will be granted to the permittee. Extensions will not be granted due to inactivity during favorable harvesting conditions.

12. Logging operations will not be allowed in a stand containing a red-cockaded woodpecker cluster sites during the breeding season, usually April 1 to June 30.

13. The permittee (or his representative) will not litter. Disposal of petroleum products onsite is prohibited. Equipment must be maintained and not leak more than a few drops of petroleum product per day. Performance bond monies may be used to pay for litter clean-up.

14. Tree-length logging and skidders will be allowed. Unnecessary damage to the residual stand will not be tolerated (see Special Condition No 4). As determined by the refuge manager or his designee, penalties may be assessed for damage to unmarked trees at a rate of three (3) times the stumpage paid for the harvested merchantable timber.

15. If spacing between trees does not allow cutter head grapples to be used without damage to leave trees, alternative harvest methods should be used.

16. Sufficient cut trees, trees that are to be removed as part of the operation, should be left along the skid trails and deck to prevent skidder damage to leave trees and these cut trees should be the last trees removed as part of the operation.

17. Each portion of the sale area must be completed before moving to other portions of the area unless authorized by the refuge manager.

18. The permittee will be responsible for job safety while operating on the refuge.

19. The possession and/or use of firearms and alcohol on the refuge are prohibited.

20. All of the Best Management Practices for forestry in Mississippi will be followed as mandatory practices. Failure to follow Best Management Practices is grounds for termination of the special use permit.

21. Logging decks must not be located within 200 feet of active or inactive red-cockaded woodpecker cavity trees.

22. Logging roads and trails shall not be established through red-cockaded woodpecker clusters.

23. When working immediately adjacent (<300 feet) to active red-cockaded woodpecker clusters, no activity will occur prior to 8 a.m. or after 4 p.m.

24. Tree being removed from areas adjacent to red-cockaded woodpecker clusters should be cut to fall away from the cluster do prevent damage to cluster trees.

25. The permitee will not cut free-standing dead trees unless approved by refuge manager or his designee.

26. Log landings, main skidder trails, and temporary logging roads will be disked, seeded with winter wildlife mix, and fertilized after harvest operations cease as recommended by Best Management Practices (MS Forestry Commission 2008).

EXHIBIT 2: BID FORM

BID FORM:

All harvesting operations must be completed by date**.** The refuge manager may grant an extension with each case, independently determined based upon the circumstances encountered.

Each bidder will submit a bid deposit in the amount of **$**___ in the form of a company check, bank draft, certified check, or cashier's check payable to the U.S. Fish and Wildlife Service. The deposit of the successful bidder will be retained by the Federal Government as a performance guarantee to cover any damages or claims the Federal Government may have against the permittee as a result of this operation under the terms and conditions of the permit/agreement. The balance, if any, will be returned to the permittee upon satisfactory completion of the operation. The deposits of the unsuccessful bidders will be returned after a determination has been made regarding the award of the permit. The right to reject any or all bids hereinunder is reserved.

The refuge will issue a special use permit to the successful bidder. The special and general Conditions below will be included in the permit. **Payment** of ___% of the lump sum will be due upon signing of permit, within 15 days of bid opening. The balance of lump sum payment is due by ___(**Date)** or prior to any logging.

For **logging access**, existing public and refuge roads will be used to access the sale area. As stated in the special conditions, the permittee will either maintain any graveled or dirt roads that may be used or pay a contractor to do so. The cost of this work may be refunded to the permittee unless built into the bid value.

Item 1. Pine Sawtimber ___tons, more or less

Hardwood sawtimber ___tons, more or less

Pine pulpwood ___tons, more or less

Hardwood pulpwood ___tons, more or less

SPECIAL CONDITIONS AS PART OF ___ **Sale** ARE ATTACHED

TOTAL BID: $

If I am adjudged the successful applicant, I agree to accept the proffered permit/agreement.

_____
(Bidder)
By _____

_____

(Mailing Address, City, State, Zip)

EXHIBIT 3: BID INVITATION (MAY HAVE OTHER VARIATIONS)

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Sam D. Hamilton Noxubee NWR

2970 Bluff Lake Road

Brooksville, MS 39739

Telephone: (662) 323-5548 FAX: (662) 323-6390

Date

Dear Sir:

Who: Sam D. Hamilton Noxubee NWR

What: Sale Name: ___ Tons of Pine Sawtimber, ___ Tons of Hardwood Sawtimber,

___Tons of Pine Pulpwood, and ___ Tons Hardwood Pulpwood

Where: Sam D. Hamilton Noxubee NWR: _____County, MS.

Show Day: Sam D. Hamilton Noxubee NWR: Date @ Time. Meet at Refuge Office at Brooksville, MS.

Bid Day, both sales: Date @ Time Refuge Office, Brooksville, MS

See complete bid invitation for complete details and conditions of the sale.

Sincerely,

Joseph “Eddie” Harsh

Refuge Forester

(662) 323-5548 (Office)

(662) 803-1973 (Cell)

SAM D. HAMILTON NOXUBEE NWR FOREST PRODUCTS SALE

BID INVITATION EXAMPLE (May have other variations)

Sealed bids will be received in the office of

Refuge Manager
Sam D. Hamilton Noxubee NWR

2970 Bluff Lake Road

Brooksville, MS 39739

Until ____ p.m., ____Date, for the sale of forest products contained in trees marked for cutting on ____ acres in Stand ____**Sale Name**, being parts of Section, Township, Range, as indicated on attached maps, on Sam D. Hamilton Noxubee NWR, in ____ County, Mississippi, located 15 miles south of Starkville, Mississippi.

All bids should be submitted on the enclosed BID SHEET and should be securely sealed in a suitable envelope and plainly marked "TIMBER BID ENCLOSED."

The trees to be cut are marked with c**olor paint**. Bids are requested on the assumption that there are approximately ___ Tons of Pine Sawtimber, ___ Tons of Hardwood Sawtimber, ___ Tons of Pine Pulpwood, and ___ Tons Hardwood Pulpwood. A list of the species, number of trees, and their volumes is attached. The marked sawtimber trees were sampled at a rate of __ percent and the pulpwood trees were sampled at a rate of __ percent. The volumes were computed from measurement and/or estimation of each sample tree and are in no way guaranteed. The sawtimber trees were scaled by the tons with a form class of 80 for all pine species and 76 for hardwood species. The pulpwood trees were scaled with a local volume table. Utilization used for sawtimber was a minimum of 14 inches DBH and to a 10-inch top. For pulpwood, a minimum of 6 inches and a maximum of 20 inches DBH to a 3-inch top were used. Pulpwood volumes were estimated for the tops of the sawtimber trees.

There will be a "**show**" day at ____ a.m., ____d**ate**. All interested parties should meet at **Refuge Office.**

Upon request, any bidder may be required to submit a statement demonstrating his ability and a list of necessary equipment available to him to carry out the operation.

All harvesting operations must be completed by ____(d**ate).** The refuge manager may grant an extension with each case independently determined based upon the circumstances encountered.

Each bidder will submit a bid deposit in the amount of **$**____ in the form of a company check, bank draft, certified check, or cashier's check payable to the U.S. Fish and Wildlife Service. The deposit of the successful bidder will be retained by the Federal Government as a performance guarantee to cover any damages or claims the Federal Government may have against the permittee as a result of this operation under the terms and conditions of the permit/agreement. The balance, if any, will be returned to the permittee upon satisfactory completion of the operation. The deposits of the unsuccessful bidders will be returned after a determination has been made regarding the award of the permit. The right to reject any or all bids hereinunder is reserved.

The refuge will issue a special use permit to the successful bidder. The special and general conditions below will be included in the permit. **Payment** of ____ percent of the lump sum will be due upon signing of permit, within 15 days of bid opening. Balance of lump sum payment is due by ____(d**ate)** or prior to any logging.

For **logging access**, existing public and refuge roads will be used to access the sale area. As stated in the special conditions, the permittee will either maintain any graveled or dirt roads that may be used or pay a contractor to do so. The cost of this work may be refunded to the permittee unless built into the bid value.

Use this area for recording your bid. Use next page for submitting bid.

Item 1. Pine Sawtimber , ___ Tons, more or less

Hardwood Sawtimber, ____ Tons, more or less

Pine Pulpwood, ____ Tons, more or less

Hardwood Pulpwood, ____ Tons, more or less

SPECIAL CONDITIONS AS PART OF ____ SALE ARE ATTACHED

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 offerer 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 offerer and will not knowingly be disclosed by the bidder or offerer 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 offerer or to any competitor; and

(3) No attempt has been made or will be made by the bidder or offerer 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 offerer'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 offerer'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 offerer 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 offerer 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.

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 I. HISTORIC VEGETATION ASSESSMENT

U.S. Fish and Wildlife Service

Southeast Region Inventory and Monitoring – Gulf Network

Historic Vegetation Assessment

Sam D. Hamilton Noxubee National Wildlife Refuge

May 1, 2013

Timothy A. Fotinos
U.S. Fish and Wildlife Service
National Wildlife Refuge System
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Summary

Sam D. Hamilton Noxubee National Wildlife Refuge is currently developing a new Comprehensive Conservation Plan (CCP) and Habitat Management Plan (HMP) for the refuge. The refuge requested support defining historic habitat condition from the Inventorying and Monitoring network (I&M) in order to aid in decision-making.

I&M provided two types of valuable data to the refuge: (1) historic accounts of vegetation communities on the refuge from primary and gray literature; and (2) spatial data from models predicting vegetation community distributions prior to major European settlement and logging. Spatial data from an available regional/national modeling effort were provided and tested using refuge specific, historic tree data to confirm local applicability of the regional level data.

Methods

The initial stages of this project were exploratory and consisted of finding all available information about vegetation communities on the refuge prior to the major changes to the landscape caused by human settlement, agriculture, logging, and subsequent silviculture. The primary literature was searched using several database sources from NCTC and local universities. Gray literature such as county land survey records and NRCS soil surveys was also searched for historic descriptions. The search turned up five applicable documents that were provided to the refuge (McLendon and Hurst 1907, Smith et al. 1910, Crabb and Hightower 1913, Leidolf et al. 2002, Campbell and Seymour 2011).

In order to provide spatial data to the refuge, I&M identified previously produced historic vegetation maps that cover the entire refuge and surrounding region. These regional scale maps were produced by LANDFIRE in a nationwide, collaborative modeling effort in 2001 and have since been updated and refined for ease of use. The LANDFIRE model results represent the potential distribution of vegetation communities given the current environmental conditions and a natural (pre-European) disturbance regime.

The problem with using such data for management decisions is lack of validation. This is particularly true of data that represent a landscape condition that theoretically existed 200 years ago and has since been highly modified. I&M pursued a unique approach to providing site-specific support for the LANDFIRE model results.

The opportunity to validate the LANDFIRE model came from a recent academic paper, published by researchers at Mississippi State University that was identified by the refuge. It presented a project in which they sought to demonstrate how General Land Office (GLO) survey data can be used to reconstruct historic vegetation communities using ordination analysis (Schauwecker et al. 2011). The project was conducted using GLO data from a portion of Winston County, Mississippi, that largely falls within refuge boundaries. The GLO survey records from original county surveys in 1830 include a witness tree at every corner and midpoint of a survey line. The trees are identified to species, or as close as possible, and data such as trunk diameter are collected so the tree can be more easily identified on

future surveys. Schauwecker et al. took these data and translated the survey coordinates to UTM coordinates and then related the location of the trees to environmental data such as elevation, slope, and soil type. The species X environment matrix was used in an ordination analysis to recreate the tree community associations that may have been present historically.

Refuge I&M was given these GLO data and used it to create a tree species distribution model for the refuge. The environmental data layers used by Schauwecker et al. to generate the matrix were reproduced by I&M in An ArcGIS project. These layers included elevation, slope, roughness, and distance to nearest stream or water body. A historic mean fire return interval layer acquired from LANDFIRE was also added to the project (LANDFIRE 2008). Tree species that occurred fewer than six times or that clearly did not include the full range of environmental conditions under which the species is observed to occur were removed from the matrix. Five tree species remained, which happen to be the dominants across much of the landscape, and were used in the model. These species were pine, red oak, post oak, hickory, and white oak. The tree species X environment matrix was reduced to minimum and maximum values for each variable. These values served as boundary parameters that defined the range of suitable physical conditions for the five tree species. Minimum and maximum parameter values for fire return interval were acquired from LANDFIRE, the Fire Effects Information System (FEIS), and NatureServe vegetation community definitions. The parameter values for each species used in the model often represented the mean values from these sources because they typically differed slightly.

An environmental suitability model was created from these data for each tree species. Five new raster layers, representing the five environmental variables used in the model, were created for each tree species. These layers identified the areas of the refuge that were within the range of suitable conditions identified for that species in the GLO data. The layers were created using map algebra calculations that examined each cell of the environmental data layer and gave the spatially corresponding cell of the new raster a value of one if the environmental data value was within the range of parameter values and assigned a zero if it was outside the range. Another map algebra calculation was done to identify the potential distribution for each tree species. The spatially corresponding cells of the five suitability layers were multiplied together and the resulting value was assigned to the cell of a new raster layer (Figure 1). Those cells where all five values were one resulted in a suitable value of one in the new raster layer. All other cells were assigned zero values because at least one suitability layer had a zero value at that cell.

1	1	0	0
1	1	0	0
1	0	0	1
0	0	1	1

×

0	1	1	0
0	1	1	1
1	1	1	0
1	1	0	0

=

0	1	0	0
0	1	0	0
1	0	0	0
0	0	0	0

Figure 1. Example of map algebra where two suitability layers are multiplied together in order to create a combined suitability layer. Corresponding cells are multiplied together and the resulting value is assigned to the corresponding cell of the new raster layer.

Results

The LANDFIRE 2008 model results for the refuge are presented below and shows the modeled distribution of vegetation communities as it may have occurred in approximately 1800 (Figure 2).

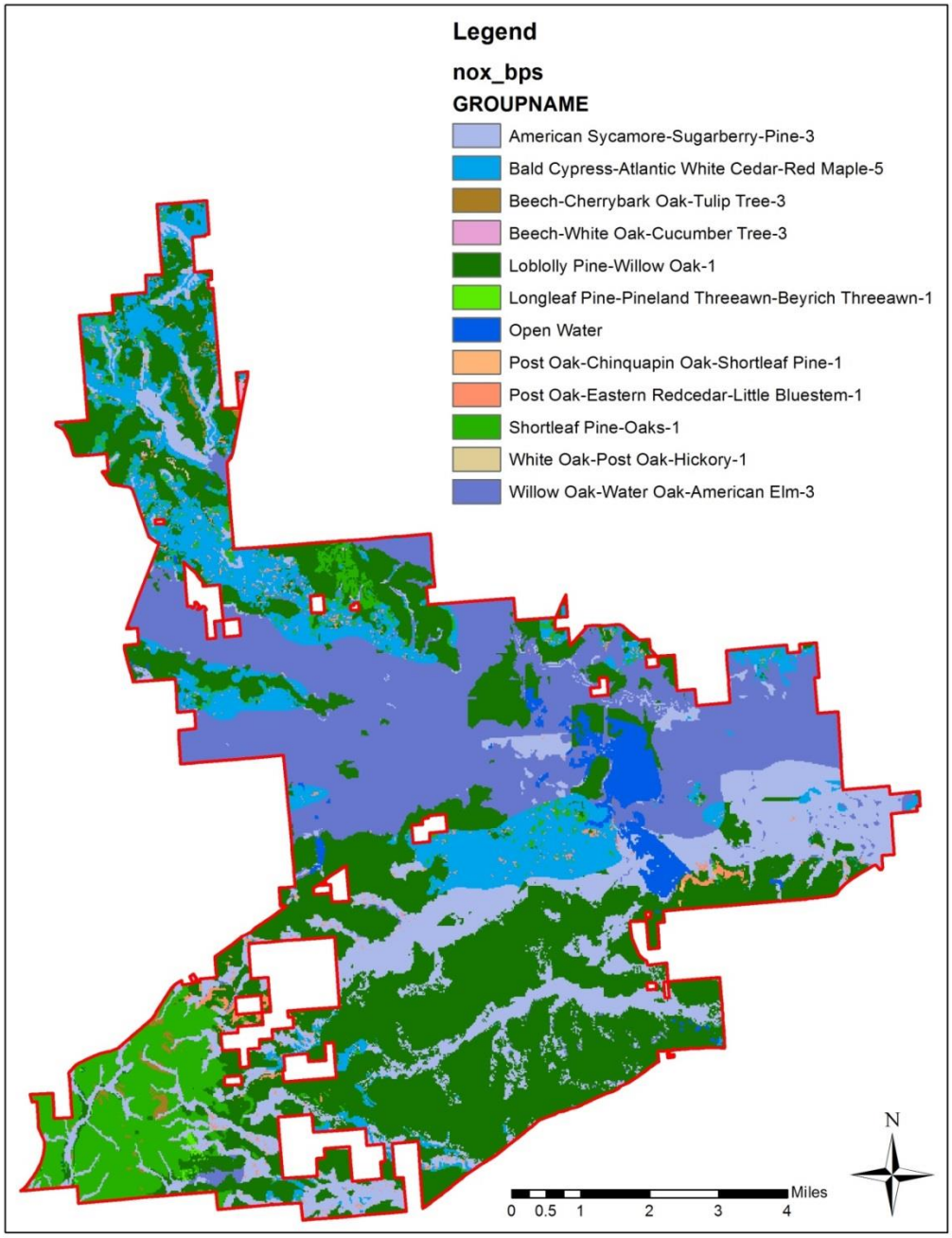
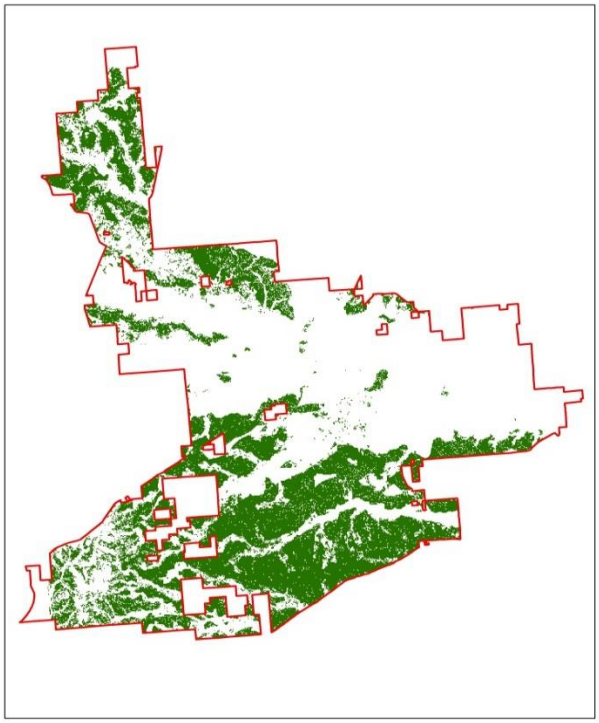


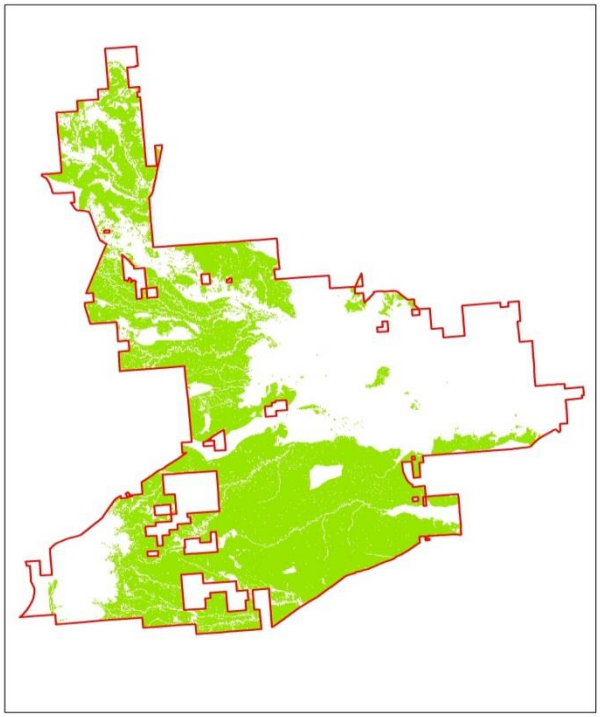
Figure 2. Modeled historic vegetation community distribution map from LANDFIRE 1.1.0 (2008). Community types are adapted from the NatureServe Ecological classification system.

The I&M environmental suitability models produced a potential distribution for each of the five tree species (Figure 3). Pines are restricted to the upland areas of the refuge (Figure 3A). Post oak and white oak overlap almost entirely with pine, but their distribution extends further in to the bottoms (Figures 3B, 3C). Hickories and red oaks are predominantly in the low-lying areas of the refuge (Figures 3D, 3E).

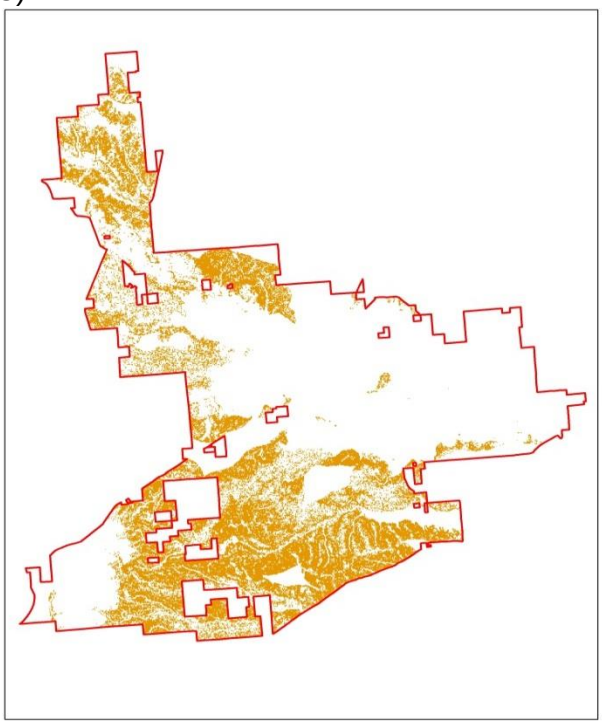
A)



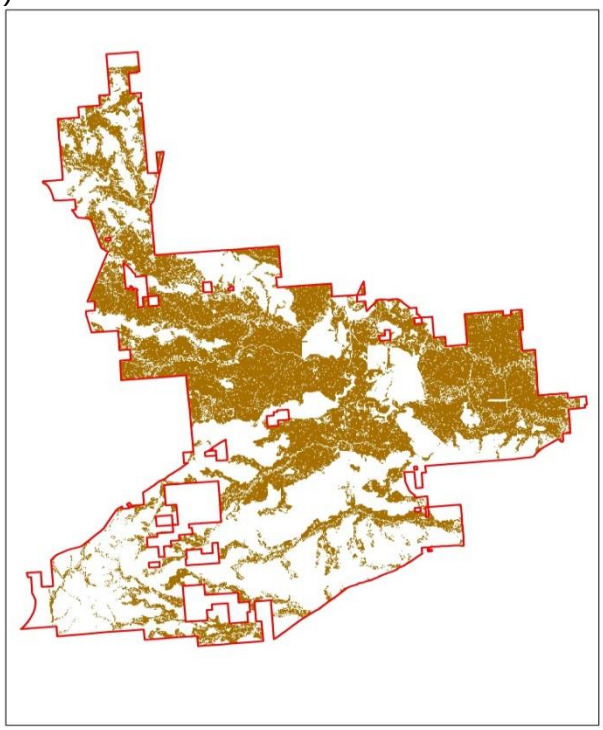
B)



C)



D)



E)

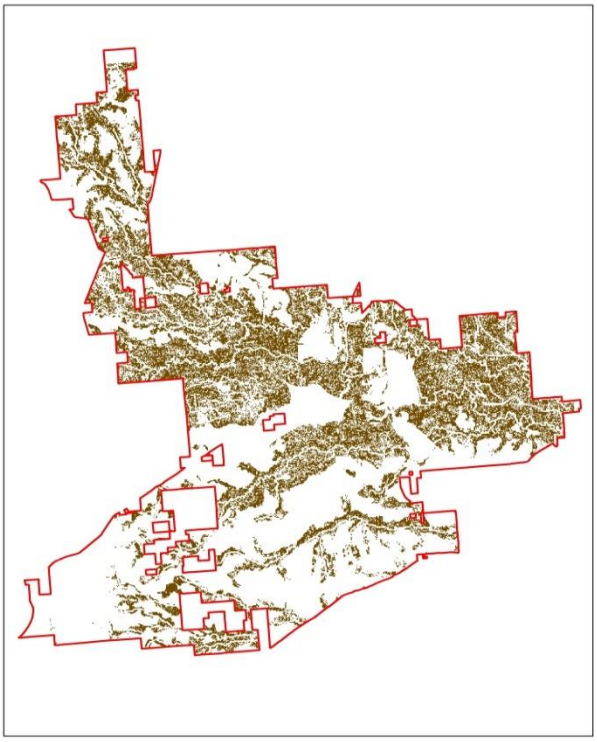


Figure 3. Potential distribution maps for (A) pine, (B) post oak, (C) white oak, (D) red oak, and (E) hickory on Sam D. Hamilton Noxubee NWR. Data is from I&M environmental suitability models.

Discussion

Whenever applying the results of a model it is important to understand the assumptions and limitations of the model. Any model is only as good as its input data. The LANDFIRE model and the community definitions used have been extensively worked on and refined by regional and national experts and represent the best available knowledge. The refuge I&M model was limited by the GLO data used to create the tree species parameter values. Only 189 tree records existed in the dataset which covered only a third of the refuge. These data were further reduced to include only five species with between 16 and 51 records from which to generate parameter values for the model. The refuge I&M model was particularly weak in the eastern and southwest portions of the refuge where the communities were not completely represented in the data or the landscape structure was most different from the remainder of the refuge. Another important consideration when using the refuge I&M model results is remembering to treat the data as the potential distribution of the tree species. The tree species were modeled individually so it did not take in to account species interactions (e.g., competition) or any proxy for this limit on distribution or abundance.

The similarity of the distribution of tree species/communities between the two models is good support for them being reasonable representations of the historic distribution of natural communities. The LANDFIRE model is derived from vegetation community definitions from the NatureServe vegetation classification system. The model created by refuge I&M uses

actual tree data collected on and around the refuge by land surveyors in 1830. Both models generated similar distributions for upland and lowland communities, although the LANDFIRE model is more detailed and has complete coverage of the refuge because of the more comprehensive dataset. Corroboration of the two models using data from different sources supports the use of these data for refuge management.

These data can be used to guide management of the refuge in many ways. The primary motivation for this work was to better understand the historic distribution and condition of habitats on the refuge. These models give likely the best insight possible as to the location and structure of refuge habitats prior to agriculture, logging, and replanting of the current loblolly forest. These data can also provide location and areal extent of different natural fire regimes for fire management planning. It can be used to compare to current vegetation patterns and quantify deviation from the "natural" historic condition. These data can also serve as a guide for restoration of refuge land from an undesired state.

Literature Cited

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APPENDIX J. Species Of Complimentary Need

The refuge has identified Resources of Concern that will guide habitat management objectives with the refuge's 18 Management Units. The primary habitat and wildlife response variables monitored will also be based on these Resources of Concern. The below wildlife species are expected to benefit from the same habitat management and have been identified as Species of Complimentary Need within the applicable management unit prescriptions located within Chapter V.

Wild turkey (*Meleagris gallopavo*)

Turkeys prefer mature woodlands comprised of a mixture of tree species with open understories growing with herbaceous (nonwoody) plants. Turkeys usually select areas with dense brush, tall grass, and fallen tree tops for nesting. Forested areas with moderate herbaceous understories, forest clearings, forest savannahs, power-line rights of way, old home sites, and spring seeps are important brood habitat. These areas usually have an abundance of insect and the moderate vegetation which allows the young poults to move freely. Brood range can be created in forested stands by thinning to a basal area of 40-60 and control burning the thinned stand. Small pine plantings in clumps <1/2-acre in size may increase habitat diversity for turkey because they provide thermal cover and roost sites. Pine stands that have been control burned are also used by turkeys. Pine plantations with short rotations offer poor turkey range.

Deciduous timber lands should be managed to optimize hard and soft mast production and to provide a dispersed system of forest openings. In timber stand improvement practices, shrubs beneficial to wild turkey should be retained (i.e., dogwood, grape, black gum, American hornbeam, serviceberry, crabapple, and others). Spring seeps should be protected and timber should not be harvested within a zone of at least 100' of a seep.

White-tailed deer (Odocoileus virginianus)

White-tailed deer are extremely adaptable animals. Their essential requirements include food, cover, and water. Abundant forest land provides suitable cover. An interspersion of brushland, woodland, and non-forested land creates more diversity in the types and amounts of food and cover present. The transition zone between two cover types is often referred to as an "edge." Deer, as well as other wildlife species, utilize such edge areas heavily. Many timber harvest operations today create an "edge effect" of benefit to deer.

Pure stands of unmanaged pine timber generally provide poor deer habitat because of the low quality forage and the scarcity of mast-producing hardwoods (e.g., oaks and other fruit-producing trees). Dense stands and closed canopies reduce browse and soft mast yields. Management efforts in this forest type should be directed toward increasing browse production. Intermediate thinning of pine stands is recommended to open the overstory and encourage desirable understory vegetation. Thinning should be sufficient to achieve a basal area of 50- to 60-square-feet per acre prior to stand regeneration. Prescribed fire is a practical and economical tool in deer management. Prescribed burning in pine stands benefits deer by increasing browse yields and improving the palatability and nutrition of understory plants.

Mixed pine-hardwood types generally provide good deer habitat and are important for mast, fruit, and browse production. These stands should be thinned frequently to renew

understory forage and hasten early mast yields. Where possible, retain valuable hardwood trees for mast production. A minimum stocking equivalent of 20-square-feet basal area per acre of mast species is suggested. A good balance between the white and red oak groups is desired to provide consistent mast production.

Bottomland hardwood forests containing a mixture of oaks and other fruit-producing trees and shrubs provides good deer habitat. These areas normally have fertile soils and provide high quality browse; however, they are often subject to flooding which may have periods of reduced available food supplies. Mast production in this habitat is generally good but as in the mixed pine-hardwood type, both white and red oak groups should be retained.

Gray squirrel (*Sciurus carolinensis)*

Gray squirrels are most numerous in mature upland and bottomland hardwood forests. These forested areas usually contain a diversity of oaks and hickories (hardwoods). Though mostly associated with hardwood forests, gray squirrels can also be found in mixed pine-hardwood forests, especially where availability of pure hardwoods stands is lacking.

Wood duck (*Aix sponsa*)

Wood ducks nest in woodland areas along lakes, rivers, and vegetated wetland areas. During the winter months, wood ducks inhabit bottomland hardwood wetlands, beaver ponds and flowages, river oxbows, meanders and backwaters, and other inland freshwater forested wetland areas. Habitat areas chosen by wood ducks are commonly used by other waterfowl species such as black ducks, hooded mergansers, and ring-necked ducks. High-quality wood duck habitat is intricately linked to preservation and management of overly mature timber along river corridors and availability of nesting sites.

Reptiles/Amphibians (Herpetofauna)

More than half of the United States' reptile and amphibian species can be found in Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, and Tennessee. The vegetation in which many reptiles and amphibians forage, nest, and shelter is often fire-dependent or fire-adapted. Without fire, canopies tend to close and shade out herbaceous groundcover, which is often the critical first link in many food webs. Canopy openings and periodic fire are both important to maintain herbaceous groundcover (i.e., grasses, sedges, and forbs), which are important wildlife foods. Light gaps and herbaceous groundcover are important in managed pine forests, whether the stand is longleaf pine, shortleaf pine, loblolly pine, or other species. Areas important to reptiles and amphibians include forested wetlands where forest cover is maintained. Isolated ponds free of fish provide breeding habitat for adult amphibians. Reptiles and amphibians benefit from drift piles and standing dead trees allowed to decompose naturally on the ground. Many amphibians and reptiles nest, forage, or shelter in or underneath rotten logs.

Forest Bats

Forest bats are dependent on the forest for survival. These species utilize living and dead trees, leaf litter, and man-made structures for roosting. These species also use forest edge, openings, and drainage corridors for foraging habitat. Following forestry best management

practices can help maintain forest quality and protect the much needed resources for forest bats throughout the landscape. These include protecting streamside management zones, retention of snags and cavity trees, and protecting wetlands and water quality with the areas.

Bats may benefit from prescribed fire by the creation of new snags through direct or indirect fire mortality. Fire can also decrease forest densities and increase openings allowing more sunlight to the forest floor, thus leading to potential increased herbaceous layer and leading to more insect production. Prescribed fire could have some short-term negative impacts as well, including the loss of unprotected snags, reduced leaf litter, and potential smoking of cavity trees. Timing and placement of prescribed fire should be considered, the most vulnerable time would be when bats are rearing young (April-July).

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 and weather, and provides nesting material 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 Mississippi, 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 crosssectional 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 thins are necessary to maintain lower basal areas as trees continue to grow after each thin.

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.

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 (Hamel 1992, 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 (O'Halloran and Conner 1987 cited in Dornak and others 2004). 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 (O'Halloran and Conner 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).

Wood stork (Mycteria Americana)

Wood storks range from North America to Argentina. In the United States, wood storks nest in South Carolina, Georgia, and Florida. After breeding, they may disperse north to North Carolina or west to Mississippi and Alabama. United States' populations are endangered. Wood storks inhabit mainly freshwater or brackish wetlands and swamps. They hunt for prey in shallow, muddy-bottomed banks or wetlands. Adult wood storks eat small fish, frogs, mollusks, snails, insects, and aquatic invertebrates. The storks prefer to feed in isolated pools created by tides or falling freshwater levels, where fish congregate en masse.

Wading birds

Biologically, the bird group known as the "wading birds" is composed of those species belonging to the families Ardeidae (bitterns, herons, egrets), Threskiornithidae (ibises and spoonbills), Ciconiidae (wood stork), and Phoenicopteridae (flamingoes), all of which possess proportionately long legs, long necks, and long bills adapted for wading and feeding in relatively shallow water, and all of which belong to the bird order Ciconiiformes. Generally, wading birds require colonial nesting sites which (1) possess woody vegetation to serve as platforms or substrate upon which to build nests, (2) are located over permanent water, and (3) are located within reasonable commuting distances to dependable foraging areas. Wading birds feed primarily on fish, crayfish, insects, and amphibians and can be found feeding in a wide variety of aquatic habitats. Some species also feed opportunistically on small birds and mammals. Gradually receding water levels concentrate prey and facilitate feeding.

Shorebirds

Shorebirds are a diverse group including plovers, yellowlegs, godwits, and sandpipers. Shorebirds are a morphologically diverse group that largely occupies an ecological gradient at the upland-wetland interface. Two species are upland specialists: American woodcock inhabit moist early succession woodland and upland sandpipers are associated with open grassland and prairie. Nesting habitat is variable for species breeding in Mississippi. Nest sites for shoreline-associated species are most often associated with sparse to moderate vegetation density whereas those species nesting on upland sites typically use more dense vegetation.

As a group, shorebirds feed primarily on aquatic invertebrates that live in saturated or shallowly inundated substrates at the margins of wetlands. The food resource, which is dependent on substrate conditions and water depths, is partitioned among species according to body size, leg length, and bill morphology. Migration habitat used by individual species can be described in a few simple dimensions: (1) foraging substrate or water depth, (2) vegetation height, and (3) vegetation density. Shorebird use of habitat overlaps with some waterfowl and wading birds at the wet end of the water-level gradient and with some upland birds at the dry end.

Invertebrates

Invertebrates inhabit multitude of habitats on the refuge including aquatic environments, upland and bottomland forests, and refuge fields. Terrestrial invertebrate abundance is generally predicted to be greater in early successional forest than mature forests (Brown 1984). Herbivores seek more nutrient-rich, herbaceous vegetation typical of early successional forest, resulting in a greater biomass of these insects on regenerating vegetation (Schowalter *et al.* 1981). Although the direction of taxon-specific terrestrial invertebrate response to timber harvest varies, most evidence indicates that canopy openings result in higher overall abundances of terrestrial invertebrates (Deans *et al.* 2005). According to Duffy and LaBar, 1994, forty-eight species of aquatic invertebrates were identified on the refuge during winter and spring sampling. The moist-soil impoundments were the highest producers in numbers and number of species, beaver ponds were the second most productive, and GTRs were the least productive.

Bass

The largemouth bass lives in all types of water, including swamps, ponds, lakes, reservoirs, creeks, and large rivers. The bass can even be found in estuaries. It prefers weedy oxbows and clear floodplain lakes. Since it is generally a warm water (81-86°F, (27.2°-30°C)) fish, it is seldom found at depths of more than 18.8 feet. During the winter, largemouth bass generally will move into deeper waters. In the spring, largemouth's migrate into waters that have warmed up sooner than that of the main body of water. Largemouth bass prey upon bluegills and redear sunfish and upon shad, minnows, smaller sunfishes, crayfishes, and amphibians in natural habitats. Etnier and Starnes (1993) report an average life span of 10 to 12 years in Tennessee.

Brim/bluegill (Lepomis macrochirus)

This species is native to lakes and streams in Mississippi River systems. Bluegill prefer to live in lakes and slow-moving, rocky streams. They can often be found in deep beds of weeds.

Threatened and endangered species that could potentially occur on the refuge but have not been documented as occurring

Indiana myotis, *Myotis sodalist**

Myotis sodalis, also known as the Indiana bat, is found only in North America. Their range spans from Iowa, Missouri, and northern Arkansas east to western Virginia and North Carolina, and north into New York, Vermont, New Hampshire, and Massachusetts. Indiana bats hibernate in the northern reaches of their range in caves during the winter. In the summer and autumn months, *Myotis sodalis* migrate to summer roosting sites. Indiana bats hibernate predominantly in limestone caves, though some hibernate under the bark of dead trees. Trees in which Indiana bats are known to roost include bitternut hickory (*Carya cordiformis*), oaks (*Quercus*), elms (*Ulmus*), pines (*Pinus*), American sycamore (*Platanus occidentalis*), and eastern cottonwood (*Populus deltoides*).

Gray myotis bat, *Myotis grisescens**

Myotis grisescens is widely distributed in the southeastern United States. The distribution of gray bats within their range has always been patchy. Ninety-five percent of the total gray bat population hibernates in only eight or nine caves. Two are located in Tennessee, three in Missouri, one in Kentucky, one in Alabama, and one in Arkansas. Gray bats are restricted entirely to areas with caves or cave-like habitats. These caves are in limestone karst areas of the southeastern United States. Gray bats do not inhabit barns or other similar structures. This leads to extremely restricted nesting opportunities. Due to their requirement of unique cave types, gray bats can only use 0.1 percent of available caves in the winter and 2.4 percent in the summer.

Northern long-eared, *Myotis septentrionalis**

The northern long-eared bat is a medium-sized bat about 3 to 3.7 inches but with a wingspan of 9 to 10 inches. Its fur color can be medium to dark brown on the back and tawny to pale-brown on the underside. As its name suggests, this bat is distinguished by its long ears. The northern long-eared bat is found in the United States from Maine to North Carolina on the Atlantic Coast, westward to eastern Oklahoma and north through the Dakotas, even reaching into eastern Montana and Wyoming. In Canada, it is found from the Atlantic Coast westward to the southern Yukon Territory and eastern British Columbia.

Northern long-eared bats spend winter hibernating in caves and mines, called hibernacula. They typically use large caves or mines with large passages and entrances; constant temperatures; and high humidity with no air currents. Specific areas where they hibernate have very high humidity, so much so that droplets of water are often seen on their fur. Within hibernacula, surveyors find them in small crevices or cracks, often with only the nose and ears visible.

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. Bats have been found roosting under the bark of a variety of tree species and within tree cavities or crevices. It is also found, rarely, roosting in structures like barns and sheds.

U.S. Fish & Wildlife Service

Integrated Pest Management Plan

Sam D. Hamilton Noxubee National Wildlife Refuge

Okibbeha, Noxubee, and Winston Counties, Mississippi

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WORK STATEMENT

A pest is commonly defined as any native living organism (plant or animal) that occurs where it is injurious, noxious, or troublesome (nuisance) to habitat, humans, or wildlife. With these species being native, the population level of the pest species, as well as its location, is relevant in considering its classification as a pest requiring management action. Exotic species are those species that are nonnative to the refuge. Exotic species include feral animals. Uncontrolled pest and invasive exotic species degrade, change, or displace native habitats and compete with native wildlife to the point of causing harm to fish, wildlife, and plant resources. Management of pest species is often conducted through spot treatments, but considerable effort is required for control and eradication of exotic organisms. Prevention is the first line and best line of defense against exotic organisms. Several exotic plant species are well established throughout the refuge. These species compete with native plants, impact quality and availability of wildlife habitat, and degrade the overall ecological integrity of the system. Pests and exotic species can negatively affect habitats in the long term.

Integrated Pest Management (IPM) strategies are designed to consider local Best Management Practices (BMPs), with special attention given to resource needs and refuge goals and objectives. IPM strategies may include prevention, no action, mechanical and physical removal, and application of biological agents and chemicals. An interdisciplinary approach using one or more of these strategies may be needed to produce the most effective long-term results. There are a number of additional factors needing to be further considered: pest biology, environmental information, available technology, and options posing the least possible risk to people, property, resources, and the environment. A primary underlying component of the IPM plan is prevention and proactive management of species to protect and conserve habitats.

Known pest and exotic species will be monitored, mapped, and control measures evaluated annually to ensure strategies are achieving desired results. Previous experiences in controlling pests and exotic species may also be described and recorded, so that only methods most likely to be effective in the future are used. Additional information may include noting if there are sensitive habitats or species present this may limit treatment option and require larger buffers or specific timing of treatments to prevent disturbance. In many cases, more than one pest or exotic species is present on a site. In these instances, strategies are designed to treat the highest priority exotic species first. This plan recognizes that control will require a multi-year commitment, continual monitoring, and post-treatment assessment with formulation of new strategies as necessary. The plan is purposely broad in scope to allow flexibility in implementation, adoption of new strategies, and incorporation of newly defined pest species into IPM, while providing guiding principles to meet IPM objectives for the refuge.

The goals of this IPM Plan are to control the population of pest plants and wildlife that interfere with the refuge's ability to meet the purposes for which it was established and eradicate exotic species. These species can cause, or are likely to cause, harm to the environment, economy, or human health. The Fish and Wildlife Service (Service) is the only agency whose primary responsibility is the conservation of the nation's fish, wildlife, and plants.

BACKGROUND INFORMATION

"The mission of the National Wildlife Refuge System (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" (National Wildlife Refuge System Improvement Act of 1997). The Service is the agency that administers the Refuge System. Currently, over 540 national wildlife refuges exist, encompassing more than 100 million acres of lands. Sam D. Hamilton Noxubee NWR is administered under the Refuge System and therefore, is part of a larger national landscape conservation plan set forth by the Service. This refuge is an extremely important component for the conservation and management of fish, wildlife, and plant resources within the Refuge System.

Sam D. Hamilton Noxubee NWR, encompassing approximately 48,219 acres, is located in east-central Mississippi in Noxubee, Oktibbeha, and Winston counties, and lies within the broadly defined Upper Gulf Coastal Plain Ecosystem, and the Gulf Coastal Plains and Ozarks Landscape Conservation Cooperative. Topography of the refuge consists of relatively even terrain within the interior flatwoods of pine and bottomland hardwoods. The elevation changes from approximately 200-520 feet in the Central Plateau region of Bevill's Hill.

The refuge is bisected by the Noxubee River, which represents the major drainage basin for the refuge. The Noxubee River, a tributary of the Tombigbee River, flows through the central portion of the refuge from west to east. Other secondary drainages flowing through the refuge include Cypress, Jones, Oktoc, Loakfoma, Lynn, Little Yellow, Yellow, Chinchahoma, and Dry creeks (Figure 1).

Overall, 94 percent of the refuge is forested dominated by stands of pine, mixed pine, hardwood uplands, mature bottomland hardwood, and cypress. Open habitat classification consists of approximately 900 acres of fields, levees, and other associated rights-of-way. Aquatic habitat is dominated by two water bodies (Bluff Lake, 950 acres; and Loakfoma Lake, 450 acres) that are principally managed for migrating and wintering waterfowl and nesting wading birds, but also provide a seasonal public recreational fishery. Approximately 320 acres of moist-soil habitat are also managed for moist-soil annual plants for use by wintering waterfowl. A more complete description of the refuge is provided in the Comprehensive Conservation Plan and Habitat Management Plan for the refuge.

CONFORMANCE WITH STATUTORY AUTHORITY

The Service is a federal bureau operated under the Department of the Interior (DOI), the Nation's principal conservation agency. The DOI is the principle landowner of most of the nation's public lands and cultural resources. Management responsibilities include fostering wise use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, managing the Refuge System, and providing for the enjoyment of life through outdoor recreation. The Service is the principal agency responsible for protecting threatened and endangered species, migratory birds, anadromous and interjurisdictional fish, and certain marine mammals.

A. Mission of the Fish and Wildlife Service

The mission of the Service 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 manages the Refuge System, the world's largest collection of lands set aside specifically for the protection of fish and wildlife populations and habitats. More than 550 national wildlife refuges covering more than 96 million acres provide important habitat for native plants and many species of insects, amphibians, reptiles, fish, birds, and mammals. These refuges also play a vital role in conserving threatened and endangered species, as well as offering a wide variety of recreational opportunities. Many refuges have visitor centers, wildlife trails, and environmental education programs. Nationwide, more than 30 million visitors annually hunt, fish, observe and photograph wildlife, or participate in interpretive activities on national wildlife refuges.

B. Mission of the National Wildlife Refuge System

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.

C. Legal Policy Content

Administration of national wildlife refuges is guided by the mission and goals of the Refuge System, congressional legislation, presidential executive orders, and international treaties. Policies for management options of refuges are further refined by administrative guidelines established by the Secretary of the Interior and by policy guidelines established by the Director of the Fish and Wildlife Service.

The following laws, regulations, and executive orders relate to the management of pest and exotic plants and animals on federal lands:

The Federal Plant Protection Act of 2000 (7 U.S.C. 7711)

(4) be subject to remedial measures the Secretary determines to be necessary to prevent the spread of plant pests(https://www.federalregister.gov/articles/2001/04/27/01-9797/plant-protection-actrevisions-to-authority-citations)

National Environmental Policy Act of 1969

preserve important historic, cultural, and natural aspects of our national heritage, and maintain,wherever possible, an environment which supports diversity, and variety of individual choice (http://ceq.hss.doe.gov/nepa/regs/nepa/nepaeqia.htm)

***The Federal Noxious Weed Act of 1974 (*7 U.S.C. 2801-2814)**

(1) Designate an office or person adequately trained in the management of undesirable plant species to develop and coordinate an undesirable plants management program for control of undesirable plants on federal lands under the agency's jurisdiction;

(2) Establish and adequately fund an undesirable plants management program through the agency's budgetary process;

(3) Complete and implement cooperative agreements with state agencies regarding the management of undesirable plant species on federal lands under the agency's jurisdiction; and

(4) Establish integrated management systems to control or contain undesirable plant species targeted under cooperative agreements.

Endangered Species Act of 1973 as amended by P.L. 94-325, June 30, 1976; P.L. 94-359, July 12, 1976; P.L. 95-212, December 19, 1977; P.L. 95-632, November 10, 1978; P.L. 96-159, December 28, 1979; P.L. 97-304, October 13, 1982; P.L. 98-327, June 25, 1984; and P.L. 100-478, October 7, 1988; P.L. 107-171, May 13, 2002; P.L. 108-136, November 24, 2003.

To provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, to provide a program for the conservation of such endangered species and threatened species, and to take such steps as may be appropriate to achieve the purposes of the treaties and conventions.

Executive Order 13112

(1) Identify such actions

(2) Subject to the availability of appropriations, and within Administration budgetary limits, use relevant programs and authorities to:

(i) prevent the introduction of invasive species;

(ii) detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner;

(iii) monitor invasive species populations accurately and reliably;

(iv) provide for restoration of native species and habitat conditions in ecosystems that have been invaded;

(v) conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally sound control of invasive species; and

(vi) promote public education on invasive species and the means to address them;

(3) Not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere unless, pursuant to guidelines that it has prescribed, the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions.

(4) Federal agencies shall pursue the duties set forth in this section in consultation with the Invasive Species Council, consistent with the Invasive Species Management Plan and in cooperation with stakeholders, as appropriate, and, as approved by the Department of State, when federal agencies are working with international organizations and foreign nations.

The National Wildlife Refuge System Improvement Act of 1997

(A) provide for the conservation of fish, wildlife, and plants, and their habitats within the System;

(B) ensure that the biological integrity, diversity, and environmental health of the System are maintained for the benefit of present and future generations of Americans.

National Wildlife Refuge System Administration Act of 1966 as amended by the National Wildlife Refuge System Improvement Act of 1997, 16 U.S.C. 668dd-668ee

4(a)(4)(B) In administering the System, the Secretary 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 Fish and Wildlife Act of 1956

Authorizes development, advancement, management, conservation, and protection of fish and wildlife resources.

Federal Insecticide, Fungicide, and Rodenticide Act (7 U.S.C. 136 r-1)

Integrated pest management is a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools in a way to minimize health and environmental risks

569 FW 1 Integrated Pest Management

(A) Establishes policy, procedures, and responsibilities for pest management activities on and off Service lands. It is consistent with the DOI Integrated Pest Management policy (517 DM 1) and other applicable authorities;

(B) Adopts IPM as our method for making pest management decisions; and

(1) A sustainable approach to managing pests that uses the following kinds of tools in a way that minimizes health, environmental, and economic risks:

(a) Biological (e.g., predators, parasites, and pathogens),

(b) Cultural (e.g., crop rotation, alterations in planting dates, and sanitation),

(c) Physical (e.g., barriers, traps, hand-pulling, hoeing, mowing, and tilling), and

(d) Chemical (e.g., pesticides, such as herbicides, insecticides, or fungicides).

(2) A science-based, decision-making process that incorporates management goals, consensus building, pest biology, monitoring, environmental factors, and selection of the best available technology to achieve desired outcomes while minimizing effects to non-target species and the environment and preventing unacceptable levels of pest damage.

(C) Provides guidance to employees on how to implement IPM for all pest management activities.

Title 50 CFR Part 30, Section 11 – Control of feral animals.

Feral animals, including horses, burros, cattle, swine, sheep, goats, reindeer, dogs, and cats, without ownership that have reverted to the wild from a domestic state may be taken by authorized federal or state personnel or by private persons operating under permit in accordance with applicable provisions of federal or state law or regulations.

Title 50 CFR Part 31, Section 14 – Official animal control operations.

(a) Animal species which are surplus or detrimental to the management program of a wildlife refuge area may be taken in accordance with federal and state laws

and regulations by federal or state personnel or by permit issued to private individuals.

(b) Animal species which are damaging or destroying federal property within a wildlife refuge area may be taken or destroyed by federal personnel.

REFUGE PURPOSES

Sam D. Hamilton Noxubee NWR was established on June 14, 1940, by Executive Order 8444 under the authority of 16 U.S.C. Sec. 715 (Migratory Bird Conservation Act). The refuge's stated purpose was **"…for use as a refuge and breeding ground for migratory birds and other wildlife…"** 16 U.S.C. Sec. 715 (Migratory Bird Conservation Act).

In conjunction with the primary establishing purposes, the refuge will provide an area for the **"… conservation, management, and restoration of the fish, wildlife, and plant resources and their habitats for the benefit of present and future generations of Americans"** 16 U.S.C., 668(a)(2) (National Wildlife Refuge System Improvement Act of 1997); **"…for the development, advancement, management, conservation, and protection of fish and wildlife resources…"** 16 U.S.C., 742(b)(1) (Fish and Wildlife Act of 1956); **"...for the benefit of the United States Fish and Wildlife Service, in performing its activities and services, such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude...."** 16 U.S.C., 742(f)(b)(1) (Fish and Wildlife Act of 1956); as well as **"...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds"** 16 U.S.C., 715(d) (Migratory Bird Conservation Act). The passage of the Endangered Species Act (ESA) in 1973 (as amended) required the refuge to support recovery actions for federally listed endangered and threatened species.

STATEMENT OF MANAGEMENT OBJECTIVES

Due to the potential of severe degradation of habitat by pest species if left unrestrained, management of pest and exotic species is vital to maintain native flora and fauna. Adaptive management will be necessary in maintaining the biological integrity of the refuge as new exotic species are identified and located, as well as native species becoming pests. Due to this fact, the species covered below are the current driving forces facing management at the refuge. The refuge's objectives are to manage native wildlife and their habitats, promote biological integrity, provide for threatened and endangered species, and allow for compatible public uses, such as hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation. Program objectives are to control pest and exotic plant and wildlife populations to aid in achieving habitat management goals. A total of 100 exotic and pest species are present on the refuge (Table 1).

Table 1. Exotic and pest species currently of known threat to Sam D. Hamilton Noxubee NWR, Mississippi

Exotic Species	Pest Species
Bicolor Lespedeza (*Lespedeza bicolor*)	Southern Wildrice (*Zizania* spp.)
Cuban bulrush (*Oxy-caryum cubense)*	Bladderworts (*Utricularia spp*)
Parrot Feather (*Myriophyllum aquaticum*)	Willow (*Salix* spp.)*
Nepalese browntop (*Microstegium vimineum*)	Giant cutgrass (*Zizaniopsis miliacea*)
Water Hyacinth (*Eichhoria crassipes*)	Sesbania (*Sesbania* spp.)
Bamboo (Phyllostachys sp.)	Sicklepod (*Cassia obtusifolius*)
Johnson grass (*Sorghum halepense*)	Red-vine (*Brunnichia ovata*)
Primrose (*Primula vulgaris*)	Watershield (*Brasenia schreberi*)
Japanese climbing fern (*Lygodium japonicum*)	American Lotus (*Nelumbo lutea*)
Bahia Grass (*Paspalum notatum*)	Frogbit (*Hydrocharis morsus-ranae*)
Autumn Olive (*Elaeagnus umbellata*)	Fall Armyworm (*Spodobtera frugiperda*)
Bermuda Grass (*Cynodon dactylon*)	Beaver (*Castor Canadensis*)
Alligatorweed (*Alternanthera philoxeroides*)	Raccoon *(*Procyon lotor)
Hydrilla (*Hydrilla verticillata*)	Nutria *(Myocaster coypus)*
Cogongrass (*Imperata cylindrica*)	Virginia opossum (*Didelphis virginianus*)
Asiatic Clam (*Corbicula fluminea*)	Striped skunk (*Mephitis mephitis*)
Nutria (*Myocastor coypus*)	White-tailed deer (*Odocolius virginianus*)
Feral Hogs (*Sus scrofa*)	Understory hardwoods**
Fire Ant (*Solenopsis invicta*)	American alligator (*Alligator mississippiensis*)***
Giant salvinia (Salvinia molesta)	Gray rat snake (*Elaphe spiloides*)****
Chinese tallow tree (*Triadica sebifera*)	Southern Pine Bark Beetles (*Dendroctonus frontalis* and Ips spp.)
Privet (*Ligustrum* spp.)	White water lily (*Nymphaea odorata*)
Common carp (*Cyprinus carpino*)	Giant cutgrass (*Zizaniopsis miliacea*)
Zebra mussel (*Dreissena polymorpha*)	Southern flying squirrel__(*Glaucomys volans*)*****
Wisteria (*Wisteria florubunda and W. sinensis*)	

* Tree species such as willow become a nuisance species when they encroach in moist soil areas.

** Tree species such as oaks and sweetgum become a nuisance species when they establish and develop in endangered red-cockaded woodpecker nesting and foraging habitats.

*** American alligators can be removed if they become a public safety issue.

**** Gray rat snakes pose a risk to the nest of the endangered red-cockaded woodpecker.

***** Southern flying squirrel pose a risk to the nest of the endangered red-cockaded woodpecker.

COMPATIBILITY WITH REFUGE OBJECTIVES

The strategies identified to aid in control of pest and exotic species are consistent with the goals and objectives associated with each refuge's Comprehensive Conservation Plan (CCP). A list of relevant goals, objectives, and strategies from the current CCP are listed below.

Sub-goal A.8 Exotic and Invasive Species

Minimize negative impacts of exotic and pest plant and animal species to levels that do not negatively affect other native species on the refuge (750 FW 1).

- Objective A.8.1: Eradicate or control spread of exotic plant and animal species to promote native plant communities in terrestrial and aquatic systems.
    - Strategy A.8.1.1: Use geographic information systems to map known locations.
    - Strategy A.8.1.2: Actively trap and remove exotic animals.
    - Strategy A.8.1.3: Actively remove or spray exotic plants with herbicides.
- Objective A.8.2: Implement procedures to minimize spread of exotic species.
    - Strategy A.8.2.1: Restrict pass-through commuter traffic to paved roads.
    - Strategy A.8.2.2: Improve equipment wash stations to reduce spread of exotic plant seeds.
    - Strategy A.8.2.3: When maintaining roads, reduce disturbance of soils and ground cover outside road system structure.
- Objective A.8.3: Manage pest species under a balanced approach.
    - Strategy A.8.3.1: Only remove individual pest species when needed to control damage to habitat or protect refuge assets.
    - Strategy A.8.3.2: The refuge will practice a zero tolerance policy for hogs and cogongrass for any alternative. Effort should be made to eradicate either wherever detected.

In addition to those known exotic species, all new exotic species discovered on the refuge which were not directly listed in this plan will be treated as discovered under the goal to eradicate.

ECONOMIC FEASIBILITY

Annual administration costs associated with the IPM include salary, equipment, contract support, administrative support, fuel, and expendable supplies. Normal operations will cost approximately $65,000 per year.

RELATIONSHIP WITH OTHER REFUGE PROGRAMS

The proposed program will not cause any major conflicts with public use programs. All control operations will be conducted in a manner to limit conflict with users of the refuge.

BIOLOGICAL SOUNDNESS OF PEST AND EXOTIC PLANTS

The pest and exotic plant species discussed below pose a major threat to native plant communities currently on the refuge. Infestation prevention from outside sources (e.g., washing of contaminated equipment), would drastically limit establishment of new sites. Early detection through monitoring and adaptive management control measures provide the best approach to limit spread and when possible eradicate infestations before they cause long-term habitat changes. The following plants are of high concern:

Cogongrass is an aggressive colony-forming dense exotic perennial grass native to Southeast Asia. Cogongrass is commonly found in circular infestations with rapidly growing and branching rhizomes, forming a dense mat to exclude most other vegetation. It can survive in full sunlight to partial shade which allows it to invade a wide range of sites including rights-of-way, roadsides, new forest plantations, open forests, old fields, and pastures. Cogongrass can also spread by wind-dispersed seeds and is promoted by burning (Miller 2003) and mowing. Control can be achieved using application of herbicides to include Glyphosate in spring and subsequent application in fall with Imazapyr to target the rhizomes.

Hydrilla is a submerged exotic aquatic perennial plant. Native to Africa, Australia, and parts of Asia, it is one of the most problematic aquatic plants in the United States. Hydrilla forms dense mats of vegetation in lakes, streams, and ponds. Hydrilla is more effective at capturing light and taking up nutrients than native aquatic plants. It also has extremely effective methods of propagation, using fragmentation and turions (over-wintering dense vegetative buds) to reproduce. Hydrilla has been found to devastate fish and aquatic habitat (http://www.ecy.wa.gov/programs/wq/ plants/weeds/hydrilla.html). Control can be achieved using herbicides including Reward (Diquat), Aquathol K (granular or liquid endothall), or Sonar (floridine).

Alligatorweed is a non-woody exotic perennial aquatic/shoreline plant native to South America. Alligatorweed has the ability to persist in terrestrial, semi-aquatic, and aquatic environments. It reproduces via vegetative fragmentation and waterborne dispersal of vegetative propagules. Alligatorweed forms dense mats on land and on the surface of water displacing native vegetation. It also alters its' aquatic habitat by decreasing water flow, increasing sedimentation, shading submersed plants, reducing oxygen levels, and choking off formerly open water column habitats (Carley and Brown 2006). Control can be achieved using herbicides including Imazapyr (Habitat) or Renovate (aquatic triclopyr).

Sesbania is an erect annual herb of the legume family which typically grows to a height of 3 to 10 feet. This pest plant, also found in Mexico, ranges from South Carolina to the southern tip of Florida, and westward to the eastern third of Texas. From there its range extends northward to Oklahoma, Illinois, and Missouri. It has also been reported as an introduced species in the northeastern United States. Sesbania prefers wet, highly disturbed habitats and sandy sites. It occurs in low sandy fields, sand bars of streams, alluvial ground along sloughs and borders of oxbow lakes, along roadsides and railroads, in disturbed urban sites and agricultural areas. It has the potential to become a troublesome exotic species in wetland communities that are managed for waterfowl. Optimum germination occurs late in the growing season when mudflats are exposed during periods of elevated temperatures. Although germination is late (best following late spring or summer drawdowns), sesbania sometimes forms dense stands that preclude germination and growth of desirable moist-soil species. The herbicide, 2,4-D Amine, is used to treat sesbania.

American lotus is a native aquatic floating or emergent perennial plant. The leaves of this pest species are simple, round, bluish-green in color, up to 2 feet in diameter, attached to the stem in center (no slit like water lilies). Leaves are flat if floating or conical if emergent and can stand above the water's surface as high as 3 1/2 feet on the rigid stem. Flowers are large (to 10 inches across) yellowish-white to yellow with more than 20 petals. The center of the flower, the seed structure, is cone-shaped (or like an inverted shower-head) and has openings in which the seeds develop. Lotus can form large colonies and spreads by seeds and large fleshy rhizomes. The plant provides important cover for a wide variety of wildlife in particular common and purple gallinule and wood ducks. The plant becomes a pest species when its population level and distribution in the lakes exceeds objectives for aquatic emergent vegetation coverage. This may be a function of lotus alone or in combination with waterlilly, watershield, and southern wildrice. The plant has a tendency to send out long runners and can rapidly colonize areas. Control can be obtained using herbicides from early spring through mid-summer using 2,4-D Amine and as the summer progresses, Glyphosate, Triclopyr, and Imazapyr.

White water lily is a pest perennial plant that often forms dense colonies. The leaves arise on flexible stalks from large thick rhizomes. The leaves are more round than heart-shaped, bright green, and 6 to 12 inches in diameter with the slit about 1/3 the length of the leaf. Leaves usually float on the water's surface. Flowers arise on separate stalks, have brilliant white petals (25 or more per flower) with yellow centers. The flowers may float or stick above the water and each opens in the morning and closes in the afternoon. The flowers are very fragrant. White water lily can spread from seeds or the rhizomes. Control can be achieved using herbicides in early spring through mid-summer including 2,4-D Amine and in fall Triclopyr and Imazapyr.

Watershield is a perennial pest plant with relatively small, floating oval to elliptical leaves (to 5 inches in diameter) with no slit. Water shield has a distinctive gelatinous slime on the underside of the leaves and coating the stems. Leaves are green above while the underside of leaves and stems are reddish-purple. Stems attach at the center of the leaves.

Flowers are small (9 ½- to ¾-inch), rise above the surface, are dull-reddish in color and consist of 3 to 4 sepals and petals. Water shield tends to be found in soft, acidic waters and can form large colonies. Control can be achieved using herbicides in late summer applications of glyphosate or triclopyr.

Giant cutgrass is a warm season, rhizomatous perennial pest grass. The height is between 3 to 9 feet. The leaf blade is long and flat, rough on edges, almost sawlike. The leaf sheath is rounded and opens with shorter than internodes. The seedhead is narrow and nodding panicles, spikelets, unisexual, 1 flowered, with male and female on same branch of panicle. It was first documented on the refuge in the mid-1990s; this native perennial grass has greatly expanded on the refuge. It forms dense monospecific stands that preclude interspersion with other native plants. Control can be achieved using herbicide applications of Glyphosate at higher label rates in spring and late summer/fall treatments with Imazapyr.

Bicolor Lespedeza is an exotic branched deciduous shrub that may reach 3 to 10 feet in height. The leaves are alternate with 3 elliptical leaflets. The upright stems are gray to green. Four- to six-inch long pea- like, purple flowers appear in June to September. Small pods containing a single black seed appear from August to March. It is a rapid-growing shrub that spreads in openings and under forest canopies. This invasive shrub was introduced for soil stabilization and in wildlife food plots. The plant can form dense stands that limit forest regeneration. The seeds of bicolor lespedeza often are spread by wildlife. Escort and Milestone VM are examples of herbicides used to treat this species.

Privets are exotic semi-evergreen to evergreen, thicket-forming shrubs to 30 feet in height that are multiple stemmed and leaning-to-arching with long leafy branches. The different privet species are essentially indistinguishable except at flowering. They are aggressive and troublesome invasive and pests, often forming dense thickets which limit development of native plants. These shrubs are shade tolerant and colonize by root sprouts or are spread widely by abundant bird- and other animal-dispersed seeds. Triclopyr and Glyphosate are both examples of herbicides used to treat privets.

Nepalese browntop or Japanese stiltgrass is an exotic annual grass that is common in a wide variety of habitats and is well adapted to low light levels. It is native in much of South Asia, Southeast Asia, and East Asia. It can be found from Iran in the west, east to China, south to the Philippines, and has since moved to the United States. The plant was accidentally introduced into the State of Tennessee around 1919 due to its use as a packing material used to ship porcelain from China. It has spread throughout the southeastern United States and is now found in 26 states. It most commonly invades along roads, floodplains, and other disturbed areas, but will also invade undisturbed habitats. White-tailed deer, which do not browse the grass, may facilitate spread by browsing on native species and thereby reducing competition for the exotic plant. Invasion of this plant can reduce growing and flowering of native species, suppress native plant communities, alter and suppress insect communities, slow plant succession, and alter nutrient cycling. Removal of this plant can lead to recovery of native plant communities. Selective herbicides

such as Poast and Vantage are examples of herbicides that can be used to treat this species.

Japanese climbing fern is a climbing and twining exotic perennial vine with lacy finely-divided leaves along green to orange to black wiry vines up to 90 feet long. Stems are slender but difficult to break. Fertile fronds, usually smaller segments with fingerlike projections around the margins bearing spore producing dots, in double rows under margins. Seeds are tiny spores dispersed by the wind. This fern spreads along highway rights-of-way (preferring under and around bridges) and invades open forests, forest road edges, and stream and swamp margins. Scattered in open timber stands and plantation can quickly increase in cover to form mats, covering shrubs and trees. This plant is deciduous in winter, while dead vines provide lattice for new growth. It resembles American climbing fern (native) and Old World climbing fern (only in Florida), but has palmately lobed 5-7 finger-like fronds. Control can be achieved through use of herbicides such as glyphosate.

Nonnative wisteria is a high climbing, twining, or trailing exotic woody vine which can be cultured to be shrubs. The vines are up to 70 feet long, deciduous, with pinnately compound leaves which can grow to 10 inches in diameter, climb by twining, covering shrubs and trees, branching infrequently. The vines root where covered by leaf litter. Flowers are fragrant, dangling, and showy. Pea-type flowers, lavender to violet (to pink to white) appear in March-May. These plants form dense infestations through vines and runners rooting at nodes or by water-dispersed seeds. Application of triclopyr or Milestone VM are examples of herbicides used to treat for this species.

Bamboo is an exotic plant having canes, 1-6 inches in diameter, golden to green to black, jointed and branched from joints, branches wiry and grass-like, stems hollow between solid joints, lower shoots and branches with loose papery sheath that cover ground when shed. They range from 16-40 feet tall, with bushy tops of lanceolate leaves in fan-clusters on grass-like stems, often golden green, from rhizomes. Flowers and seeds are very rare and usually not seen. They were widely planted as ornamentals for fishing poles around old home sites and now escaped. The plant colonizes by rhizomes and infestations rapidly expand with disturbance. Applications of herbicides including glyphosate can be used at higher label rates on new growth to control this species; repeated applications may be required.

Tallowtree can reach 60 feet tall and 3 feet in diameter. These exotic trees have leaves with a wide-angled base and turn yellow to red in fall. Its flowers appear in April – June on slender spikes up to 8 inches, with tiny flowers, yellowish green sepals but no petals, female flowers at base, and male flowers along the spike. Seeds appear between August and December in small clusters at branch terminals. The seeds are dark green in summer becoming dry and splitting to reveal 3 white wax-coated seeds that remain attached until winter (resembling popcorn and thus the common name). This species invades stream banks, riverbanks, and wet areas like ditches as well as upland sites. It thrives in both

freshwater and saline soils and is spreading widely through ornamental plantings, bird- and water-dispersed seeds, and colonizing by root sprouts. Herbicides including glyphosate can be used to control this species.

Johnson grass is a tall, coarse, exotic perennial grass with stout (up to ¾-inch in diameter) rhizomes. It grows in dense clumps or nearly solid stands and can reach 8 feet (2.4 meters) in height. Leaves are smooth, 6 to 20 inches long, and have a white or light green mid vein. Stems are pink to rusty red near the base. Panicles are large, loosely branched, purplish, and hairy. Spikelets occur in pairs or threes and each has a conspicuous awn. Seeds are reddish-brown and nearly 1/8-inch long. Johnson grass should be accurately identified before attempting any control measures. If identification of the species is in doubt, the plant's identity should be confirmed by a knowledgeable individual and by consulting appropriate books. POAST and OUTRIDER (Sulfosufuron) are good examples of herbicides used to control Johnson grass.

Understory hardwoods become a pest species needing treatment when it encroaches into endangered red-cockaded woodpecker (RC W) foraging and nesting habitat. The RCW has very specific habitat needs. The RCW adapted to open, mature pine forests throughout the southeastern United States, which was historically maintained by lightning-created fire. They only nest in cavities in living pine trees. The trees must be large enough for the RCW to excavate the nest cavity. The trees cannot be too crowded nor have too much woody vegetation--especially mid-level trees--near them. Management objectives are generally to have a wide open, park-like stand of pine trees with a mostly herbaceous understory. Hardwood midstory results in cluster abandonment; therefore, it is critical that hardwood midstory be controlled. Prescribed burning is the most efficient and ecologically beneficial method to accomplish hardwood midstory control. Either mechanical and/or chemical treatment may also be required for control of the midstory. Arsenal is an herbicide commonly used to treat understory hardwoods.

CONTROL METHODS OF PEST AND EXOTIC PLANTS

A. Preventive Measures

Roadsides and waterways are the front line of invasion by exotic species as vehicles owners unknowingly transport exotic plant parts and seed. Due to increased human usage along refuge access routes, exotic species from throughout the country are aided in their dispersal. All pest and exotic species can degrade, change, or displace native habitats. The refuge will explore preventive measures to reduce the likelihood of invasive species transported onto the refuge (i.e., contaminated equipment) through appropriate contract language requiring off-site washing of commercial vehicles and equipment. In addition, the refuge shall minimize contamination of its own equipment and distribution of invasive plants through cleaning of equipment following visitation to infested areas. Other measures will include the reduction of pass-through vehicular traffic that is unrelated to refuge visitation. Public education through signage, presentations, and outreach will highlight the importance of early prevention.

B. Eradication or Control Measures

Control of pest and exotic species is vital to protect native flora and fauna. Manual methods such as pulling, digging, or cutting; mechanical techniques such as mowing, tilling, and clipping; cultural methods such as planting cover, smother or nurse crops after tillage; and biological control agents can all effectively control certain species. The Nature Conservancy has written extensively on these methods in the "Weed Control Methods Handbook: Tools and Techniques for Use in Natural Areas" (Tu, et. al. 2001). More passive, long-term approaches will sometimes be used. For instance, tree and shrub seedlings can be planted to restore forest or shrub habitat in an open field. In highly infested sites, spot treatments may be required around the trees and shrubs to keep invasive species from choking out seedlings. However, once trees and shrubs are established, shading can be an excellent control mechanism as the canopy develops. Active control may only target the most aggressive invasive species initially crowding out seedlings.

To eradicate exotic plants or control pest plants, it may be necessary to use herbicide treatments which could potentially affect non-target native plants. Most herbicides are not designed to treat a specific species but instead treat a wide range of species in a certain group (i.e., grasses, broadleaves, and woody species). Specific chemicals and rates of application will be addressed by Refuge System pesticide use proposals, as well as evaluated during the Intra-Service Section 7 consultation. To control or eradicate certain exotic species, some accidental takes of native plants will occur. Native plants will be protected to the best extent possible through treatment of exotics when first discovered before wide-range control is needed. When and if wide-range control becomes needed, timing and placement of herbicides will be carefully controlled to best protect native plants and animals dependent on these species.

The Service uses pesticides (term also includes herbicides) as one tool in an integrated pest management approach in managing exotic and pest species that interfere with resource management objectives. There are numerous chemicals available, and it is imperative to consider all the ramifications involved with selecting and applying pesticides. The Service has stringent policies and procedures to help ensure that refuge managers are aware of the necessary protocols required to use pesticides on Service lands. The Service is generally more restrictive regarding chemical usage than the Environmental Protection Agency (EPA) and has an extensive pesticide review and approval process (Pesticide Use Proposal process) which is required for each pesticide. In addition, an Intra-Service Section 7 Consultation that is conducted by the Service's Ecological Services office evaluates the toxicity affects that each pesticide may or may not have on threatened and endangered species in and/or around the proposed spray area. Both processes provide guidelines/use requirements for the refuge managers to follow for each pesticide. Following both review processes, the refuge manager is to ensure that pesticides are used safely and effectively in compliance with the Endangered Species Act and other applicable laws and regulations, low risk products are selected, label instructions are followed, best products are selected for the target species,

adequate pesticide application buffers are maintained, and ground and surface water are protected.

Trained refuge staff or contractors may be used to apply pesticides to target species. Application methods can include hand foliar spraying, hack and squirt, stem injection, cut stump spraying, mechanized foliar spraying, and basal spraying. Regardless of the technique chosen, the chemical chosen to treat invasive species on refuge is the most narrowly specified pesticide available for the target organism in question, unless considerations of persistence or other hazards would preclude that choice.

BIOLOGICAL SOUNDNESS OF PEST AND EXOTIC WILDLIFE

There are seven exotic and pest animal species that pose a major threat to native flora and fauna communities on the refuge. Some of these species can dramatically change the habitat, consume native flora and fauna, interfere with the nesting and survival of RCWs, affect water quality, and even transmit diseases.

Raccoons are native pest species on the refuge. The raccoon is the largest of the procyonid family, having a body length of 16 to 28 inches and a body weight of 8 to 20 pounds. Its grayish coat mostly consists of dense underfur which insulates against cold weather. Two of the raccoon's most distinctive features are its extremely dexterous front paws and its facial mask, which are themes in the mythology of several Native American tribes. Raccoons are noted for their intelligence, with studies showing that they are able to remember the solution to tasks for up to three years. The diet of the omnivorous raccoon consists of birds, mammals, fish, amphibians, and bird eggs. Due to their opportunistic diet, raccoons interfere with wood duck banding efforts on the refuge by damaging traps and consumption of bait. Tree hollows and rock crevices are preferred by raccoons as sleeping, winter, and litter dens. If such dens are unavailable or accessing them is inconvenient, raccoons use burrows dug by other mammals, invade buildings or make use of other areas providing cover.

Beavers are native, North America's largest rodent, and are built for life in the water. Adults can be up to four feet long and weigh over 60 pounds. The beaver has webbed hind feet and a large, flat, nearly hairless tail. Beavers live in family groups or colonies. A colony is made up of a breeding male and female and their offspring. Beavers are very territorial and will protect their lodges from other beavers. Beavers can have both a positive and a negative impact on the environment. When beavers build dams, they create new wetland environments for other species. These wetlands can help slow erosion, raise the water table, and help purify the water. Beavers can play a major role in succession. When beavers abandon their lodges and dams, aquatic plants take over the pond. Dams can slow the flow of water in streams and cause silt to build up, creating loss of habitat for other species. Most of the beaver's diet is made up of tree bark and cambium, the soft tissue that grows under the bark of a tree. They especially like the bark of willow, maple, cypress, cottonwood, beech, and poplar trees. Beavers also eat other vegetation like roots, buds and other water plants. Their feeding and dam building habits can damage and kill many trees and plants.

Nutria are large, stout-bodied exotic rodents much like a beaver. Weights are from less than 12 to over 20 pounds. The total length can be up to 3 1/4 feet in length. The first 3 toes of the hind foot are webbed. This species is sexually mature at 5-6 months, and breed throughout the year. Two to three litters of 2-11 young are born each year. They build burrows and winter nesting platforms 20-30 inches wide and 6-9 inches above the water. Nutria are herbivores and consume approximately 25 percent of their weight daily. Succulent, lower portions of plants being preferred food. Roots, rhizomes, tubers, and tree bark are important during winter when the green parts of plants aren't available. Nutria also eat farm and garden crops and lawn grasses found next to water. Nutria can excavate soil and handle small food items. Nutria damage is related to burrowing and feeding. Nutria construct burrows in the banks of rivers, sloughs, and ponds, sometimes causing considerable erosion. Burrows can weaken roadbeds, stream banks, dams, and dikes, which may collapse when the soil is saturated by rain or high water. Rain action can wash out and enlarge collapsed burrows and compounds the damage.

Feral hogs create a risk to native flora and fauna. These domesticated animals can severely threaten our wildlife and their habitats in various ways. The most noticeable effect is the decline of wildlife populations as they may actively kill and consume native species or out-compete native species for food, water, and other resources. These animals can also serve as disease reservoirs and pose a threat to the health of both humans and other animals. Feral hogs are highly adaptable and capable of fending for themselves, making them capable of existing in a variety of habitats. A mature feral hog may reach a shoulder height of 36 inches and weigh from 100 to over 400 pounds. Provided there is good nutrition, feral hogs are capable of breeding at six months of age, but normally wait until eight to ten months. Average litter size is four to six young but under good conditions may have ten to twelve young. Feral hogs are omnivorous. They are very opportunistic feeders and much of their diet is based on seasonal availability. Foods include grasses, forbs, roots and tubers, browse, mast (acorns), fruits, bulbs, and mushrooms. Animal matter includes invertebrates (insects, snails, earthworms, etc.), reptiles, amphibians, and carrion, as well as live mammals and ground nesting birds and their eggs. Feral hogs are especially fond of acorns and domestic agricultural crops such as corn, milo, rice, wheat, soybeans, peanuts, potatoes, watermelons, and cantaloupe. Feral hogs can damage levee, roadsides, and native flora and fauna. Feral hog activity in streams reduces water quality by increasing turbidity (excessive silt and particle suspension) and bacterial contamination. In time, turbidity and added contaminants affect a variety of native aquatic life, most notably fish, freshwater mussels, amphibians, and insect larvae. In some streams, feces from feral hogs have increased fecal coliform concentrations to levels exceeding human health standards. Feral hogs are known carriers of at least 45 different parasites (external and internal) and diseases (bacterial and viral) that pose a threat to livestock, pets, wildlife, and in some cases, human health.

White-tailed deer is a medium-sized ungulate native to the refuge. The deer's coat is a reddish-brown in the spring and summer and turns to a grey-brown throughout the fall and winter. Male deer usually weighs 130 to 290 pounds. White-tailed deer are generalists and

can adapt to a wide variety of habitats. White-tailed deer eat large varieties of food, commonly eating legumes and foraging on other plants, including shoots, leaves, cacti, and grasses. They also eat acorns, fruit, and corn. Their special stomach allows them to eat some things that humans cannot, such as mushrooms and poison ivy. Their diet varies by season according to availability of food sources. They will also eat hay, grass, white clover, and other food that they can find in a farm yard. Though almost entirely herbivorous, white-tailed deer have been known to opportunistically feed on nesting songbirds, field mice, and birds trapped in mist nets. Due to ongoing public hunting seasons used to control deer numbers, deer are not normally seen as a pest on the refuge. Human-deer conflicts along roadways and habitat destruction by deer within the refuge can occur if deer populations are allowed to grow without control.

Gray rat snake is a large, moderately stout snake attaining a maximum length of about 84 inches. The gray rat snake has a gray background color with brown to dark gray blotches. Belly is white with boxlike dark gray to brownish blotches and dark spots that become stripes under the tail. It occurs in most kinds of terrestrial habitats but attains greatest densities in areas where forests and farmland are generally intermixed and small rodents are relatively abundant. Skillful climbers, rat snakes ascend trees or rafters of buildings in search of birds, eggs, and mice. They may nest high in tree cavities, a position that may place them in direct competition with nesting RCWs and wood ducks. Adult snakes mainly feed on mice and eggs, but will also eat birds, insects, rats, bats, and other small mammals. Juveniles feed mainly on lizards and small frogs.

Southern flying squirrel is one of two species of the genus Glaucomys, the only native flying squirrels found on the refuge. It is found in deciduous and mixed pine-hardwood forests. Flying squirrels have grey brown fur on top with darker flanks and are a cream color underneath. They have large dark eyes and a flattened tail. They have a furry membrane called a patagium which extends between the front and rear legs, used to glide through the air. Southern flying squirrels feed on fruit and nuts from trees such as red and white oak, hickory, and beech. They store food, especially acorns, for winter consumption. They also dine on insects, buds, mushrooms, mycorrhizal fungi, carrion, bird eggs, and nestlings and flowers. Southern flying squirrels show substantial homing abilities, and can return to their nests if artificially removed to distances of over one-half mile. Southern flying squirrels nest in natural cavities and RCW cavities. The southern flying squirrel is one of the most prevalent users of RCW cavities (Loeb 1993). Flying squirrel interference with RCW nesting is suspected of having a negative impact on RCW populations (Jackson 1978, U.S. Fish Wildlife Service 1985, Lennartz and Heckel 1987).

Southern pine bark beetle, both southern pine beetle and Ips bark beetle, are native beetles found extensively in southern pine habitats. The southern pine beetle (*Dendroctonus frontalis*) 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.

Pines of all ages and sizes are attacked by Ips bark beetles *(Ips grandicollis, calligraphus and avulsus)*. They usually attack injured, dying or recently felled trees, and logging debris. Infested trees usually have numerous white to reddish brown pitch tubes, about the size of a wad of gum, on the bark. In trees of low vigor, pitch tubes may be lacking and the earliest signs will be reddish bark crevices at the tree's base. Adult beetles are attracted to weakened trees and chew round holes through the outer bark into the cambium layer. "Y" or "H" shaped egg tunnels are in the soft inner bark parallel with the grain of the wood, and generally free of boring dust. The distinct gallery pattern is used for identification purposes even when larvae and adults are absent. Eggs are laid singularly in small egg niches cut along the main tunnel. Larvae hatch and feed in generally distinct lines. Larvae feeding tunnels are usually filled with boring dust. Larvae mature, pupate, and transform to adults in 25 to 40 days, depending on the temperature. Emerging adults may or may not attack nearby trees.

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.

CONTROL METHODS OF PEST AND EXOTIC WILDLIFE

A. Preventive Measures

Preventing the introduction of exotic plants and animals is often tied to education of the public. Residents and sportsmen sometimes introduce exotic and feral animals into areas they do not currently inhabit under a belief they are helping the animals or to create a hunting opportunity, thereby increasing the rate of spread species. Changing this public perception through education is a key component to controlling feral hogs. The Service will work with partners to educate sportsmen and other user groups on the negative effects of

feral hogs to the native flora and fauna. Additionally, refuge staff will work to enforce laws to reduce the transport of exotic animals into new environments. Public education emphasizing the potential for spreading of diseases, potential for habitat destruction, and refuge purposes may help reduce the transportation and release of exotic and pest animals.

The spread of exotic plants is often tied to the unintentional transport of adult plants or their seeds on vehicles and equipment. Unwashed vehicles including heavy equipment, cars, and trucks that become covered in thick layers of mud are often transporting these unwanted plants from area to area. Unwashed boats and trailers often introduce exotic aquatic plants in to lakes near boat ramps. Public education will again play a key role in preventing this. Law enforcement to prevent off-road driving by visitors will also be needed.

Pest species are native and prevention is closely tied to ongoing management of these species as part of public use programs and case-by-case spot treatments.

B. Eradication or Control Measures

The refuge proposes to maintain raccoons, nutria, and beaver numbers to levels at which they do not adversely impact other species or the habitat, and proposes to dramatically increase control of feral hogs by initiating one or more of the following control means: (1) provide recreational opportunities for hunters to harvest white-tailed deer; (2) provide for individual hunters to take raccoons, nutria, beaver, and hogs as incidental species during recreational public hunts for upland game or deer on parts of the refuge; (3) harvest exotic and pest species by refuge staff and contractors, using firearms and trapping; (4) work cooperatively with neighboring landowners and land managers to remove feral hogs and beavers having impacts across boundary lines; (5) install snake excluder devices on RCW cavity trees; (6) capture and euthanasia; (7) remove beaver dams that interfere with water control assets; and (8) remove trees needed to stop the active spreading of bark beetle infestations. Any or all of these methods could be used at the refuge manager's discretion, depending on the situation.

The refuge currently allows archery, primitive weapons, and gun deer hunting and small game hunting. Hunters can harvest raccoon, beaver, and feral hogs during any open deer season on the refuge. There is no bag limit on feral hogs. All state and federal regulations must be complied with for hunting these species. All game animals killed must be removed from the refuge at the conclusion of the days hunt. No live animals can be released on or removed from the refuge without permit.

Hunter harvest is not expected to influence the control or eradication of feral hogs on the refuge and could encourage public to release hogs. Therefore, the refuge staff will trap and euthanize feral hogs throughout the year. Each trap can vary by dimensions and design such as door types (salon, rooter, dead fall, and single side swing). Most of the live traps are open topped to allow for escape of native species such as deer. Refuge staff will make every effort to release any species accidently captured without harming that species. Feral hogs will be euthanized at the trap site or when spotted on the refuge. No hogs killed by refuge staff will be used for human consumption but disposed near the site of capture.

Raccoon control at duck banding sites will be conducted through trapping and euthanasia. Beavers that compromise the integrity of levees, water control structures, or flood actively growing timber will be trapped and euthanized. Dams will be racked or explosives used to restore water flow. No animals taken through this program will be used for human consumption.

On occasion, staff and visiting public encounters lost pets, or other domesticated animals that have been "dumped" or otherwise disposed of as unwanted pets, or have escaped from pens. Should the animal appear to simply be lost, staff will attempt to capture the animal and contact its owners. Animals will be released into the care of a local animal shelter or other appropriate humane care facility. Domesticated animals may be encountered that appear to be sick and dangerous to refuge staff or visitors. In such circumstances these animals would be euthanized.

Primary prevention of snake depredation on RCW nests can be achieved through placement of a 36-inch wide piece of metal sheet flashing wrapped around the tree bole. This snake excluder device provides a non-lethal means of preventing climbs. In the event a rat snake is found in a cavity, the snake may be captured live if possible and released one mile from any RCW cluster, or euthanized. Wood duck nest boxes fitted with a cone shaped predator shield provides a physical barrier to climbing snakes and raccoons. These shields need to tightly fit around the pole to prevent the snake from climbing to the boxes. In addition, overhanging tree limbs provide an alternative route for snakes to gain access to nest boxes. Pruning branches may be needed annually around nest boxes. Rat snakes found in wood duck nest boxes may be captured live if possible and released one mile from wood duck box, or euthanized.

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. Fixed-wing or rotary aircraft provide an efficient means of surveying pine stands on the refuge in 3-4 hours. Transects running east-west spaced 1-2 miles apart at altitudes of 1,000-1,500 feet provides adequate detection. Approximate location of infestations can be referenced on aerial photographs and by taking an over flight GPS waypoint. This means of survey allows rapid detection of all spots greater than 1/4 acre in size. During extreme conditions, recurring aerial flights may be needed on a weekly basis to deal with the epidemic. Determining the exact ground location of the spots require more intensive efforts. Ground crews utilize the approximate spot mapping and waypoints to target a search area. 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 spot. Loggers need to treat each site as soon as possible to limit spread. In situations where spots remain untreated for more than seven days, remarking of the site may be necessary to increase the size of the buffer if the spot has grown. In some circumstances, spots may emerge very closely to adjacent spots and ground crews should be observant for newly created spots in the direction of the spread.

JUSTIFICATION OF CONTROL METHODS OF INTEGRATED PEST MANAGEMENT PLAN

All refuges are to provide habitat for the protection of fish and wildlife. The upland pine hardwood forests, bottomland hardwood forests, and aquatic systems of the refuge provide the habitat base to achieve this objective. The problems created by pest and exotic plants and wildlife on refuges are well documented. They include soil erosion, leaching of minerals and nutrients, habitat destruction, native plant species destruction, changes in vegetative succession rates, and removal of ground cover. Other problems include competition for food with native wildlife, predation on native wildlife, and disease transmission to livestock, native wildlife, and humans.

MONITORING

Monitoring of the various control options will play a very important role in the management of the raccoon, beaver, feral hog, and exotic plant populations on refuge lands. All refuge personnel shall record information on species and acres treated and reported yearly to the refuge manager. Refuge game check stations are used to record animals harvested as part of the refuge's public use programs.

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APPENDIX 1

Mechanical, Cultural, and Biological techniques used to control exotic, nuisance, and pest animals and plants are outlined in the table below.

Control Technique	**Habitat Benefits**	**Constraints/Disadvantage**	**Application Specifications**
Pest Animal Control			
Trapping	Reduces girdling, felling, and mortality of trees from beaver; Reduces depredation of birds and their nests, amphibians and reptiles, and other animals; Reduces trampling of plants, spread of invasive plants, erosion and water pollution from feral animals	Access by staff Staff safety Reduces habitats used by wading birds, waterfowl, prothonotary warbler; amphibians, reptiles, and Mitchell's satyr butterfly	Primary option for management of beaver and feral animals
Recreational Hunting (Incidental Species)	Reduces girdling, felling, and mortality of trees from beaver; Reduces depredation of birds and their nests, amphibians and reptiles, and other animals; Reduces trampling of plants, spread of invasive plants, erosion and water pollution from hogs	Access by staff Staff safety Reduces habitats used by wading birds, waterfowl, prothonotary warbler; amphibians, reptiles, and Mitchell's satyr butterfly	Viable option for management of beaver and feral animals by staff
Euthanization	Reduces girdling, felling, and mortality of trees from beaver; Reduces depredation of birds and their nests, amphibians and reptiles, and other animals; Reduces trampling of plants, spread	Access by staff Staff safety Reduces habitats used by wading birds, waterfowl, prothonotary warbler; amphibians, reptiles, and Mitchell's satyr butterfly	Viable option for management of beaver and feral animals, flying squirrels, and gray rat snakes by staff

Control Technique	Habitat Benefits	Constraints/Disadvantage	Application Specifications
	of invasive plants, erosion and water pollution from hogs		
Dam Removal	Maintains the natural flow of water courses; Removes water which can stress or kill trees	Access by staff Staff safety Reduces habitats used by wading birds, waterfowl, prothonotary warbler; amphibians, reptiles, and Mitchell's satyr butterfly	Primary option for removal of excess water
Excluder Devices	Reduces predation of endangered RCWs	Access by staff Staff safety; reduces habitat for other woodpeckers	Primary option for flying squirrels and gray rat snakes
Capture and Release	Reduces predation of endangered RCWs; Return lost pets to owners	Access by staff Staff safety;	Viable option for feral animals and gray rat snakes
Tree Harvesting	Reduces loss of habitat for endangered RCWs	Access by staff Staff safety; reduces habitat for other woodpeckers	Primary option or Southern Bark Beetles
Cooperation with Neighbors	Reduces girdling, felling, and mortality of trees from beaver; Reduces depredation of birds and their nests, amphibians and reptiles, and other animals; Reduces trampling of plants, spread of invasive plants, erosion and water pollution from feral animals	Access by staff Staff safety Reduces habitats used by wading birds, waterfowl, prothonotary warbler; amphibians, reptiles, and Mitchell's satyr butterfly	Viable option for management of beaver and feral animals
Pest Plant Control			
Hack and Squirt	Controls trees greater than 5 inches in diameter	Not recommended for use in spring during heavy sap flow Safety issue with tools	Viable option for forest management, woody encroachment in moist-soil units or grasslands/old fields, and invasive species
Stem Injection	Controls trees greater than 5	Not recommended for use in spring during heavy sap	Viable option for forest

Control Technique	Habitat Benefits	Constraints/Disadvantage	Application Specifications
	inches in diameter	flow; safety issue with tools	management, woody encroachment in moist-soil units or grasslands/old fields, and invasive species
Cut Stump	Prevents re-sprouting of hardwoods	Must cut tree down to apply; safety issue with tools	Viable option for forest management, woody encroachment in moist-soil units or grasslands/old fields, and invasive species
Basal Spraying	Control thin barked trees less than 6 inches in diameter; Reduces encroachment of undesirable species	Time intensive	Primary option for controlling invasive/pest species in all habitats;
Direct Foliar Spraying	Control of many woody plants, herbaceous weeds, grasses, vines, invasive/pest species; can reach up to 20 feet in height	Time intensive; Noise impact issues during nesting seasons if within red-cockaded woodpecker clusters and near bald eagle nests if using heavy equipment	Primary option for control in all habitats
Air Foliar Spraying	Control of many woody plants, herbaceous weeds, grasses, vines, invasive/pest species;	Spray can drift and impact desirable species	Viable option for controlling nuisance plants especially in lakes
Basal Soil	Control of many annual and perennial weeds	Can affect desirable species	Not a viable option
Insect Outbreaks (Tree Removal)	Reduces potential for insect or disease outbreak spread and fire/safety hazards	Extra work for staff to mark area and issuance of special use permits; proximity of red-cockaded woodpecker clusters and bald eagle nests; erosion potential	Viable option for red-cockaded woodpecker foraging areas; Benefits public while meeting habitat objectives
Storm Damage (Tree Removal)	Reduces potential for insect or disease outbreaks	Decreases course woody debris in forest; proximity of red-cockaded woodpecker	Viable option to prevent insect spread especially

Control Technique	Habitat Benefits	Constraints/Disadvantage	Application Specifications
	and fire/safety hazards	clusters and bald eagle nests; erosion potential	southern bark beetles which could decrease red-cockaded woodpecker habitat and storm damage which could represent a safety or fire hazard
Manual Thin	Increase stand structure/diversity by allowing light to forest floor	Safety issues with tools; proximity of red-cockaded woodpecker clusters and bald eagle nests; erosion potential	Viable option to thin stands too young to harvest or remove woody encroachment in fields
Mechanized Thin	Increase stand structure/diversity by allowing light to forest floor	Restricted to drier periods; proximity of red-cockaded woodpecker clusters and bald eagle nests; erosion potential	Viable option to thin stands too young to harvest or remove woody encroachment in fields
Dozer	Removal or push over vegetation	Restricted to drier periods; proximity of red-cockaded woodpecker clusters and bald eagle nests; erosion potential	Viable option to remove woody encroachment in RCW areas and reduce size of exotic, invasive, nuisance or pest species prior to herbicide treatments
Roll-drum Chopper	Removal or push over vegetation	Restricted to drier periods; proximity of red-cockaded woodpecker clusters and bald eagle nests; erosion potential	Viable option to remove woody encroachment in RCW areas and reduce size of exotic, invasive, nuisance or pest species prior to herbicide treatments
Mulching	Increase stand structure/diversity by allowing light to forest floor; adds course woody debris to forest floor	Restricted to drier periods; proximity of red-cockaded woodpecker clusters and bald eagle nests;	Viable option to remove non-desirable midstory in both pines and hardwoods
Early Season Drawdown	Irrigation, control of invasive and pest species, establishment of	Must have a water control structure	Primary method for creating wading bird habitat

Control Technique	Habitat Benefits	Constraints/Disadvantage	Application Specifications
	favorable native plants, mudflats and shallows habitat for migratory birds, lake improvement, and flooding moist-soil areas or GTRs		
Late Season Drawdown	Irrigation, control of invasive and pest species, establishment of favorable native plants, mudflats and shallows habitat for migratory birds, lake improvement, and flooding moist-soil areas or GTRs	Must have a water control structure; reduced oxygen levels which can result in fish kills	Primary method for creating wading bird habitat and controlling invasive and pest species
Mid-Season Drawdown	Drawdown from April 15 through June 1 which encourage beneficial species	Allows some nondesirable species to germinate	Primary option to manage for desirable moist-soil plants
Fast Drawdown	Completed within 2 to 3 days; quick turn-round time to enter unit	Allows some nondesirable species to germinate; reduce or completely loose available habitat quickly	Primary option to manage for desirable moist-soil plants and when unit is being planted to hot foods
Slow Drawdown	Completed within 2 to 5 weeks; extended habitat availability and foraging; elevated soil moisture which promotes desirable species; decrease probability of undesirables	Woody encroachment with extended periods of mudflats; longer to enter an unit in need of treatment	Viable option to manage for desirable moist-soil plants
Flooding	Fall flooding provides foraging habitat to migratory waterfowl; late spring/summer flooding provides foraging habitat for wading birds	Unit inundation by guaranteed water source (wells/gravity flow) or must catch rainfall, surface run-off, or backwater floods	Primary option for providing food resources to migratory waterfowl and wading birds

Control Technique	Habitat Benefits	Constraints/Disadvantage	Application Specifications
Shallow Disking	Disking less than 4 inches deep can set back succession, controls undesirable species, and rejuvenates moist-soil plants	Water removal from units reduces migratory wading bird habitat, but drying the unit out is essential to allow equipment into the unit	Viable option to manage for desirable moist-soil plants
Deep Disking	Disking more than 4 inches deep can set back succession, controls undesirable species, and rejuvenates moist-soil plants	Water removal from units reduces migratory wading bird habitat, but drying the unit out is essential to allow equipment into the unit	Viable option to manage for desirable moist-soil plants
Mold-Board Plow	Plowing 10-12 inches deep to remove woody encroachment	Water removal from units reduces migratory wading bird habitat, but drying the unit out is essential to allow equipment into the unit	Not a viable option at this time
Dozer	Removal of woody vegetation	Water removal from units reduces migratory wading bird habitat, but drying the unit out is essential to allow equipment into the unit	Viable option to remove woody stems in which disking cannot affect
Cultipacker/Roller	Compact top of soil to improve conditions for desirable plants	Water removal from units reduces migratory wading bird habitat, but drying the unit out is essential to allow equipment into the unit	Not a viable option at this time
Roll-drum Chopper	Removal of woody vegetation	Water removal from units reduces migratory wading bird habitat, but drying the unit out is essential to allow equipment into the unit	Viable option to remove woody stems in which disking cannot affect or prior to herbicide treatments
Mowing	Removal of dominant overstory undesirable species allows desirable species to respond and provides substrate for invertebrates	Water removal from units reduces migratory wading bird habitat, but drying the unit out is essential to allow equipment into the unit	Viable option to manage for desirable moist-soil plants
Summer Irrigation	Increases yields of annual seed producers and some perennials;	Can be expensive but works well in situations with gravity flow water sources	Viable option to manage for desirable moist-soil plants

Control Technique	Habitat Benefits	Constraints/Disadvantage	Application Specifications
	stress some plants		
Agriculture	Can achieve high energy foods needed by waterfowl	Can be expensive and time consuming for staff	Primary option to provide high levels of useable energy to waterfowl in Prisock fields
Haying	After seed set, haying allows sunlight to reach seeds for sprouting and does not reduce vigor of warm season native grasses	Can be expensive and time consuming for staff	Viable option to manage for desirable warm season native grasses
Mowing	Removal of vertical structure and set back of woody vegetation	Can be expensive and time consuming for staff	Viable option to manage for desirable warm season native grasses
Dormant Season Burns	Suppress growth of understory hardwoods and maintains existing grasses and forbs for resources of concerns, reduces fuel loads, protect property/natural resources	Weather determines days prescribed fire can be implemented, smoke management and staffing requirements	Most available option for management of pine forests for resources of concern; viable option for management of grasslands/old fields
Growing Season Burns	Better controls growth of understory hardwoods and promotes grasses and forbs for resources of concerns, reduce fuel loads, protect property/natural resources	Higher fire danger and temperature reduce number of viable days, smoke management and staffing requirements	Least available option for management of pine forests for resources of concern; primary option for management of grasslands/old fields

U.S. Fish & Wildlife Service

Visitor Services Plan

Sam D. Hamilton Noxubee National Wildlife Refuge

Okibbeha, Noxubee, and Winston Counties, Mississippi

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Summary

A visitor services plan is required to ensure public uses at Sam D. Hamilton Noxubee National Wildlife Refuge (hereinafter referred to as the Sam D. Hamilton Noxubee NWR or the refuge) are appropriate and compatible with the National Wildlife Refuge System (Refuge System) mission and the purposes for which the refuge was established. The Fish and Wildlife Service (Service) prepared this plan to describe visitor services as a step-down plan to the comprehensive conservation plan (CCP). The visitor services plan documents the recreational activities planned at the refuge and the structure of the visitor services program. The following wildlife-dependent recreational uses have been determined to be compatible through the CCP process at the refuge: hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation. Evaluation and adaptive management of the visitor program is a key element of this plan.

I. Background Information

REFUGE PURPOSE

Sam D. Hamilton Noxubee NWR was originally created from lands obtained through the 1930s Resettlement Administration. The primary establishing legislation for the Noxubee National Wildlife Refuge was Executive Order 8444, dated June 14, 1940, with the stated purpose, "…as a Refuge and breeding ground for migratory birds and other wildlife…" 16 U.S.C., 715 (Migratory Bird Conservation Act of 1929). Additional purposes under which lands are managed include:

"...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." 16 U.S.C., 715d Migratory Bird Conservation Act of 1929);

"...for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude...." 16 U.S.C., 742f(b)(1) (Fish and Wildlife Act of 1956);

"...conservation, management, and restoration of the fish, wildlife, and plant resources and their habitats for the benefit of present and future generations of Americans." 16 U.S.C., 668dd(a)(2) (National Wildlife Refuge System Administration Act of 1966);

"...for the development, advancement, management, conservation, and protection of fish and wildlife resources...." 16 U.S.C., 742f(a)(4); and in accordance to Service policy (610 FW 4.23) the refuge is also tasked with management of the proposed wilderness to achieve the purposes of the Wilderness Act of 1964 (Public Law 88-577).

REFUGE HISTORY

Established in 1940 as Noxubee National Wildlife Refuge, the refuge was subsequently renamed Sam D. Hamilton Noxubee NWR by Public Law 112-279 on February 14, 2012.

Refuge archaeological investigations have uncovered a variety of cultural resources, ranging from early Native-American relics to old homesteads. Other evidence of early Euro-American settlements is also abundant on the refuge, including roads, cemeteries, churches, schools, mill sites, cisterns, a WWII practice bombing range, and one diversion canal dating back to the late 1800s and early 1900s.

At the time of acquisition by the Federal Government, the lands of the refuge had a few existing public roads, many of which were soon abandoned. The Civil Conservation Corps (CCC) built new roads, bridges, levees, fences, and Bluff Lake. The refuge's initial goals were to rehabilitate the land and create more wildlife habitat through planting trees to reduce soil erosion. Each year from the time of establishment until the early 1950s, the refuge planted thousands of acres in loblolly pine. Further alterations of the land were conducted including the construction of erosion control structures, Loakfoma Lake, additional levees and water control structures, and four greentree reservoirs (GTRs). Roads and bridges were continually updated to improve access.

Over the years, the refuge staff restocked the land with numerous native wildlife species. Those species included white-tailed deer (*Odocoileus virginianus*), beaver (*Castor canadensis),* Canada geese *(Branta canadensis),* and American alligator (*Alligator mississippiensis*). Fishing on the refuge was first allowed in 1941. By 1949, hunting of squirrels was allowed. Public use and providing developed visitor services on the refuge began in earnest in the 1950s, and was mainly focused on deer hunting, camping, and fishing opportunities. Starting in 1943 and remaining until the 1970s, the refuge partnered with Mississippi Department of Wildlife, Fisheries and Parks on management of the refuge's public fishing; a fee was charged for fishing on the refuge. In the 1960s, the refuge opened to waterfowl hunting and turkey hunting.

Sam D. Hamilton Noxubee NWR currently consists of 48,219 acres of which the majority of the refuge is open to public use during the year. For hunters, a variety of hunting opportunities are available for game species, including squirrel, rabbit, raccoon, quail, deer, turkey, and waterfowl. The refuge also provides free fishing opportunities. Camping is no longer allowed. The refuge has increased the quality of public access with improved paved roads and installation of modern bridges along its primary access routes. Numerous gravel roads allow access throughout the refuge. The refuge also supports numerous observation platforms, boardwalks, and walking trails as well as a modern visitor center and environmental education center.

The refuge has a well develop environmental education partnership with the Starkville School District and periodic interpretation programs provide the public opportunities to learn about and enjoy wildlife resources. Education and interpretation play key roles in assisting the refuge to keep its increasing amount of use by the visiting public compatible with the purposes for which the refuge was established. Consistent with the provisions outlined in the National Wildlife Refuge System Improvement Act of 1997 (Improvement Act), the Service provides many additional recreation opportunities that reflect the unique qualities and features of the Refuge System and the refuge.

REFUGE LOCATION

Sam D. Hamilton Noxubee NWR is located within three counties (Noxubee, Oktibbeha, and Winston) in east-central Mississippi, approximately 17 miles south-southwest of Starkville and approximately 120 miles north-northeast of Jackson, the capital city of Mississippi (Figure 1). There are four major access routes to the refuge: Oktoc Road from Starkville; Highway 25 by way of Loakfoma Road; the Brooksville-Louisville Road from Louisville; and Lynn Creek Road from Brooksville.

VISITOR SERVICES PROGRAM PURPOSE AND SCOPE OF PLAN

The purpose of the Sam D. Hamilton Noxubee NWR visitor services program is to foster understanding and instill appreciation of the fish, wildlife, and plants and their conservation by providing the public with safe, quality, appropriate, and compatible wildlife-dependent recreational and educational programs and activities. It is the refuge's goal to help the public make that initial connection to the outdoors that can continue to develop over a life time. In 1997, Congress passed the Improvement Act which clearly states that on national

wildlife refuges, wildlife comes first. The Improvement Act also identified six priority wildlife-dependent public use activities and programs that are compatible with the mission of the Refuge System. These uses include hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation.

The purpose of the Visitor Services Plan is to establish priorities and identify improvements, and to serve as a guide to the refuge's visitor service program over the next fifteen years. The visitor service goals, objectives, and strategies have been identified within Chapter IV of the CCP for the refuge. A separate Hunt Plan, which is a step-down plan from this Visitor Services Plan, has also been prepared (Appendix E). This Visitor Services Plan addresses compatible wildlife-dependent recreational uses on national wildlife refuges, including hunting, wildlife observation, wildlife photography, and environmental education and interpretation. The Visitor Services Plan also addresses the volunteer program and the partnership and resource protection goals from Chapter IV of the CCP.

HISTORY OF THE REFUGE VISITOR SERVICES PROGRAM

EXISTING VISITOR SERVICES

The refuge has more than 160,000 visits annually (based on 2012 RAPP database; U.S. Fish and Wildlife Service, 2011, written comm.). The refuge has a well-developed Visitor Services Program, modern visitor center, and a separate state-of-the-art environmental education building. The refuge promotes all priority public use activities as described within the Improvement Act. Visitors participate in a variety of activities including fishing, waterfowl hunting, upland game hunting, big game hunting, use of the visitor center, hiking, motorized and non-motorized boating, auto tour routes, bird watching, wildlife photography, wildlife observation, environmental education, and research. The refuge serves as an outdoor classroom for Mississippi State University, Starkville School District, and other local educational institutions and home-schooled children. The refuge's growing volunteer program provides many benefits to the refuge, but also allows the public to gain a unique understanding of managing for wildlife.

PUBLIC ACCESS

The refuge provides ample access suitable for the majority of public users. There are five boat ramps (two improved concrete and three graveled) on Bluff, Loakfoma, and Ross Branch lakes that are maintained by refuge staff. Historically, peak use of the refuge occurred during the refuge's spring fishing and fall hunting seasons, but non-consumptive use is increasing throughout the year. At this time, the refuge maintains 61 miles of graveled and 17 miles of asphalted roads as identified in the Federal Highways Refuge Roads Inventory (Appendix B). Numerous roads are open to the public and provide ample opportunities to hunt, fish, observe, and photograph wildlife and access *to* boardwalks, trailheads, and overlooks. With recent upgrades in key refuge access roads, commercial and pass-through traffic is on the increase along with a general increase in traffic speeds and volume. Additional increases are anticipated as the State of Mississippi recently established Mississippi's Noxubee Hills Scenic Byway, which includes the improved refuge

roads as part of its designated route. Use of refuge graveled roads by commercial trucks is also increasing as these vehicles take advantage of shorter routes through the refuge. The increase in traffic volume and use by high weight vehicles are increasing maintenance costs and higher traffic speeds are causing increasing observations of vehicle accidents and wildlife mortality.

Hunting

Sam D. Hamilton Noxubee NWR offers the public a wide range of hunting opportunities including seasons for archery, primitive weapon and modern gun, as well as special opportunities for youth and mobility impaired hunters. The refuge is visited by hunters living throughout the southeast to participate in a quality white-tailed deer hunting experience, as well as waterfowl hunting in the flooded bottomland forests. Deer and squirrel hunting remain the most popular public hunting opportunities, followed by waterfowl, and turkey. In addition to these hunting seasons, refuge hunters have the opportunity to harvest beaver, nutria, and feral hog (*Sus scrofa*) incidental to any hunt with weapons that are legal for that particular hunt.

Fishing

The refuge currently has two lakes (Bluff and Loakfoma), one reservoir (Ross Branch), several smaller ponds, and one river (Noxubee) that offers reliable fishing opportunities. Fishing on refuge lakes is open March 1 – November 30 in conjunction with Mississippi fishing regulations (including size restrictions and limits). Anglers have opportunities to catch largemouth bass, crappie, catfish, and sunfish. The popular species pursued by sport anglers have not changed over time: crappie, black bass (largemouth and spotted), bluegill, red-ear sunfish, and catfish. The refuge sponsors an annual youth fishing derby for the general public that continues to be popular with local residents and a second special event youth fishing derby for the Palmer Home for Children.

Wildlife Observation and Wildlife Photography

A large variety of wildlife can be observed on the refuge. There are many clusters of the endangered red-cockaded woodpecker (RCW) readily accessible to the public. The American alligator that occupies the refuge's lakes is one of the most sought-after species among wildlife observers and photographers. Wading birds and migratory birds seen from the refuge's observation towers, boardwalks, trails, and roadsides are also a draw for wildlife observers and photographers.

Environmental Education and Outreach

The Larry Box Environmental Education Center is a partnership between the Starkville Mississippi School district and the refuge. The refuge's education center is located near the visitor center and office and is staffed by Starkville School District personnel. As part of the

center's efforts, the refuge is able to offer several curriculum-based environmental education programs, ranging from animal adaptations to habitat management, for hundreds of students each year.

The Education Center offers visiting school groups a variety of equipment to use during their visit: binoculars, dip nets, bug boxes, microscopes, plus forestry supplies, waterfowl banding equipment, etc. School groups enjoy the use of the classroom in the refuge's Environmental Education Center, displays within the refuge's visitor center, and the outdoor area located near Douglas Bluff.

Interpretation

Bottomland hardwood ecology, forest disturbance, animal adaptations, species interdependence, the Refuge System, RCWs, and habitat management are the primary themes and messages interpreted. These themes and messages help visitors understand the key resource issues related to the Service, the Refuge System, and the refuge (USFWS 2008c).

Volunteers and Partners

The refuge has an increasing number of volunteers providing important help to the refuge that range from helping at special events to resident volunteers staying at the refuge and providing support normally limited to paid staff only. Total volunteer hours average more than 12,000 hours yearly. Volunteer recruitment is an ongoing effort and all new volunteers receive appropriate orientation and training prior to work assignments. The refuge's rural location could be seen as a limiting factor with regard to the number of available volunteers who possess the time, interest, and skills to assist on the refuge, but the close proximity of Mississippi State University, Columbus Air Force Base, and the importance of the refuge to the community plays a more important role in regards to attracting volunteers.

Community partners include Mississippi State University, Friends of Noxubee, Mississippi Department of Fisheries, Wildlife, and Parks, USDA Forest Service, Wild Turkey Federation, Ducks Unlimited, Bass Pro Shops, Audubon Society, and the Jena Band of the Choctaw Tribe.

VISITOR SERVICES ISSUES, CONCERNS, AND FACTORS TO CONSIDER

Based on internal, public, and intergovernmental scoping, the Service identified a total of 16 priority resource issues related to fish and wildlife population management, habitat management, resource protection, visitor services, and refuge administration. All public and advisory team comments were considered; however, some issues that may be important to the public are beyond the scope of the Service's authority and cannot be addressed within this planning process. The Service did consider all issues that were raised throughout the planning process and has developed a plan that attempts to balance competing opinions regarding important issues. The Service identified those issues that, in its best professional

judgment, are priorities for future refuge management. The priority issues for visitor services are summarized below.

- Need for increased support of fishing and hunting activities
- Demand for more or upgraded public use activities
- Lack of improved signage and access to information
- Need for effective environmental education programs to help minimize negative impacts to wildlife and habitat

Visitation and recreation is expanding at a rapid pace and staff levels and budgets declined with the increasing demand. Most visitor facilities are getting significant daily use but little daily or weekly maintenance. In some cases, the increasing use is impacting wildlife, and conflicts between user groups have occurred. Educating the next generation of users is a priority, but it would be a challenge considering the list of issues facing refuge staff.

The refuge is charged with the wise stewardship of wildlife and plant resources, while at the same time allowing appropriate and compatible wildlife-dependent visitor activities. The guiding principal that directs the Visitor Services Program is the Improvement Act and the six priority wildlife-dependent uses identified for refuge lands. These six uses include: hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation. Non-wildlife dependent uses are discouraged from occurring on refuge lands.

THEMES, MESSAGES, AND TOPICS

The refuge provides opportunities for public uses that are compatible with the purposes for which the refuge was established and can be supported based on funding and staffing levels. Hunting and fishing are two of the six priority public uses on national wildlife refuges. At this time, the refuge offers a wide variety of hunting and fishing opportunities and limitations have been placed to ensure compatibility. Overall, the most common question from the public is the desire for more improved access to the refuge for recreation. However, these requests often conflict with the purpose of the refuge. Some requested uses that have been determined to be inappropriate include riding all-terrain vehicles, camping, and entering closed areas (see CCP Appendix F). Providing for public safety and compatible public uses requires a balanced approach and a focus on refuge priorities.

As one of the six priority public uses, the refuge staff strives to make environmental education an important program for the surrounding community and the general public. The refuge and the Starkville School District partner to staff and provide resources at the refuge's education center, which hosts school groups from throughout Mississippi.

Good quality, available sources of refuge information are critical to the public's appreciation and use of refuge resources. Information dissemination provides a vehicle for the Service to communicate to the public the many recreational opportunities available on the refuge, as well as the value of the natural resources. Limited resources often inhibit providing the much needed information to the public. The refuge needs to continue to seek improved methods for providing information while managing for resource management goals and the refuge's establishing purposes.

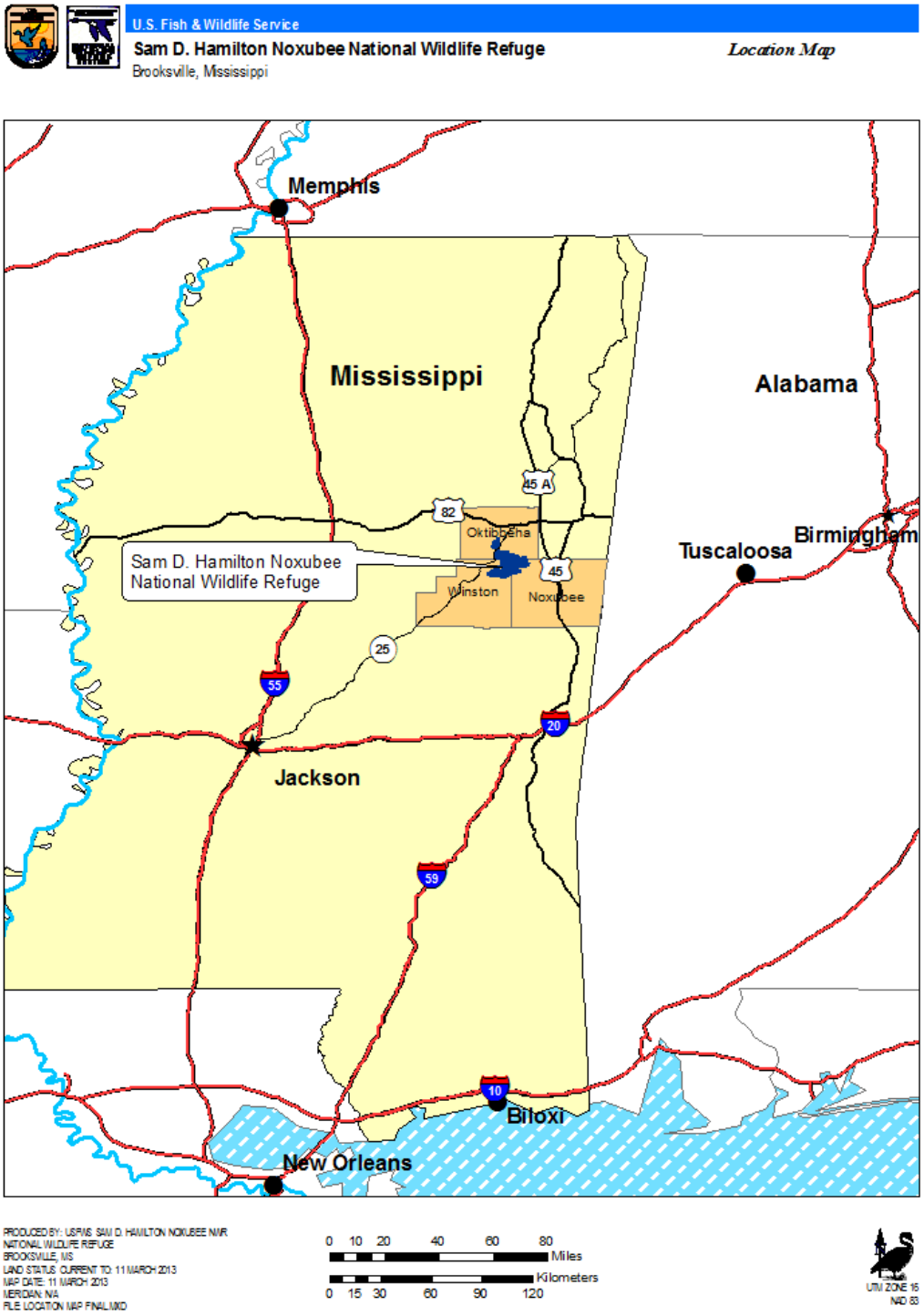
VISITOR FACILITIES

Existing public amenities include:

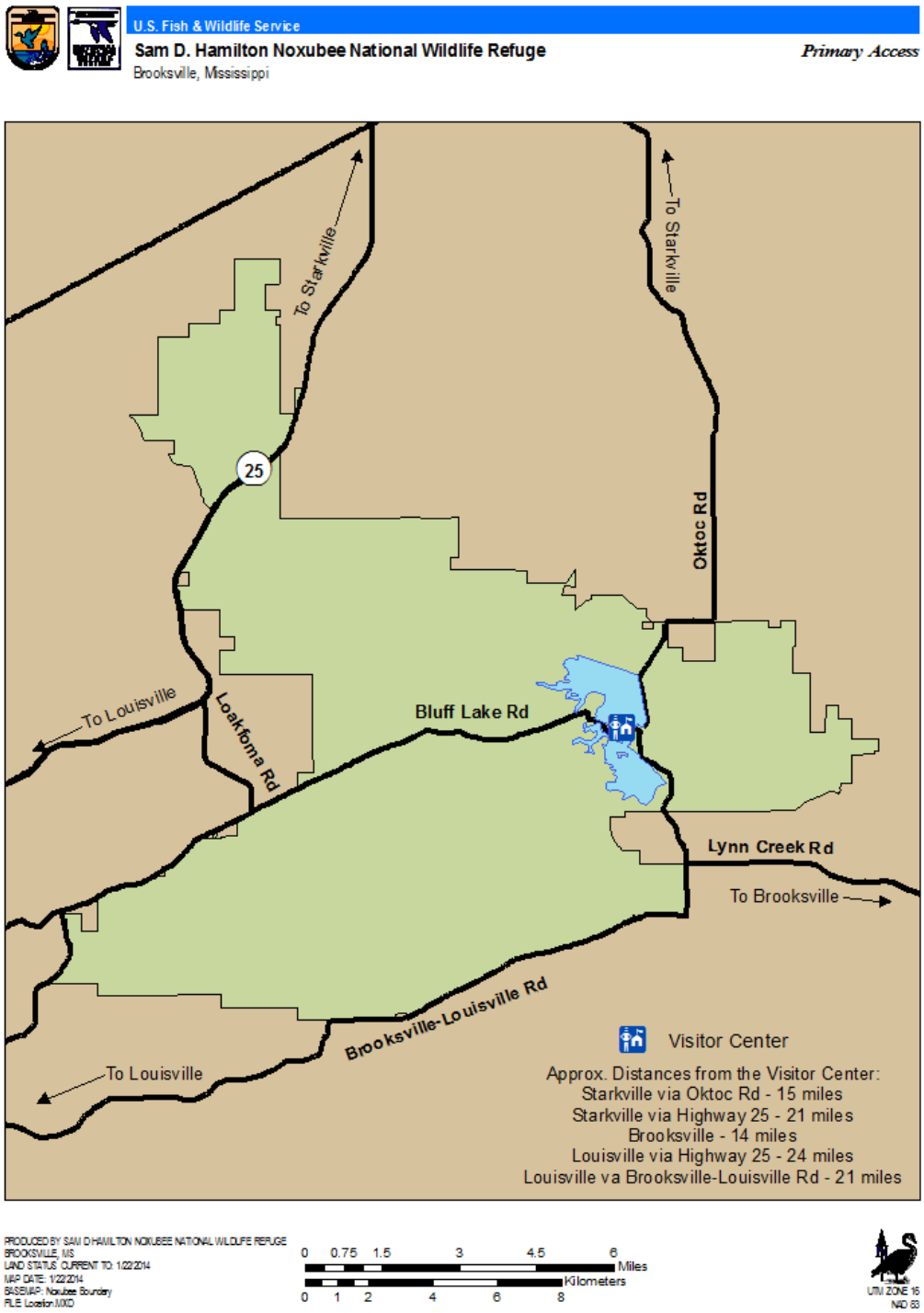
- Sam D. Hamilton Noxubee NWR Visitor Center
- Public Restrooms
- Bluff Lake Boardwalk
- Bluff Lake Boat Ramp and Parking Area
- Cypress Cove Boardwalk
- Ross Branch Non-motorized or Limited Access Boat Ramps (graveled)
- Cypress Cove Two Non-motorized or Limited Access Boat Ramps (graveled)
- Goose Overlook
- Loakfoma Lake Overlook/Tower
- Loakfoma Lake Handicapped Fishing Jetty
- Morgan Hill Overlook
- Morgan Hill Prairie Trail
- Webster Memorial
- Four Informational Kiosks
- Multiple Parking Areas
- Loakfoma Boat Ramp
- Seven Hunter Check Stations
- Woodpecker Trail
- Ray Watson Memorial Trail
- Beaver Dam Trail
- Scattertown Trail
- Craig Pond Trail
- Wilderness Trail
- Trail of Big Trees

VISITOR SERVICES MAP(S)

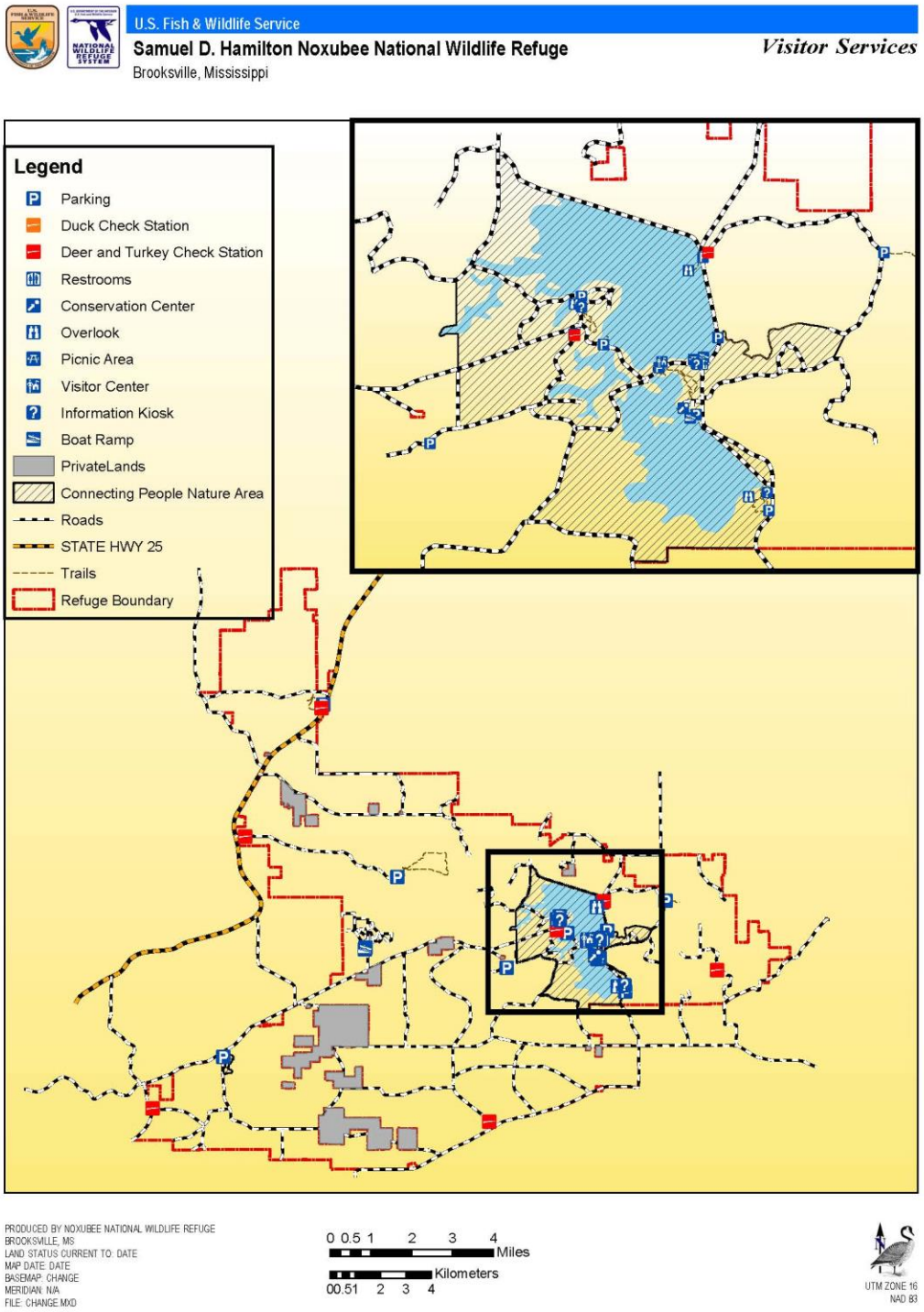
Location map



Access map


U.S. Fish & Wildlife Service
Sam D. Hamilton Noxubee National Wildlife Refuge
Brooksville, Mississippi
Primary Access
To Starkville
To Starkville
25
Oktoc Rd
To Louisville
Loakfoma Rd
Bluff Lake Rd
Lynn Creek Rd
To Brooksville
Brooksville-Louisville Rd
To Louisville
Visitor Center
Approx. Distances from the Visitor Center:
Starkville via Oktoc Rd - 15 miles
Starkville via Highway 25 - 21 miles
Brooksville - 14 miles
Louisville via Highway 25 - 24 miles
Louisville va Brooksville-Louisville Rd - 21 miles
PRODUCED BY SAM D HAMILTON NOXUBEE NATIONAL WILDLIFE REFUGE
BROOKSVILLE, MS
LAND STATUS CURRENT TO: 1/22/2014
MAP DATE: 1/22/2014
BASEMAP: Noxubee Boundary
FILE: Location.MXD
0 0.75 1.5 3 4.5 6 Miles
0 1 2 4 6 8 Kilometers
UTM ZONE 16
NAD 83

Public amenities map



REFUGE VISITATION TRENDS AND IDENTIFYING AUDIENCES

SOCIOECONOMIC ENVIRONMENT

The refuge consists of 48,219 acres within the 61,715-acre approved acquisition boundary. Its northern boundary is about 5 miles south-southwest of Starkville, Mississippi, and about 12 miles west of Brooksville, Mississippi. The largest municipality and population center in the area is Columbus, Mississippi, about 35 miles to the northeast, in Lowndes County.

The region encompassing the refuge, often referred to as the Golden Triangle, is supported by an agricultural and timber economy. Much of the area is forested, and the forest products industry is vital to the region's local economy. Forestry is second only to farming as the largest industry in Mississippi. Manufacture of wood products also form the second largest manufacturing sector in Mississippi. Most of the forest industry is based on privately owned forested land, which tends to be in smaller scattered parcels. Concurrently, the number of working farms is declining and the size of larger corporate farms is increasing regionally. While agricultural and timber products have always been a large component of the economy, beginning in the 1950s and continuing until the national recession in the 1980s, manufacturing became the primary source of employment and income for the area's population. Growth in this sector slowed somewhat during the late 1990s. Currently, value-added manufacturing is seen as the most promising field for economic development in the region.

The total population of the three counties in which the refuge is located is about 78,161 people, or only about 3 percent of the state's population, and grows at about 2.4 percent every 5 years (Table 1). The people in these counties typically are native to the state, have a per capita income of about $16,000, with about 76 percent of persons over the age of 25 having high school diplomas (U.S. Department of Census 2011 Estimate).

VSP Table 1. Demographic Characteristics for the Local Counties, Mississippi and the United States, 2012

Characteristic	Oktibbeha County	Noxubee County	Winston County	State of Mississippi	United States
Demographic					
Population, 2012	48,192	11,218	19,029	2,977,457	311,587,816
Total Land Area (square miles)	458.2	695.14	607.25	46923.27	3531905.43
Population change (%), 2010-2012	1.1	-2.8	-0.9	0.3	0.9
Population Density (population/square mile)	105.1	16.1	31.3	63.2	87.4
Race/Ethnicity (% of Population)					

Characteristic	Oktibbeha County	Noxubee County	Winston County	State of Mississippi	United States
White	59	27	51.9	60	78.1
Black/African American	36.8	71.8	46	37.3	13.1
Hispanic/Latino (of any race)	1.6	0.9	1	2.9	16.7
Asian	2.8	0.2	0.2	0.9	5
Education (% of population over 25)					
High School degree	85.9	64.7	80.6	80.3	85.4
College degree	41.7	12.1	15.3	19.7	28.2
Economic					
Median Household Income	29,013	21,798	33,007	38,718	52,762
Per capita Income	19,330	12,508	18,313	20,521	27,915
Individuals below poverty level (%)	34.1	36.1	22.8	21.6	14.3

The refuge plays an important role in the economy of local communities and the region. With annual visitation of more than 160,000 visits, the refuge is an important destination for people seeking recreational and educational opportunities, attracting local residents as well as tourists. Approximately one-third of these visitors participate in consumptive use activities such as hunting and fishing, while the other two-thirds are involved in non-consumptive recreation (e.g., bird watching, sightseeing, hiking, picnicking, etc.) or education. Most, if not all, utilize services provided by local vendors within the surrounding communities, thus infusing money into the local economy.

VISITOR CAPACITY

Balancing the needs of visitors and the goal of protecting and managing resources can be challenging. In addition to resource protection, visitor capacity also impacts quality of experience for visitors. Visitor capacity is not always about limiting numbers of visitors. It is also about visitor experience and limiting impacts to resources.

IMPLEMENTATION STRATEGIES

This section uses Visitor Services Standards (Standards) to discuss relevant CCP goals and objectives. Many visitor services related objectives may be found within non-visitor services focused CCP goals (i.e., Fish and Wildlife Populations, Habitat Management, Resource Protection, and Refuge Administration). The process of using the Standards will identify existing CCP strategies and develop additional strategies that will form the basics of the

Visitor Services Plan. Table 2 lists all CCP goals and the corresponding objectives that are relevant to Visitor Services:

VSP Table 2. CCP Goals Summary

MANAGEMENT GOALS	OBJECTIVES
Goal B - Manage and protect habitats for migratory and native wildlife on the refuge to contribute to the purposes for which the refuge was established, as well as to fulfill the mission of the Refuge System (620 FW 1, USFWS 2002).	*Sub-goal B.4:* Manage the 1,200-acre proposed Wilderness to retain its primeval character and influence.
GOAL C - Protect the natural and cultural resources of the refuge	*Sub-goal C.1:* Maintain, preserve, and protect archaeological, cultural, historic, and natural resources representing the natural and cultural history of the local area.
GOAL D - Provide opportunities for compatible wildlife-dependent public uses that promote an understanding and appreciation of fish, wildlife, habitat conservation, and the mission of the Refuge System (605 FW 2, USFWS 2006).	*Sub-goal D.1:* Provide hunting opportunities while ensuring safe, compatible, and quality experiences.
	Sub-goal D.2: Provide fishing opportunities while ensuring safe, compatible, and quality experiences (605 FW 3, USFWS 2006).
	Sub-goal D.3: Provide wildlife observation and photography opportunities while ensuring safe, compatible, and quality experiences.
	Sub-goal D.4: Ensure the refuge is welcoming and visitors are provided with clear information that promotes and raises public awareness of the refuge and the Service.
	Sub-goal D.5: Promote and utilize the Larry Box Environmental Education Center and other refuge resources to expand and enhance environmental education opportunities.
	Sub-goal D.6: Manage public access to provide a safe human experience in an environmentally appropriate manner to support wildlife-dependent priority public uses while ensuring uses are compatible with the refuge purposes.
	Sub-goal D.7: Provide outreach opportunities that promote an understanding and appreciation of fish, wildlife, habitat conservation, and the mission of the Refuge System.
	Sub-goal D.8: Manage abandoned agricultural open field areas to the community type most suitable for meeting the refuge goals and objectives.

MANAGEMENT GOALS	OBJECTIVES
GOAL E - Provide sufficient leadership, staffing, information, and infrastructure to manage and protect migratory and native wildlife populations and their habitats, cultural resources, and compatible public uses that contribute to the purposes for which the refuge was established as well as the mission of the Refuge System.	*Sub-goal E.1:* Maintain quality programs, facilities, and infrastructure along with a highly skilled and trained professional staff.

Standard 1: Develop a Visitor Services Plan

Policy (605 FW 1.14 A)

The policy states that the national wildlife refuge managers will develop a Visitor Services Plan that addresses all compatible wildlife-dependent recreational uses on their refuge.

Current program discussion:

This plan describes those visitor services programs that have been determined to be both appropriate and compatible with the mission of the Refuge System and the purposes for which the refuge was established.

Standard 2: Hunting

Policy (605 FW 2)

The policy states hunting is an appropriate use of wildlife resources of the Refuge System. When compatable, hunting programs are to be quality programs, conducted in a safe and cost-effective manner, and to the extent practicable, carried out in accordance with state regulations.

Current program discussion:

Sam D. Hamilton Noxubee NWR offers the public a wide range of hunting opportunities including quota deer seasons using archery, primitive weapon and modern gun, as well as special opportunities for youth and mobility impaired hunters. The refuge serves a wide audience and is visited by hunters living throughout the southeast. Deer and squirrel hunting remain the most popular public hunting opportunities, followed by a quota waterfowl, general turkey, and general furbearers. In addition to these hunting seasons, refuge hunters have the opportunity to harvest beaver, nutria, and feral hog (*Sus scrofa*) incidental to any hunt with weapons that are legal for that particular hunt.

Goal(s), Objective(s), and Strategies

CCP Goal: Provide opportunities for compatible wildlife-dependent public uses that promote an understanding and appreciation of fish, wildlife, habitat conservation, and the mission of the Refuge System (605 FW 2, USFWS 2006).

CCP Sub-goal D. 1: Provide hunting opportunities while ensuring safe, compatible, and quality experiences.

Objective D.1.1: Review and, if needed, update the Hunt Plan annually in conjunction with state agency and public input.

- Strategy D.1.1.1: Participate in state coordination meetings.
- Strategy D.1.1.2: Periodically host open house to increase public participation.

- Objective D.1.2: Promote hunting in areas other than the area defined as the "Connecting People with Nature" area.
    - Strategy D.1.2.1: Maintain, and if needed, increase information kiosks and check stations available to hunters.
    - Strategy D.1.2.2: Develop a disabled (as defined by Mississippi Admin Code Title 40 Part 2 Chapter 2 Rule 1.4 Special Use Regulations for Individuals with Disabilities) hunter program which provides for a natural hunting experience and increased access.
- Objective D.1.3: Ensure that water management associated with waterfowl hunting is compatible with the forest structure and forest species composition while providing public hunting opportunities.
    - Strategy D.1.3.1: Move waterfowl hunting areas so no one GTR is flooded more frequently than twice within a 5-year period.
    - Strategy D.1.3.2: Allow up to two years of consecutive hunting within any one GTR.
- Objective D.1.4: Continue to ban use of all-terrain vehicles (ATVs) and utility terrain vehicles (UTVs) and other off-road vehicles.
    - Strategy D.1.4.1: Use the refuge's special use permit system to address individual users needing special consideration.
    - Strategy D.1.4.2: Restrict use of ATVs and UTVs to administrative uses only.
- Objective D.1.5: Continue to ban use of horses and other forms of equestrian uses.
    - Strategy D.1.5.1: Maintain road system to allow ample access by way of vehicle.
    - Strategy D.1.5.2: When not inside the proposed Wilderness Area, allow hunters and anglers to use bicycles and push-pull carts.
- Objective D.1.6: Continue to protect the American alligator from harvest within the refuge boundary.
    - Strategy D.1.6.1: Continue to ban the hunting of alligators on the refuge.
    - Strategy D.1.6.2: Work with state biologists to manage individual alligators that become a threat to humans.
- Objective D.1.7: Establish parking areas along Bluff Lake Road to allow better hunting access.

- Strategy D.1.7.1: Attempt to provide at least one parking area for every half mile of road distance.
- Strategy D.1.7.2: Identify and map areas currently favored by refuge users and consider development of nearby parking areas.

- Objective D.1.8: Partner with State of Mississippi and non-governmental organizations to host hunting opportunities for youth and disabled hunters.
  - Strategy D.1.8.1: Provide a disabled turkey hunter season open to qualifying hunters.
  - Strategy D.1.8.1: Provide a disabled deer hunter season open to qualifying hunters.
  - Strategy D.1.8.2: Continue to host youth squirrel hunting class in partnership with state and non-governmental organizations.

Significant Program Changes:

Under this plan, the refuge intends to offer greater amounts of public recreation through safer parking areas and hunts designed toward better meeting the needs of the disabled. Waterfowl hunters will also be given a more diverse hunting experience as the yearly hunting locations rotate among the GTRs. Beyond these changes, most changes will constitute updating language. Consideration will be given to opening newly acquired properties with refuge hunting regulation matching those in adjacent units. Establishment of the "Connecting People with Nature" and "Experiencing Nature" areas will help reduce user group conflicts and increase visitor safety and provide non-consumptive users better opportunities to learn about the refuge's natural resources. Within the "Experiencing Nature" area, hunting will be promoted and additional hunting opportunities facilitated when compatible with the purpose of the refuge. For instance, more opportunity may be offered for hunting squirrels with dogs and deer with archery equipment. Fees associated with quota deer and quota waterfowl will continue and increase to $20.

Monitor and Evaluate:

Hunter check stations are currently used to collect data on the hunt success, which would continue. Hunters will be required to report game harvested on the refuge using a Service Harvest Report Card (OMB Control Number 1018-0140). If through biological evaluation, game populations are determined to be unhealthy, or safety issues become a problem, the quota permit system may be expanded or modified.

Standard 3: Fishing

Policy (605 FW 3)

This policy states fishing is an appropriate use of the Refuge System. When compatible, fishing programs are to be quality programs conducted in a safe and cost-effective manner, and to the extent practicable, carried out in accordance with state regulations.

Current Program Discussion:

Since establishment of the refuge, fishing has been offered at the refuge; from 1940 until the mid-1970s, fishing operated under a fee program. Opportunities exist for anglers to fish in refuge lakes during a limited timeframe, from March 1 through October 31 except for those specifically posted as "Closed To All Entry." Additionally, the Noxubee River and man-made ponds along Highway 25 are open year-round for recreational fishing.

Goal(s), Objective(s), and Strategies

CCP Goal: Provide opportunities for compatible wildlife-dependent public uses that promote an understanding and appreciation of fish, wildlife, habitat conservation, and the mission of the Refuge System (605 FW 2, USFWS 2006).

Sub-goal D.2: Provide fishing opportunities while ensuring safe, compatible, and quality experiences (605 FW 3, USFWS 2006).

- Objective D.2.1: Open year-round bank fishing on Bluff Lake where and when compatible with other priority uses.
  - Strategy D.2.1.1: Open to year-round bank fishing within Bluff Lake along eastern levee and southern shore.
  - Strategy D.2.1.2: Open plunge pool below Bluff Lake radial arm structure to year-round fishing.
- Objective D.2.2: Continue to support and expand handicapped fishing opportunities according to American Disablities Act (ADA) guidlines.
  - Strategy D.2.2.1: Replace fishing pier at Ross Branch Reservoir with handicapped accessible floating pier.
  - Strategy D.2.2.2: Replace fishing dock at Loakfoma Lake boat ramp with handicapped accessible floating pier.
  - Strategy D.2.2.3: Continue to develop handicapped fishing peninsula within Loakfoma Lake for use by wheelchair-bound anglers.
  - Strategy D.2.2.4: Ensure piers and jetty meet ADA guidelines.
- Objective D.2.3: Designate a non-motorized Bluff Lake boat launch near Cypress Cove.
  - Strategy D.2.3.1: Limit motorized boats within Bluff Lake to be launched from the improved concrete boat ramp on the southeast shore of the lake.
  - Strategy D.2.3.2: Consider development of concession for non-motorized boat rentals near Cypress Cove.

- Objective D.2.4: Establish improved parking areas for spillways at Loakfoma and Bluff Lake, and Ross Branch Reservoir.
    - Strategy D.2.4.1: Provide paved drive and parking at Loakfoma Lake.
    - Strategy D.2.4.2: Provide paved parking at Bluff Lake motorized ramp and spillway lots.
    - Strategy D.2.4.3: Improved graveled parking at Ross Branch Reservior.

Significant Program Changes:

Fishing will be promoted and additional opportunities and accommodations will be facilitated when possible. An example of additional opportunities is allowing bank fishing year-round on the west side of the lake from the Bluff Lake Boardwalk to the Cypress Cove Boardwalk. A separate non-motorized boat lunch will be designated in place of the unimproved motorized launch near Cypress Cove of Bluff Lake. Facilities will continue to be developed toward creating better access for disabled users.

Monitor and Evaluate:

The refuge would continue to partner with Mississippi State University, Mississippi Department of Wildlife, Fisheries, and Parks, and Private John Allen Fish Hatchery to complete creel surveys as well as fish sampling.

Standard 4: Wildlife Observation and Wildlife Photography

Policy (605 FW 4 and 604 FW 5)

These policies state that wildlife observation and wildlife photography are appropriate wildlife-dependent recreational uses of Refuge System lands. When compatible, visitors of all ages and abilities are to have an opportunity to observe and photograph key wildlife and habitat resources of the refuge. Viewing and photographing wildlife in natural or managed environments should foster a connection between visitors and natural resources.

Policy (605 FW 1 and 603 FW 1)

The Improvement Act states that compatible wildlife-dependent recreational uses are the priority public uses of the Refuge System (hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation) and will receive enhanced consideration over other general public uses. Volunteers, partners, recreation fees, and concessions are tools available to assist in managing these uses. We will only permit other uses when we determine that they are legally mandated, provide benefits to the Service, occur due to special circumstances, or facilitate one of the priority wildlife-dependent recreational uses.

Policy (50 CFR Part 25.61) and Director's Order No.139

This policy and director's order discusses the Service's policy for concession management and provides guidance for permitting and administering concession operations on Service lands. Concessions are used to assist refuges in providing wildlife-dependent recreation activities to the

visiting public. The concessions are managed through contracts between the Service and a private entity, where the private entity is allowed to charge a fee for services provided at a refuge to the visiting public.

Policy (50 CFR 29.1; 50 CFR 27.97; 8 RM 16; 603 FW 1; 605 FW 5)

A commercial recreational use is a use that generates revenue or that results in a commodity which can be sold for income or revenue. Before considering compatibility, the use must be appropriate and determined to contribute to the achievement of the refuge purpose or the mission of the Refuge System, as outlined in 50 CFR 29.1.

To be allowed on a refuge, a commercial use must go beyond the "not materially interfere with…" requirement and must contribute to the achievement of the refuge purpose or mission of the Refuge System. The contribution must be clearly defined in the justification section of the compatibility determination for any commercial use.

Title 50 CFR 27.97, Private Operations, prohibits an unauthorized commercial enterprise on any national wildlife refuge. Thus, commercial tours are required to apply for a special use permit from the refuge manager. By establishing a special use permit system, the refuge staff is able to set sustainable limits on the number of permits issued.

In determining if a commercial recreational use is compatible, one way to connect it to the mission of the Refuge System is to determine if the commercial recreation use will facilitate one of the wildlife-dependent priority public use activities which are "directly related to the mission of the Refuge System" (Improvement Act).

Current program discussion:

An estimated 160,000 visits occur on the refuge annually. Visitors can enjoy over 42,000 acres of accessible refuge lands. Currently, both non-consumptive and consumptive user groups can utilize all open areas of the refuge. For example, hikers can walk into areas where hunters are hunting. As the non-consumptive user group grows, the refuge recognizes many of these visitors are not prepared for the wildness of some areas of the refuge.

Goals, Objectives, and Strategies

CCP Goal: Provide opportunities for compatible wildlife-dependent public uses that promote an understanding and appreciation of fish, wildlife, habitat conservation, and the mission of the Refuge System (605 FW 2, USFWS 2006).

Sub-goal D.3: Provide wildlife observation and wildlife photography opportunities while ensuring safe, compatible, and quality experiences.

- Objective D.3.1: Establish a defined area around Bluff and Loakfoma lakes to serve as a "Connecting People with Nature" area for public users requiring greater support and developed amenities.

- Strategy D.3.1.1: Replace existing public restrooms with self-contained, prefabricated restroom facility, eliminating water and power use.
- Strategy D.3.1.2: Transition existing picnic area to serve as a “Connecting People with Nature” or wildlife viewing areas for families and users less able to experience the entire refuge.
- Strategy D.3.1.3: Manage refuge trails to include only those within the “Connecting People to Nature” area and the Scattertown Trail.
- Strategy D.3.1.4: If found compatible, limit non-wildlife dependent activities (e.g., weddings) to only the “Connecting People with Nature” areas.
- Strategy D.3.1.5: Establish seasonal closure of trail segments within the RCW Clusters during periods of RCW nesting when in conflict with trail system.
- Strategy D.3.1.6: Establish a developed (i.e., paved) wildlife observation trail for both bicycles and pedestrians extending from the motorized boat launch at Bluff Lake, and past the office and visitor center along the shore of Bluff Lake ending at the Goose Overlook. A loop extension would then proceed to the Smith Fields, down Goose Pen Road to Ennis Road, then around the southern end of Loakfoma Lake. The trail would then loop back to its origin along the paved Loakfoma Road.
- Strategy D.3.1.7: Consider use of concessions to provide non-motorized canoe and kayak rentals for use within the “Connecting People with Nature” area.
- Strategy D.3.1.8: Consider use of commercial activities including commercial filming, weddings, photography, and wildlife observation tours.
- Strategy D.3.1.9: Prohibit hunting within the “Connecting People with Nature” area unless connected to specific education program.

- Objective D.3.2: Establish a defined area outside Bluff and Loakfoma lakes to serve as the “Experiencing Nature” area for public users receiving little to no support and developed amenities.
  - Strategy D.3.2.1: Limit recreational bicycling to roads open to motorized vehicles and trails specifically designated for bicycle use.
  - Strategy D.3.2.2: Discontinue maintenance of the Wilderness Trail, Trail of Big Trees, and Craig Pond Trail.
  - Strategy D.3.2.3: Encourage exploration through cultural and historical plaque system.

Sub-goal D.8**:** Manage abandoned agricultural open field areas to the community type most suitable for meeting the refuge goals and objectives.

- Objective D.8.1: Manage existing open fields for forested habitat when that is the best use of the land.
  - Strategy D.8.1.1: Replant or allow natural succession of trees into fields needed for the management of forest breeding birds or RCW.
- Objective D.8.2: Manage existing open fields as fields when not needed for management of forest breeding birds or RCW.
  - Strategy D.8.2:1: Manage existing open fields within the Keaton Tower area for grassland songbirds and other native wildlife.
  - Strategy D.8.2.2: Manage up to 30 acres at Goose Overlook Field of nonnative grasses for winter wildlife foraging as part of Public Use Program.
  - Strategy D.8.2.3: Maintain 31 acres of the Prairie Demonstration Area (Morgan Hill) as a Blackbelt Prairie Demonstration Area and regenerate the remaining acres into a mixed pine habitat to supplement RCW habitat in that area.

Significant Program Changes:

Changes from current conditions include establishing a defined area around Bluff and Loakfoma lakes to serve as a “Connecting People with Nature” area for public users requiring greater support and developed amenities. This area would have developed (i.e., paved) wildlife observation trail for both bicycles and pedestrians extending from the motorized boat launch at Bluff Lake, and past the office and visitor center along the shore of Bluff Lake ending at the Goose Overlook. A possible loop extension would then proceed to the Smith Fields, down Goose Pen Road to Ennis Road, then around the southern end of Loakfoma Lake. The trail would then loop back to its origin along the paved Loakfoma Road. All areas outside this defined area would serve as the “Experiencing Nature” area for public users, requiring little to no support and developed amenities.

Monitor and Evaluate:

A monitoring program would be established to evaluate wildlife impacts from the new trails, kayak routes, and viewing area, as well as canoeing and kayaking in the refuge waters especially near rookeries. Negative wildlife disturbances would be recorded. The staff would evaluate the disturbances, and if problems are identified, find ways to minimize or eliminate the problems. If necessary, a canoe route, viewing facility, or open water area can be closed seasonally or the use can be modified or moved.

Standard 5: Environmental Education

Through formal, curriculum-based environmental education tied to national and state education standards, the Refuge System is to advance public awareness, understanding, appreciation, and

knowledge of key fish, wildlife, plants, and their habitats. Each refuge staff person is to assess his/her potential to work with schools in providing an appropriate level of environmental education. Refuges may support environmental education through the use of facilities, equipment, educational materials, teacher workshops, and study sites that are safe and conducive to learning.

Current program discussion:

The Larry Box Environmental Education Center is a partnership between the refuge and the Starkville School District. It serves as a great way to connect children and young adults to nature. Only phase 1 of a first 3 phases of the project has been completed. When fully completed, the education center will be a self-sustaining facility to provide food, lodging, and support staff. Currently, only Starkville School District classes are able to use the Environmental Education Center at no cost. Other school districts must pay $5 per student for use of the facility.

Goals, Objectivess, and Strategies

CCP Goal: Provide opportunities for compatible wildlife-dependent public uses that promote an understanding and appreciation of fish, wildlife, habitat conservation, and the mission of the Refuge System (605 FW 2, USFWS 2006).

Sub-goal D.5: Promote and utilize the Larry Box Environmental Education Center and other refuge resources to expand and enhance environmental education opportunities.

- Objective D.5.1: Through a continued partnership and coordination with Starkville School District, Mississippi State University, and other educational groups, the refuge will continue to facilitate environmental education programs at the center along with coordinated use of the refuge's visitor center and other refuge facilities.
    - Strategy D.5.1.1: Support wildlife-based educational activities and curriculum through the center while following state and national core curriculums for elementary, middle, high school, and college students.
    - Strategy D.5.1.2: Develop better signage to keep general public from disrupting with classes.
    - Strategy D.5.1.3: Seek alternative funding and support opportunities for the center to support higher levels of participation by both schools inside and outside the Starkville School District.
- Objective D.5.2: Review and update the agreement with Starkville School District.
    - Strategy D.5.2.1: Promote the usage of the center for environmental education and educationally based meetings.
    - Strategy D.5.2.2: Ensure no unauthorized access to the center and Douglas Bluff environmental education zones.

- Strategy D.5.2.3: Encourage greater active involvement of other area school systems.

Sub-gaol D.8**:** Manage abandoned agricultural open field areas to the community type most suitable for meeting the refuge goals and objectives.

CCP Strategies:

- Strategy D.8.3: Maintain 31 acres of the Prairie Demonstration Area (Morgan Hill) as a Blackbelt Prairie Demonstration Area and regenerate the remaining acres into a mixed pine habitat to supplement RCW habitat in that area.

Significant Program Changes:

The refuge would assist in developing standard based curriculums for state and national core curriculums for elementary school, middle school, high school, and college students

Monitor and Evaluate:

The refuge would monitor and evaluate environmental education based on the representation of the communities and number of students visiting for education. Teacher feedback would be considered in further development of the program.

Standard 6: Interpretation

Policy (605 FW 1.14 B)

Under this policy, refuges are to be welcoming, safe, and accessible. Refuges should provide visitors with clear information so they can easily determine where they can go, what they can do, and how to safely and ethically engage in recreational and educational activities. Facilities will meet the quality criteria defined in 605 FW 1, Section 1.6 of the Service Manual. Refuge staff should treat visitors with courtesy and in a professional manner.

Policy (605 FW 7)

Refuges are to communicate the most important fish, wildlife, habitat, and other natural resource issues to visitors of all ages and abilities through effective interpretation. Staff are to tailor messages and delivery methods to specific audiences and present them in appropriate locations. Through heightened awareness, refuges are to inspire visitors to take positive actions supporting refuge goals and the Refuge System mission.

Current program discussion:

Many current visitors using the refuge's picnic area, boardwalks, trails, and observation towers are unaware of the fact they are visiting a national wildlife refuge. This is a crisis of identity for the refuge. As visitation grows, the refuge must find a way to connect the mission of the Service to the areas used by visitors.

Goals, Objectives, and Strategies

CCP Goal: Provide opportunities for compatible wildlife-dependent public uses that promote an understanding and appreciation of fish, wildlife, habitat conservation, and the mission of the Refuge System (605 FW 2, USFWS 2006).

Sub-goal D.4: Ensure the refuge is welcoming and visitors are provided with clear information that promotes and raises public awareness of the refuge and the Service.

- Objective D.4.1: Maintain refuge signs at or above current standards as stated in refuge sign manual.
  - Strategy D.4.1.1: Encourage greater volunteer involvement in maintenance of refuge assets.
  - Strategy D.4.1.2: Develop and install trail-head signs.
- Objective D.4.2: Establish interpretive signage throughout the "Connecting People with Nature" area.
  - Strategy D.4.2.1: Identify key use and gathering locations for the visiting public.
  - Strategy D.4.2.2: Develop information kiosks best suited for informing and educating based on the use occurring within the location.

Significant Program Changes:

Establishing a defined area around Bluff and Loakfoma lakes to serve as a "Connecting People with Nature" area for public users requiring greater support and developed amenities.

Monitor and Evaluate:

A monitoring program would be established to evaluate wildlife impacts from the new trails, kayak routes, and viewing area, as well as canoeing and kayaking in the refuge waters especially near rookeries. Negative wildlife disturbances would be recorded. The staff would evaluate the disturbances, and if problems are identified, find ways to minimize or eliminate the problem. If necessary, a canoe route, viewing facility, or open water area can be closed seasonally or the use can be modified or moved.

Standard 7: Outreach

Policy (605 FW 1.14I)

Effective outreach depends on open and continuing communication between the refuge staff and the public. This communication involves determining and understanding the issues, identifying audiences, crafting messages, selecting the most effective delivery techniques, and evaluating effectiveness. Achieved results will further the mission of the Refuge System and purpose(s) of the refuge. *See the National Outreach Strategy: A Master Plan for Communicating in the U.S. Fish and Wildlife Service,* and *America's National Wildlife Refuge System: 100 on 100 Outreach Campaign*.

Current program discussion:

The use of social media has gained popularity in recent years. It is our goal to offer more quality information to this new age of technology savvy visitors. Using this new technology to promote our "Wildlife First" mission will increase awareness to many new user groups.

Goals, Objectives, and Strategies

CCP Goal: Provide opportunities for compatible wildlife-dependent public uses that promote an understanding and appreciation of fish, wildlife, habitat conservation, and the mission of the Refuge System (605 FW 2, USFWS 2006).

Sub-goal D.7: Provide outreach opportunities that promote an understanding and appreciation of fish, wildlife, habitat conservation, and the mission of the Refuge System.

- Objective D.7.1: By 2015, redesign refuge web page for ease of access and use.
  - Strategy D.7.1.1: Follow Department of the Interior and Service standards in development of web page.
  - Strategy D.7.1.2: Incorporate video and other features to encourage use by the general public.
  - Strategy D.7.1.3: Provide Watson Trail mp3 audio tour files for public download.
- Objective D.7.2: Participate in community development activities such as the Chamber of Commerce and Rotary Club.
  - Strategy D.7.2.1: Reestablish Chamber of Commerce memberships in all three counties within refuge boundary.
  - Strategy D.7.2.2: Provide public talks and presentations.
- Objective D.7.3: By 2016, update and distribute information including general, trail, hunting, fishing, and public use information.
  - Strategy D.7.3.1: Conduct yearly review of information
  - Strategy D.7.3.2: Move toward providing greater amounts of information electronically instead of the traditional paper products.
  - Strategy D.7.3.3: Use social media to reach out to the public and inform them of refuge happenings.

Significant Program Changes:

Refuge staff will attempt to write posts weekly and more often if content is available. The staff will utilize social media to communicate with the public. Members of the public may find posts informative

as they may discuss a variety of management activities pertaining to forest health and RCW management, volunteer opportunities, and public events, as well as other relevant information regarding the refuge and the Refuge System and other branches of the Service.

Monitor and Evaluate:

The refuge will use feedback provided through daily interactions with the public, as well as complaints and comments provided by the public to ensure refuge information is efficiently and effectively transferred. Refuge staff will monitor the e-mails and other electronic communication methods, host public events, and communicate with visitors.

Standard 8: Volunteers and Friends

Policy (605 FW 1.14J)

Volunteer and refuge support groups fortify the refuge's staff with their gift of time, skills, and energy and are integral to the future of the Refuge System. Refuge staff will initiate and nurture relationships with volunteers and refuge support groups, and will continually support, monitor, and evaluate these groups with the goal of fortifying important refuge activities. The National Wildlife Refuge System Volunteer and Community Partnership Enhancement Act of 1998 (P.L. 105-242) strengthens the Refuge System's role in developing effective partnerships with various community groups. Whether through volunteers, refuge support groups, or other important partnerships in the community, refuge personnel will seek to make the refuge an integral part of the community, giving rise to a stronger Refuge System.

Current program discussion:

The refuge has a quickly increasing number of volunteers providing important help to the refuge that range from helping at special events to resident volunteers staying at the refuge. Volunteer recruitment is an ongoing effort and all new volunteers receive appropriate orientation and training prior to work assignments. The refuge's rural location could be a limiting factor with regard to the number of available volunteers who possess the time, interest, and skills to assist on the refuge, but the close proximity of Mississippi State University and the importance of the refuge to the community plays an important role as well.

Community partners include Mississippi State University, Friends of Noxubee, Mississippi Department of Wildlife, Fisheries, and Parks, USDA Forest Service, Wild Turkey Federation, Ducks Unlimited, Bass Pro Shops, Audubon Society, and the Jena Band of the Choctaw Tribe.

Goals, Objectives, and Strategies:

CCP Goal: Provide sufficient leadership, staffing, information, and infrastructure to manage and protect migratory and native wildlife populations and their habitats, cultural resources, and compatible public uses that contribute to the purposes for which the refuge was established as well as the mission of the Refuge System.

> Sub-goal E.1: Maintain quality programs, facilities, and infrastructure along with a highly skilled and trained professional staff.

- Objective E.1.3: Support and expand involvement of additional partnerships including The Friends of Noxubee NWR, Inc.
    - Strategy E.1.3.1: Have direct staff involvement with partnership groups.
    - Strategy E.1.3.2: Develop opportunities for involvement in daily refuge management activities.
    - Strategy E.1.3.3: Participate in state and community level disaster preparedness planning.
- Objective E.1.4: Use volunteers (including commuting and resident RV volunteers), and interns to supplement the work of paid professional staff in staffing the visitor center and completing both routine duties and refuge projects.
    - Strategy E.1.4.1: Develop resident volunteer camper pads.
    - Strategy E.1.4.2: Develop paid or unpaid volunteer coordinator position.
    - Strategy E.1.4.3: Continue to provide and maintain onsite housing for employees, volunteers, and interns, as well as recreational vehicle pads for resident volunteers.
    - Strategy E.1.4.4: Work with other refuges to promote recreational vehicle volunteers.
    - Strategy E.1.4.5: Work with other refuges to advertise recreational vehicle volunteer positions.

Significant Program Changes:

The refuge providing and maintaining onsite housing for employees, volunteers, and interns, as well as recreational vehicle pads for resident volunteers.

Monitor and Evaluate:

Refuge management will work closely with volunteers and interns to ensure they receive the appropriate level of support and guidance. Like employees, long-term volunteers will receive position descriptions and receive feedback on their performance. Volunteers will also be asked for their feedback on how the refuge can improve the program.

9: Recreation Fee Program

Policy (261 FW 1; 263 FW 1); Federal Lands Recreation Enhancement Act of 2004 (P.L. 108-447); U.S. Fish and Wildlife Service Guidance on the Recreation Fee Program – September 2008

"The Federal Lands Recreation Enhancement Act of 2004 (FLREA) allows land management agencies, such as the National Wildlife Refuge System, to charge fees for entry and certain amenities

(user fees). The charging of entrance and user fees at national wildlife refuges can be a helpful management tool if the program is well-managed and implemented."

Current program discussion:

It is the refuge's goal to provide quality public services. Currently, the refuge charges an administrative fee for the white-tailed deer and waterfowl hunts.

Goals, Objectives, and Strategies

CCP Goal: Provide opportunities for compatible wildlife-dependent public uses that promote an understanding and appreciation of fish, wildlife, habitat conservation, and the mission of the Refuge System (605 FW 2, USFWS 2006).

Sub-goal D.6: Manage public access to provide a safe human experience, in an environmentally appropriate manner to support wildlife-dependent priority public uses while ensuring uses are compatible with the refuge purposes.

- Objective D.6.1: Maintain at least seven kiosks in all areas where public users gather.
  - Strategy D.6.1.1: Maintain sufficient kiosks at major refuge access points for public use.
  - Strategy D.6.1.2: Develop online virtual kiosks for visitors.
- Objective D.6.2: Allow public to only use those roads needed to support public use programs while ensuring public safety.
  - Strategy D.6.2.1: Establish limited number of key entry roads into the refuge at the following locations: refuge boundary at Bluff Lake Road near Logan Road, refuge boundary at Bluff Lake Road near Ross Branch Reservoir, the intersection of Singleton and Dummy Line roads, and Loakfoma Road at the Morgan Hill Refuge Boundary.
  - Strategy D.6.2.2: Establish speed control measures to ensure public safety particularly in "Connecting People with Nature" area.
- Objective D.6.3: Maintain visible refuge boundary markers and signs.
  - Strategy D.6.3.1: Routinely check and replace boundary paint and signs.
  - Strategy D.6.3.2: Use GIS and GPS to map and manage realty features.
- Objective D.6.4: Continue to update and enforce refuge regulations according to the Code of Federal Regulations.
  - Strategy D.6.4.1: Update refuge public use information reflecting yearly changes.

        - Strategy D.6.4.2: Review and update the Code of Federal Regulations to properly inform refuge users and protect refuge resources.

    - Objective D.6.5: Establish a public use fee providing exemptions to private inholding landowners and partners (cooperating organizations). (*Footnote: The Service will not charge fees to any person under 16 years of age, any person engaged in a non-recreational activity authorized under a valid permit issued by the refuge, such as landowners using private inholdings, permit for commercial agriculture, etc., Service-authorized research activities, or federal, state, and tribal business, or outings conducted for non-commercial educational purposes by schools or bona fide academic institutions).

        - Strategy D.6.5.1: Establish a public use fee for all users.
        - Strategy D.6.5.2: Maintain quota hunter fees for deer and waterfowl.
        - Strategy D.6.5.3: Maintain a special event permit fee.

Significant Program Changes:

The refuge will initiate a general public use fee to generate alternative funding. Revenue from the program will be used to help pay for restrooms and wildlife viewing improvements in the "Connecting People with Nature" area as outlined in the CCP, and maintain other visitor facilities. The fee is for an individual adult over the age of 15. Visitors will have the option to purchase a daily ($5) pass or annual ($25) public use pass. Quota deer and quota waterfowl permits would be increased from $15 to $20. The fee could be purchased by mail, online, or through local vendors. An estimated $250,000 to $500,000 could be generated from this program annually. In addition to making facility improvements, the revenue generated by the recreational use fee may be used to partially fund one or more staff positions.

Monitor and Evaluate:

As the refuge manages the number of access points into the refuge with the potential to close some graveled roads seasonally to public access while requiring a public access fee, refuge management will monitor public feedback and satisfaction. Gains in resource protection and management of the fee program will undergo continued scrutiny and be adjusted as needed.

10: Wilderness

Policy (Wilderness Act of 1964 (U.S.C. 1131-1136) Public Law 88-577, September 3, 1964)

The Wilderness Act of 1964 directed the Secretary of the Interior, within 10 years, to review every roadless area of 5,000 or more acres (2,024 or more hectares) and every roadless island (regardless of size) within national wildlife refuges and national parks, and to recommend to the President the suitability of each such area or island for inclusion in the National Wilderness Preservation System by later special Acts of Congress. The Wilderness Act provides criteria for determining suitability and contains provisions related to activities that can be undertaken on a designated area.

The Wilderness Act establishes additional purposes for the designated wilderness areas within refuges (50 CFR 29.12), which "shall be administered for the use and enjoyment of the American people in such manner as will leave them unimpaired for the future use and enjoyment as wilderness,

and so as to provide for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness." Proposed wilderness areas are managed so as to protect their wilderness values pending action by Congress.

Current Program discussion:

A Wilderness Review was completed resulting in a 1,200-acre proposed wilderness area within the National Wilderness Preservation System at the refuge in 1974. The proposed wilderness area is managed using the guidance in the refuge manual 6 RM 8, Wilderness Area Management. Additional research natural areas were identified for protection and preservation but no action was taken to clearly document their location nor plans developed for their management.

Goals, Objectives, and Strategies

CCP Goal: Manage and protect habitats for migratory and native wildlife on Sam D. Hamilton Noxubee NWR to contribute to the purposes for which the refuge was established as well as to fulfill the mission of the National Wildlife Refuge System (620 FW 1, USFWS 2002).

Sub-goal B.4 : Manage the Proposed Wilderness Area of 1,200 acres in Management Unit 7 to retain its wilderness character.

- Objective B.4.1: Provide approximately 1,200 acres of bottomland hardwood habitat benefiting forest breeding birds, within the context of protection of wilderness character attributes in accordance with the Wilderness Act.
    - Strategy B.4.1.1: Monitor the effects of passive forest management activities to maintain integrity of desired species composition, habitat structure, and forest health.

Significant Program Changes:

There are no significant changes occurring under this plan.

Monitor and Evaluate:

Law enforcement to ensure public compliance with the Wilderness Act and monitoring of wilderness character will be the ways to assess actions taken under this plan.

III. Implementation Schedule

This table allows the refuge to view all the strategies together as they relate to the project completion timeframes, which is the life of the CCP. See Table 3.

IV. Project Cost

This table is designed to view all the refuge visitor services project costs as they relate to the standards used by the refuge.

VSP Table 3. Project Cost

Projects	Targeted Completion Date	Cost	Funding Source (RONS, SAMMS, VFE, Partnership Funds, Etc.)	Date of Cost Estimation
Develop a disabled hunter program	2015	$500	8081	2014
Establish parking areas along Bluff Lake Road to allow better hunting access	2020	$3,000	8081	2014
Partner to host hunting opportunities for youth and disabled hunters	2015	$2,500	8081	2014
Open year-round bank fishing on Bluff Lake where and when compatible with other priority uses	2015	$1,000	8081	2014
Replace fishing pier at Ross Branch Reservoir with handicapped accessible floating pier	2018	$4,500	8081	2014
Designate a non-motorized Bluff Lake boat launch near Cypress Cove	2015	$1,000	8081	2014
Designate the improved boat ramp as the sole public boat launch for motorized boats within Bluff Lake	2015	$1,000	8081	2014

Projects	Targeted Completion Date	Cost	Funding Source (RONS, SAMMS, VFE, Partnership Funds, Etc.)	Date of Cost Estimation
Ensure Loakfoma Lake fish jetty meets disabled guidelines	2018	$10,000	8081	2014
Establish improved parking areas for spillways at Loakfoma and Bluff lakes, and Ross Branch Reservoir.	2020	$60,000	8081	2014
Establish a defined area around Bluff and Loakfoma lakes to serve as a “Connecting People with Nature” area for public users requiring greater support and developed amenities	2015	$1,950,500	8081	2014
Replace existing public restrooms with self-contained, prefabricated restroom facility, eliminating water and power use	2015	$25,000	8081	2014
Establish seasonal closure of trail segments within the RCW clusters during periods of RCW nesting when in conflict with trail system	2015	$6,000	8081	2014
Limit recreational bicycling to roads open to motorized vehicles and trails specifically designated for bicycle	2015	$4,000	8081	2014

Projects	Targeted Completion Date	Cost	Funding Source (RONS, SAMMS, VFE, Partnership Funds, Etc.)	Date of Cost Estimation
use				
Establish a developed (i.e., paved) wildlife observation trail for both bicycles and pedestrians extending from the motorized boat launch at Bluff Lake, and past the office and visitor center along the shore of Bluff Lake ending at the Goose Overlook. A possible loop extension would then proceed to the Smith Fields, down Goose Pen Road to Ennis Road, then around the southern end of Loakfoma Lake. The trail would then loop back to its origin along the paved Loakfoma Road.	2025	$2,500,000	8081	2014
Develop better signage to keep general public from interfering with classes	2014	$5,000	8081	2014
Maintain refuge signs at or above current standards as stated in refuge sign manual	2014	$10,000	8081	2014
Establish interpretive signage throughout the “Connecting People	2018	$15,000	8081	2014

Projects	Targeted Completion Date	Cost	Funding Source (RONS, SAMMS, VFE, Partnership Funds, Etc.)	Date of Cost Estimation
with Nature" area				
Redesign refuge web page for ease of access and use	2015	$2,000	8081	2014
Update and distribute general information cards, and trail and hunting, fishing and public use brochures	2015	$9,000	8081	2014
Use social media to reach out to the public and inform them of refuge happenings	2015	$1,500	8081	2014
Continue to provide and maintain onsite housing for employees, volunteers, and interns, as well as RV pads for resident RV volunteers	2015	$30,000	8081	2014
Establish a general public entry fee providing exemptions to private inholding landowners and partners (cooperating organizations)	2015	$5,000	8081	2014
TOTAL PROJECT COST		**$4,585,000**		

V. Visitor Services Annual Work Plan

This table allows the individual responsible for the visitor services program to see at a glance the plans for the year and associated deadlines for the task.

VSP Table 4. Visitor Services Annual Work Plan

Category	Event	JAN	FEB	MAR	APR	MAY	JUN	JULY	AUG	SEPT	OCT	NOV	DEC
Annual Events	National Wildlife Refuge Week						X						
	Fishing Derby				X						X		
	Junior Duck Stamp Contest			X									
	Update Hunt Plan			X									
	Update Public Use Brochures						X						
Required Reporting	Fee Recreation Report		X										
	RAPP								X				
	Annual Narrative		X										
	SAMMS								X				
	RONS												
Required Training	Orientation to the Privacy Act							X					
	Record Managemen							X					

Category	Event	JAN	FEB	MAR	APR	MAY	JUN	JULY	AUG	SEPT	OCT	NOV	DEC
	t Awareness												
	Credit Card	X											
	Ethics (4 hours, Supervisor)									X			
Annual Meetings	Hunt meeting with State			X									
	Volunteer Recognition Day											X	
Routine Activities	Article for Friend Group Newsletter	X			X			X			X		
	Article for Egrits			X					X				
	School programs	X	X	X	X	X				X	X	X	X
	Community programs (Rotary Club)	X										X	
	Monthly Friends Group Meetings	X	X	X	X	X	X	X	X	X	X	X	X
Special Projects	Connecting People with Nature Area	X	X	X	X	X	X	X	X	X	X	X	X

VI. Visitor Services Annual Partnership Planning

This table tracks the refuge's formal and informal partnerships. This table could also cross reference with the Project Cost Table to help identify potential project funding opportunities.

VSP Table 5. Visitor Services Annual Partnership Planning

Visitor Services Annual Partnership Planning - Fiscal Year (2014)							
Name of Partnership	**Type of Partnership (Academia, Non-profit, Agency, etc.)**	**Agreement Type (Grant, Challenge Cost- Share, Cooperative, MOU, Donation, Programmatic, etc.)**	**Partnership's Goal for Refuge**	**Type of Contribution**		**Time Frame of Project**	**Comments**
				In-kind (materials, labor)	**Monetary**		
Starkville School District	Academia	MOU	Education	EE Center operated by school district		Jan 2046	The school district provides staffing and maintenance.
Tombigbee NF Labor Share	Agency	MOU	Share Labor	In-kind sharing of staff		Jan 2016	Both agencies agree to share staff expertise as needed.
Kinsail Hunt Permit Sales	Corporate	MOU	Sale of Refuge Hunt Permits		Charge of $5 per application	Jan 2023	MOU can be terminated with 30-days notice

APPENDICES

APPENDIX A: List of Preparers

- Megan Zopfi, USFWS, Intern
- Sam Sosa, USFWS, Intern
- Dr. Steven Reagan, USFWS, Project Leader, Sam D. Hamilton Noxubee and Choctaw NWRs
- Kimberly Sykes, USFWS, Deputy Manager, Sam D. Hamilton Noxubee and Choctaw NWRs
- Michelle Paduani, USFWS, Natural Resource Planner
- Andrea Dunstan, USFWS, Sam D. Hamilton Noxubee NWR, Visitor Services

APPENDIX B: Comparison of Public Use Fees

VSP Table 6. Comparison of public use fees within Mississippi for general access for Sam D. Hamilton Noxubee NWR, other NWR lands, State Parks, Wildlife Management Areas, National Forest, Mississippi State University.

Location	SDHN NWR	Other Refuges in MS	MS State Parks	MS WMA	NF	MSU
Annual	$25	$0	$42	$15 resident /$30 non-resident	$50	$0
Daily	$5	$0	$3	N/A	$5	$0
Deer Hunting	$20	$15	N/A	$0	$0	$15
Waterfowl Hunting	$20	$15	N/A	$0	$0	N/A
Special Events	$50	$50	Variable	N/A	$15	N/A
Amenities	Check stations, Bathrooms, Small Game Hunting, Migratory Bird Hunting, Big Game Hunting, Fishing, Wildlife Observations, Visitor Center, Boardwalks, Hiking Trails, Parking Areas, Roads, Environmental Education and Interpretation.	Check stations, Bathrooms, Small Game Hunting, Migratory Bird Hunting, Big Game Hunting, Fishing, Parking areas, roads, Environmental Education and Interpretation.	Picnic areas, playgrounds, nature trails. Additional charges may apply based on facilities used.	Small Game Hunting, Migratory Bird Hunting, Big Game Hunting, Fishing.	Small Game Hunting, Migratory Bird Hunting, Big Game Hunting, Fishing, Picnic areas, Swimming, Wildlife Observation, Bathrooms. Additional charges may apply based on facilities used.	Fishing, Hiking Trails, Environmental Education, Interpretation, Wildlife Observation, Small Game Hunting, Migratory Bird Hunting, Big Game Hunting.

APPENDIX C: Appropriate Use Determinations

Refer to Appendix E of the Sam D. Hamilton Noxubee CCP.

APPENDIX D: Compatibility Determination

Refer to Appendix F of the Sam D. Hamilton Noxubee CCP.

APPENDIX E: Sport Hunting and Fishing Plan

SPORT HUNTING and FISHING PLAN

U.S. FISH AND WILDLIFE SERVICE

SAM D. HAMILTON NOXUBEE NATIONAL WILDLIFE REFUGE

December 2014

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INTRODUCTION

Located within three counties (Noxubee, Oktibbeha, and Winston), Sam D. Hamilton Noxubee NWR was established on June 14, 1940, from lands acquired through the Resettlement Administration of the 1930s. Prior to government ownership, the land was extensively farmed and overgrazed by cattle. Today, the refuge encompasses 48,219 acres of bottomland and upland forests, rivers, wetlands, and moist-soil impoundments.

The majority of the refuge lies in the Interior Flatwoods Region of the Upper Coastal Plain which is relatively flat with elevations rarely varying more than 20 feet throughout the area. Parts of the refuge fall outside this region and elevation can vary as much as 100 feet over a distance of several hundred feet. Waters on the refuge are influenced by levee construction, topography, timber stand composition, and the invasion of nonnative species. The majority of wetland habitat on the refuge occurs in Bluff and Loakfoma lakes (1,062 acres) and bottomland hardwood forests. Twenty-five miles of the Noxubee River meander through the refuge and an additional 55 miles of tributary streams and creeks exist within refuge boundaries. Oktoc Creek drains through Bluff Lake, providing the water supply for this lake and greentree reservoirs 1 and 2.

Occupied by a variety of game species, including quail, white-tailed deer and turkey, as well as nongame neotropic migratory birds, 44,500 acres of the refuge are composed of bottomland and upland forests. The refuge provides crucial breeding habitat for the red-cockaded woodpecker (RCW), a federally listed endangered species since 1970. Because forest management directly impacts wildlife management, refuge forests are manipulated to provide diverse habitat types year-round. Prescribed fire, vegetative regeneration, thinning, and selective harvests are but a few management techniques used to improve wildlife habitat.

A series of low levees were constructed to permit winter flooding of certain hardwood bottomland areas, a practice commonly known as “greentree reservoir management,” to entice waterfowl to the refuge. Water level manipulation in greentree reservoirs and moist-soil impoundments stimulates the growth of native wetland plants and results in an abundance of seeds, invertebrates, crustaceans, and mollusks; all of which are favored foods of migratory waterfowl, wading birds, and shorebirds.

In 1993, the refuge embarked on a venture to demonstrate what was represented within the prairie which historically occurred in areas east of the refuge boundary. Morgan Hill Overlook Trail winds through this demonstration and affords visitors a unique opportunity to view this vanishing habitat.

CONFORMANCE WITH STATUTORY AUTHORITY

Sam D. Hamilton Noxubee NWR is an extremely important component for the conservation and enhancement of fish, wildlife, and plant resources within the National Wildlife Refuge System. The refuge’s stated purpose was “… for use as a Refuge and breeding ground for migratory birds and other wildlife…” 16 U.S.C. Sec. 715 (Migratory Bird Conservation Act).

In conjunction with the primary establishing purposes, the refuge will provide an area for the "… conservation, management, and restoration of the fish, wildlife, and plant resources and their habitats for the benefit of present and future generations of Americans" 16 U.S.C., 668(a)(2) (National Wildlife Refuge System Improvement Act) as well as "…for the development, advancement, management, conservation, and protection of fish and wildlife resources…" 16 U.S.C., 742(b)(1) (Fish and Wildlife Act of 1956). The passage of the Endangered Species Act (ESA) in 1973 (as amended) required the refuge to support recovery actions for federally listed threatened and endangered species.

This plan supports the priority public use provisions of the National Wildlife Refuge System Improvement Act of 1997. Hunting and sport fishing as specified in this plan are wildlife-dependent recreational use and the law states that as such, they "shall receive priority consideration in national wildlife refuge planning and management." The Secretary of the Interior may permit hunting and fishing on a refuge if he determines that such use is compatible with the refuge's purpose for which it was established. The hunting and fishing program would not materially interfere with or detract from the fulfillment of the purposes of the refuge or mission of the National Wildlife Refuge System (603 FW).

Public hunting and fishing on Sam D. Hamilton Noxubee NWR are appropriate and compatible forms of wildlife-dependent public recreation, which is compatible with the purposes for which the refuge was established. When used wisely, hunting can be a viable management tool that often inhibits the overpopulation of species within a given habitat community and can provide and benefit greater wildlife diversity. The hunting program is designed to minimize potential conflicts with refuge purposes; therefore, hunting activities are permitted on 42,000 acres. Hunting of big game (white-tailed deer, turkey), small game (squirrel, rabbit, quail, raccoon, opossum), and migratory birds (ducks, woodcock, and coots,) and incidental take species (beaver, coyote, feral hog, and nutria) are permitted unless otherwise stated in the annual public use regulations brochure. The refuge will be open to recreational fishing, and will mirror state regulations, except for additional regulations that protect migratory birds and threatened and endangered species use(s), and to maintain a self-sustaining, healthy fishery. Additional restrictions may take the form of seasonal closures, catch and release, type of bait allowed, prohibition of lead sinkers, and time of day for fishing access.

STATEMENT OF GOALS AND OBJECTIVES

Although the conservation of waterfowl remains a principal goal, the Service's responsibility has expanded to include other goals and objectives. The following general goals and objectives are recognized in the comprehensive conservation plan:

Goal A: Fish and Wildlife Populations - Manage and protect migratory and native wildlife populations on Sam D. Hamilton Noxubee NWR to contribute to the purposes for which the refuge was established as well as to fulfill the mission of the National Wildlife Refuge System (701 FW 1, USFWS 1992).

Sub-Goal A.1 Waterfowl - Manage and protect waterfowl populations in concert with the goals and objectives of North American Waterfowl Management Plan (NAWMP).

Sub-Goal A.2 – Waterbirds - Manage and protect waterbird populations in concert with the goals and objectives of the North American Waterbird Conservation Plan (USFWS 2007).

Sub-Goal A.3 - Forest Breeding Birds - Manage and protect forest breeding bird populations in concert with the goals and objectives of the Partners in Flight North American Landbird Conservation Plan (Rich et al., 2004).

Sub-Goal A.4 - Threatened and Endangered Species - Manage and protect threatened and endangered species in concert with the Endangered Species Act (730 FW 2).

Sub-Goal A.5 – Eagles - Manage and protect eagles in accordance with the Bald and Golden Eagle Protection Act.

Sub-Goal A.6 Resident and Other Species - Manage and protect other species populations that have a direct tie to the purpose of the refuge and mission of the Service and to support the goals of Mississippi's Comprehensive Wildlife Conservation Strategy.

Sub-Goal A.7 Aquatic Biota - Manage and protect a diverse assemblage of native fish species, particularly those priority conservation actions identified for the Tombigbee Drainage within Mississippi's Comprehensive Wildlife Conservation Strategy.

Sub-Goal A.8 Exotic, Nuisance and Invasive Species - Minimize negative impacts of exotic and invasive species to levels that do not negatively affect other objectives.

Goal B: Habitats - Manage and protect habitats for migratory and native wildlife on the refuge to contribute to the purposes for which the refuge was established, as well as to fulfill the mission of the National Wildlife Refuge System (620 FW 1, USFWS 2002).

Sub-Goal B.1: Pine and Mixed Pine/Hardwood - Achieve desired forest conditions within pine forests to protect, manage, enhance, and restore the values and functions of these habitats to sustain the biological needs of native wildlife and migratory birds.

Sub-Goal B.2 Bottomland Hardwood Forests - Achieve desired forest conditions within bottomland hardwood forest to protect, manage, enhance, and restore the values and functions of these habitats to sustain the biological needs of native wildlife by implementing recommendations within the Lower Mississippi Valley Joint Venture (LMVJV) Restoration, Management, and Monitoring of Forest Resources in

the Mississippi Alluvial Valley: Recommendations for Enhancing Wildlife Habitat 2007 (aka Desired Forest Conditions).

Sub-Goal B.3 Aquatic Environments - Actively manage approximately 252 acres of shallow water moist-soil impoundments, 1,200 acres of lakes, and 1,645 acres of greentree reservoirs for native species, including a diversity of reptiles, fish, amphibians, and waterfowl species, through water level manipulation and to fulfill the mission and purposes for which the refuge was established, while maintaining functional integrity of the surrounding habitat.

Sub-Goal B.4 - Proposed Wilderness - Manage the 1,200-acre proposed Wilderness to retain its primeval character and influence.

Goal C: Resource Protection - Protect the natural and cultural resources of the refuge.

Sub-Goal C.1: Resource Management and Education - Maintain, preserve, and protect archaeological, cultural, historical, and natural resources, representing the natural and cultural history of the local area.

Sub-Goal C.2 – Protection - Implement law enforcement procedures to protect the refuge's cultural resources and diminish site destruction due to looting and vandalism.

Sub-Goal C.3 - Land Acquisition - Identify willing sellers and acquire private lands within the existing approved acquisition boundary that would enhance the conservation values of the refuge.

Sub-Goal C.4 - Conservation Easements

Continue to provide oversight on nine (9) Farm Service Agency Conservation Easements.

Sub-Goal C.5 - Wild-land Fire Urban Interface

Provide resource protection to control wild fire.

Goal D. Visitor Services - Provide opportunities for compatible wildlife-dependent public uses that promote an understanding and appreciation of fish, wildlife, habitat conservation, and the mission of the National Wildlife Refuge System (605 FW 2, USFWS 2006).

Sub-goal D.1 Hunting - Provide hunting opportunities while ensuring safe, compatible, and quality experiences.

Sub-goal D.2 Fishing - Provide fishing opportunities while ensuring safe, compatible, and quality experiences (605 FW 3, USFWS 2006).

Sub-Goal D.3 - Wildlife Observation and Photography - Provide wildlife observation and photography opportunities while ensuring safe, compatible, and quality experiences.

Sub-Goal D.4 – Interpretation - Ensure the refuge is welcoming and visitors are provided with clear information that promotes and raises public awareness of the refuge and the Service.

Sub-Goal D.5 - Environmental Education - Promote and utilize the Larry Box Environmental Education Center (EE Center) and other refuge resources to expand and enhance environmental education opportunities.

Sub-Goal D.6 Public Access - Manage public access to provide a safe human experience, in an environmentally appropriate manner to support wildlife-dependent priority public uses while ensuring uses are compatible with the refuge purposes.

Sub-Goal D.7 – Outreach - Provide outreach opportunities that promote an understanding and appreciation of fish, wildlife, habitat conservation, and the mission of the Refuge System.

Sub-Goal D.8 - Open Lands - Manage abandoned agricultural open field areas to the community type most suitable for meeting the refuge goals and objectives.

Goal E. Refuge Administration - Provide sufficient leadership, staffing, information, and infrastructure to manage and protect migratory and native wildlife populations and their habitats, cultural resources, and compatible public uses that contribute to the purposes for which the refuge was established as well as the mission of the National Wildlife Refuge System.

Sub-Goal E.1 Operations and Maintenance - Maintain quality programs, facilities, and infrastructure along with a highly skilled and trained professional staff.

Sub-Goal E.2 - Science and Research - Continue to support and explore greater opportunities to expand on existing baseline information through monitoring and reconnaissance and practice adaptive management to support the purposes for which the refuge was established.

Sub-Goal E.3 Law Enforcement - Provide law enforcement for visitor safety, protection of resources, and to ensure public compliance with refuge regulations.

Sub-Goal E.4 Levees, Roads and Rights-of-ways - Manage all levees, roads, and rights-of-ways without jeopardizing the infrastructure's condition, designed function, and minimally impacting wildlife resources.

Sub-Goal E.5 - Research Natural Areas - Eliminate the designation of Research Natural Areas and incorporate "Old Robinson Road Research Natural Area," (consisting of an estimated 46 acres) and the "Morgan Hill Research Natural Area" (consisting of an estimated 67 acres) into surrounding management units.

Sub-Goal E.6 - Habitat Conditions - Manage refuge habitats to reflect historic conditions in accordance with Service policy.

The objectives of the refuge hunting and fishing program are as follows:

1) Provide a quality recreational and educational experience for a diverse audience through a varied hunting and fishing program.

2) Provide an opportunity for the youth of Mississippi to engage in hunting and fishing, instill a basic understanding of conservation measures, and the role of the Service in the conservation picture.

3) Foster support and knowledge of refuge goals and objectives by working in close association with the general public and Mississippi Department of Wildlife, Fisheries, and Parks through their assistance with the harvest and thus management of resident species on the refuge while providing safe, educational, and instructive opportunities.

4) Allow for the harvest of big game, small game, waterfowl, and fish on the refuge to help maintain healthy population levels and facilitate maintenance of quality habitat for endangered species, migratory birds, and native flora and fauna.

5) Provide reasonable accommodations for individuals with disabilities to participate in refuge hunting and fishing activities.

6) Control nuisance and exotic wildlife.

Conducting a well-managed hunting and fishing program on the refuge will assist the refuge in meeting one of its primary objectives, which is to provide the general public with quality wildlife-dependent recreational programs that are compatible with the purposes for which it was established. Recreational hunting and fishing will provide the general public with a wildlife-dependent recreational opportunity. Allowing hunting and fishing will promote appreciation and wise use of refuge terrestrial and aquatic resources. There will be opportunities to observe natural relationships and the diversity necessary for a healthy ecosystem. The public will gain valuable knowledge through brochures, maps, and interpretive literature available and distributed at the refuge. Special events will help to further instill a conservation ethic and stewardship of natural resources. Regulation and information signs will also be available at various sites around the refuge. Through these resources the public will attain an understanding of natural resource management and of the Service's role in conserving and protecting natural resources. Visitors will also form an appreciation and an awareness of the roles they play within the ecosystem. By utilizing this knowledge, the public will be able to participate in solving problems facing wildlife/wildland resources.

ASSESSMENT

Compatibility with Refuge Objectives

Hunting and fishing are two of the six wildlife-dependent recreational uses prioritized by the Improvement Act. The Secretary of the Interior may permit hunting and fishing on a refuge if

he determines that such use is compatible with the purpose's for which it was established. The hunting and fishing program would not materially interfere with or detract from the fulfillment of the purposes of the refuge or mission of the National Wildlife Refuge System (603 FW). Hunting and fishing meet the above refuge objectives by providing a wildlife-dependent recreation and also by enhancing indigenous species of wildlife.

Biological Soundness

Deer

Compatible and beneficial with refuge objectives, deer harvest is essential to maintain the herd at or below habitat carrying capacity. When overpopulated, deer over-browse their habitat, which can completely alter the plant composition of a forest. Because young tree seedlings can be killed by over-browsing, failure to establish regenerative forests will have negative impacts on future resident and migratory wildlife populations. Overpopulation can lead to: outbreaks of devastating diseases such as epizootic hemorrhagic disease (EHD), bluetongue, and hoof-sloughing; starvation; increased car-deer collisions; and poor overall herd health. Deer are also the primary vector for the spread of tick borne illnesses and diseases to humans, such as Lyme disease and babesiosis.

Refuge staff have recorded deer harvest rates on approximately 48,000 acres from 1989-2013. Averages of 437 deer per year were harvested within the 25-year period, although after 2011 the number of deer taken has significantly decreased. A harvest ratio of two bucks per doe remains constant throughout the time period. Hoof-sloughing was first documented in 2009 and relatively few records have been documented since. In recent years, the refuge has provided self-check kiosks for hunters to record white-tailed deer harvest data. Recent records from self-check kiosks are inconsistent and lack important data; therefore, records are not as complete as previous years.

Wild Turkey

Turkey hunting on the refuge is limited to a 7-week spring season plus a 1-week youth hunt. Turkey hunting is permissible on the refuge in all open hunting areas. State bag limits and restrictions apply.

Utilizing bottomland hardwood stands, turkeys require mature trees for cover and nocturnal roost sites. Varying greatly by habitat type, successful nesting sites contain dense understory vegetation with a lower overstory density, basal area, and percent canopy cover. The Lower Mississippi Valley Joint Venture suggests implementing variable timber harvests across the landscape to provide quality habitat conditions that will reduce predation rates and increase wild turkey populations. By creating a mosaic of habitat, these areas will be conducive to turkey hunting immediately following timber harvest activities. In 2012, the Mississippi Department of Wildlife, Fisheries, and Parks chronicled a 3-year positive trend in reproduction, averaging 2.27 poults per total hen for the east-central region of Mississippi as compared 1.88 poults per total hen in 2011. Hunters harvested 3.9 gobblers per 100 hours of hunting in the east-central region during 2012. Fifty-four percent of harvested birds were

2-year-old birds with spurs of 0.5- to 1 inch, while 44 percent were considered to be 3 years old.

Migratory Birds

Migratory bird hunting on the refuge consists of ducks, geese, woodcock, and coots. Migratory bird hunting regulations, including seasons and bag limits, are set annually by the Service using survey, production, harvest, and hunter participation data to ensure that cumulative adverse impacts do not occur to migratory bird populations. These regulations are then adopted by the state. State regulations can never be more liberal, only more conservative, than federal regulations. Migratory bird hunting seasons on the refuge follow the state regulated seasons, but are more restrictive in that hunting is only permitted until noon two days per week.

Small Game (Squirrel, Rabbit, Raccoon, Opossum, and Quail)

Although no studies have been conducted on small game within the refuge, studies have been conducted within and outside of Mississippi to determine the effects of hunting on the population dynamics of small game. Results have consistently shown that small game, such as rabbits and squirrels, are not affected by hunting, but rather are limited by food resources. Gray squirrels, fox squirrels, eastern cottontails, and swamp rabbits are prolific breeders and their populations have never been threatened by hunting in Mississippi, even prior to the passing of modern hunting regulations. These small species populations, although not affected by hunting, are limited by food resources.

Opossum and raccoon are hunted primarily at night. Raccoon are more sought after than opossum by the public. Raccoon and opossum are overpopulated and are known depredator of turkey, turtle, and songbird nests. Hunting helps regulate opossum and raccoon populations; however, unless the popularity of this type of hunting increases, raccoon and opossum numbers will always be higher than desired. When these species become extremely overabundant, diseases such as distemper and rabies reduce the populations. However, waiting for disease outbreak to regulate their numbers can be a human health hazard.

Bobwhite populations reached peak numbers in the mid-to-late 1940s in Mississippi and were high through the early 1970s. Over the last 30 years, however, our quail population has dropped by more than 70 percent to historically low levels. The decline can be attributed to many causes including predators, diseases, parasites, pesticides, and other factors. While all of these may affect quail, the most significant cause of population decline has been loss of quality habitat. There is a direct cause and effect relationship between changes in land use and this population decline. Ideal habitat consists of a balanced mixture of bare ground, native clump grasses, annual weeds, woody cover, and seeds and insects for food. Quail hunting on the refuge is possible due to the expanse of early successional habitat created from the management of the endangered red-cockaded woodpecker.

Incidental Take Species: Beaver, Coyote, Feral Hog, Nutria

Beaver - Once valued as an important resource for its pelt, the beaver is socially regarded as a nuisance in forest management. Beavers, however, can have both a positive and a negative impact on the environment. When beavers build dams, they create new wetland environments for other species. These wetlands can help slow erosion, raise the water table, and help purify the water. Beavers can play a major role in succession. When beavers abandon their lodges and dams, aquatic plants take over the pond. Dams can slow the flow of water in streams and cause silt to build up, creating loss of habitat for other species. Most of the beaver's diet is made up of tree bark and cambium, the soft tissue that grows under the bark of a tree. They especially like the bark of willow, maple, cypress, cottonwood, beech, and poplar trees. Beavers also eat other vegetation like roots, buds, and other water plants. Their feeding habits damage and/or kill many trees and plants. Flooding caused by beaver dams can damage timber; if inundated, trees may die or become prone to rot and disease and may severely deteriorate habitat. Dams and lodges can directly affect roadways by flooding or indirectly via erosion. Beavers are notorious for obstructing water control structures and culverts. Repairs to damaged roadways and obstruction removals are costly and time consuming.

Coyote - Historically located in grasslands and sparse woodlands of western North America, the coyote has adapted to virtually every habitat type. Coyotes typically predate on small mammals such as rabbits and rodents, carrion, ungulates, and insects and readily eat vegetative matter such as fruits and berries if available. Diet may also include ruffed grouse and turkeys and may change in response to food availability and seasonal change. The increase of coyotes can influence population dynamics of other mesocarnivores, such as foxes, and may result in an alteration of small mammal communities and the fluctuation of microhabitats and plant communities.

Although white-tailed deer and bobwhite quail reproductive success will increase with coyote removal, overall population densities for both species will remain unchanged. Therefore, short-term coyote removal programs typically are not sufficient in reducing coyote density and therefore do not alter ecosystem composition. The opportunity to participate in the incidental take of coyotes on the refuge will not diminish nor inhibit local densities or populations.

Feral Hogs - Introduced to North America by Spanish explorers, feral hogs are highly adaptable habitat generalists and occupy a variety of habitats. As opportunistic omnivores, hogs out-compete native animals for food sources, such as roots and plant matter, reptiles, amphibians, small mammals and ground-nesting birds. Feral hogs cause numerous problems within forest ecosystems; pine and hardwood regeneration can be destroyed by direct consumption, rooting, and trampling. Intense rubbing and damage to bark layers can leave trees susceptible to harmful insects and pathogens. Rooting and wallowing can cause erosion along waterways and wetlands while instigating the loss of native plants. Hogs are known carriers of at least 45 external and internal parasites and diseases, many of which

can be fatal to wildlife. Incidental take of wild hogs provides another management tool to reduce this injurious species while providing a gratifying activity for local hunters.

Nutria - Imported from South America, nutria are small aquatic rodents opportunistic feeders that forage on aquatic and terrestrial vegetation. Nutria negatively impact wetlands by: threatening biodiversity by eliminating valuable food resources thus reducing invertebrate populations; creating turbid environments supporting native species; causing damage to manmade structures such as culvert, berms, levees, and bridges; and provide vectors for wildlife disease.

Fisheries

The aquatic ecosystems on the refuge include reservoirs, artificial ponds, beaver ponds, and the Noxubee River and its tributaries. The mostly unchannelized Noxubee River is a complex floodplain river system. Along with the two man-made reservoirs on the refuge, it supports a wide variety of fish and other aquatic life. The dynamic nature of the flooding regime and associated wetland habitats provide a renewable fishery resource on the refuge. The creeks, sloughs, and lakes support a diverse warm water fishery, including largemouth bass (*Micropterus salmoides*), spotted bass (*M. punctulatus*), black crappie (*Pomoxis nigromaculatus*), white crappie (*P. annularis*), bream (*Lepomis* spp.), channel catfish (*Ictalurus punctatus*), and blue catfish (*I. furcatus*). Nongame fish such as common carp (*Cyprinus carpio*), freshwater drum (*Aplodinotus grunniens*), and bigmouth buffalo (*Ictiobus cyprinellus*) are also found in refuge waters. When flooding occurs in the spring, these areas provide excellent nurseries for juvenile fish. These waters also provide essential habitat for a host of reptile and amphibian species.

Economic Feasibility

The annual cost of refuge activities to administer the hunting program is an estimated $438,000. These costs include staff (approximately 365 days, $328,000) and operating expenses ($110,000) for refuge law enforcement and hunter and angler assistance during the seasons. The estimate includes non-law enforcement staff activities associated with evaluating resources available for hunting and fishing(e.g., biological assessments of target species) as well as preparing for (e.g., special signage and access) and monitoring hunting and fishing activities.

Adequate refuge personnel and base operational funds are available to manage recreational hunting and fishing activities at existing and projected levels. Administrative staff time primarily involves phone conversations, written correspondence, and personal interaction with visitors at the visitor's center. There is also additional work entering activity data into a database for analysis. Field work associated with administering the program primarily involves conducting law enforcement patrols to increase recreational hunter and angler compliance with state and federal regulations and to foster respect for local residents' activities and property.

Relationship with other Refuge Programs

As public use levels expand across time, unanticipated conflicts between user groups may occur. Experience has proven that time and space zoning (e.g., establishment of separate use areas, use periods, and restrictions on the number of users) is an effective tool in eliminating conflicts between user groups. Conflicts between hunters/anglers and non-consumptive users might occur but would be mitigated by time (non-hunting or non-fishing seasons) and space zoning of non-consumptive users and hunters/anglers. The refuge would focus non-consumptive use (mainly bird watching and other wildlife viewing) in the areas that are closed to hunting or fishing.

The public would be allowed to harvest a renewable resource, and the refuge would be promoting a wildlife-dependent recreational opportunity that is compatible with the purpose for which the refuge was established. The public would have an increased awareness of the refuge and the National Wildlife Refuge System and public demand for more hunting and fishing would be met. The public would also have the opportunity to harvest a renewable resource in a traditional manner, which is culturally important to the local community. This alternative would also allow the public to enjoy hunting and fishing at little cost in a region where private land is leased for hunting, often costing a person $300-$2000/year or more for membership. This alternative would allow youth the opportunity to experience a wildlife-dependent recreation, instill an appreciation for and understanding of wildlife, the natural world and the environment, and promote a land ethic and environmental awareness.

None of the proposed hunts offer major conflicts with other hunts or with non-consumptive users. The spring turkey hunt does not coincide with any other hunting season. Deer gun hunting is limited in duration and could potentially conflict with squirrel, rabbit, quail, raccoon, and opossum hunting. Archery hunting of deer is the entire state deer season but does not conflict with several small game hunts. Recreational fishing, including temporal and spatial restrictions, combined with seasonal nature of other wildlife-dependent recreation activities will reduce the potential for conflict.

Recreational Opportunity

The proposed action of allowing hunting and fishing on the refuge through the Recreational Hunting and Fishing Plan for Sam D. Hamilton Noxubee NWR would provide the public with a quality recreational experience, and provide the refuge with a wildlife management tool to promote biological integrity and enhance opportunities for environmental education as it relates to consumptive use of natural resources. The nature of the refuge dictates that much of the area would be well-utilized. Roads have been established to help improve public access. Several check station kiosks have been constructed and strategically placed across the refuge to improve communication and efficiency.

DESCRIPTION OF HUNTING AND FISHING PROGRAM

The refuge totals approximately 48,219 acres of which 42,000 acres, or 85 percent, will be open to public hunting under the conduct of this hunt plan.

A) There are currently considered to be harvestable populations of small game (squirrel, rabbit, raccoon, opossum, quail), big game (deer, turkey), migratory birds (geese, woodcock, coots, ducks), incidental take species (beaver, coyote, feral hog, nutria), and game fish. Beavers, coyotes, feral hogs, and nutria can be hunted during all open refuge hunting periods. Legal weapons for incidental take are limited to those permitted for the ongoing hunt. Seasons and bag limits may be more restrictive but not more liberal than those set by the State of Mississippi. Refuge regulations (species, limits and general regulations) will follow state guidelines to the greatest extent possible, and will be coordinated with the state annually. More restrictive regulations would be implemented, as necessary, to conserve populations and provide for safe, quality wildlife-dependent recreation. Refuge personnel will coordinate with the State of Mississippi to manage opportunities on the refuge. Appropriate state/federal licenses and recreational gear licenses are required. Commercial harvesting of game species and tournaments are not permitted on the refuge.

B) Hunting and fishing will be permitted in accordance with federal regulations governing public use on national wildlife refuges as set forth in 50 CFR. Hunting and fishing will be conducted within the framework of applicable State of Mississippi regulations and other federal laws regulating the take of wildlife, subject to the special conditions as published annually in 50 CFR and outlined in annual refuge-specific public use brochures, which are available to the general public. Refuge-specific hunting regulations allow for proper management of public lands and their resources. They also provide increased safety to refuge visitors. Harvest regulations fall within the state season but may be restricted to fewer days/harvest limits.

C) The refuge is open every day from one hour before sunrise until one hour after sunset, except authorized uses. All lands currently outside the closed to all public entry areas owned and/or managed as a part of the refuge may be opened to the taking of all game species by the public with the following exception: Douglas Bluff Education Area, “Connecting People with Nature” area, moist-soil impoundments, and other designated areas. Waterfowl hunting is only allowed in the area designated on the map on designated mornings, until 12 noon, excluding federal holidays of the state waterfowl seasons. All other hunting is prohibited in the waterfowl hunting area during the waterfowl hunts. All refuge waters are open to fishing from March 1 through October 31, except for those specifically posted as “Closed To All Entry.” Bank fishing is allowed year-round on the west side of the lake from the Bluff Lake Boardwalk to the Cypress Cove Boardwalk. Additionally, the Noxubee River and borrow pit areas along Highway 25 are open year-round for recreational fishing.

D) All future lands acquired or managed as part of the refuge whether through fee-title purchase, donation, lease, management agreement, memorandum of understanding, or any other means may be opened for taking of game species as part of the refuge’s public use program as described within this plan. Exceptions may exist for any conditions, exclusions, or reservations contained within deeds or agreements.

E) All persons participating in refuge small game or turkey hunts or fishing shall be required to possess a $25 annual (or $5 daily) refuge Public Use Permit and a free General Public Use Brochure permit. All persons participating in the white-tailed deer and waterfowl quota hunts will be required to purchase an additional $20 Quota Hunt Permit. Any persons conducting special events such as field trials will need to purchase a $50 Special Use Permit. The General Public Use Brochure permit is primarily for the purpose of providing information on hunting and fishing regulations and other refuge specific regulations. The General Public Use Brochure permit is required to be signed and carried signifying the hunter/angler has read and understood the rules. The Public Use Permit and General Public Use Brochure permit shall be available to all persons desiring to participate in refuge programs. Permits are non-transferable and all signature blocks must be signed and in possession while on the refuge. Should public demand become great enough that numbers must be restricted, a lottery system may be instituted in an effort to control numbers of hunters/anglers. In addition, consideration may be given to time and space scheduling and/or zoning to allow for disabled accessibility, youth, non-consumptive user conflicts, and/or over-use issues. Additionally, all appropriate state/federal licenses and recreational gear licenses are required.

F) Enforcement of refuge regulations is an essential element in protecting trust resources and in providing for a quality recreational opportunity. Periodic, random patrols of refuge lands will be conducted by refuge law enforcement personnel. In addition, harvest and public use data may be collected at various times within the refuge. Law enforcement personnel may also be available to respond to specific reports of suspected violations.

G) Information and open dates are available at refuge headquarters and specified in the General Public Use Brochure permit.

H) Personal property, including decoys, blind material, cameras, and boats, must be removed from the refuge daily (see 50 CFR 27.93), unless otherwise stated in the General Public Use Brochure permit. Portable stands may be placed on the refuge from September 1 through January 15, except in the designated Wilderness Area where all personal property must be removed daily. Tree stands may not be placed on endangered red-cockaded woodpecker cavity trees which are marked with white painted bands. Additionally, within the designated Wilderness Area, mechanical equipment is prohibited including bicycles. Each stand is required to be tagged with the owner's name, address, and permit number. Anglers must tend all trotlines and jugs every 24 hours and remove them when not in use. The refuge is not responsible for the theft or damage that may occur to any personal property, including damage from habitat management activities.

I) Motor vehicles are allowed only on designated routes shown on the map on the reverse side unless the road is closed by sign or gate. Vehicles must be parked adjacent to these roadways, and may not block gates. No vehicles are allowed to travel off-road. Unless otherwise posted, refuge speed limits are 25 miles-per-hour. Bicycles will be allowed access to gated roads within areas open to hunting as part of accepted hunting and fishing gear.

J) Recreationalists must travel on refuge waters at idle speed only and must not produce a wake when the lakes are open to fishing and recreational use. Watercrafts are not permitted in the spillways below the lakes.

K) No person may capture, kill, or destroy any wildlife and remove the head, claws, teeth, hide, antlers, or any or all of such parts from the body with the intent to abandon the body. The removal of any object (natural, historic, or archaeological feature, etc.) is prohibited. Collection or release of plants, animals, insects, etc., is prohibited unless granted a special use permit. Hunters are allowed to hunt from tree stands in accordance with 50 CFR 32.2(i). Hunters must use a full body safety harness at all times while hunting from a tree. It is unlawful to drive a nail, spike, or other metal object into a tree or to hunt from any tree in which such an object has been driven. Cutting or trimming branches or brush for shooting lanes is prohibited. Marking of trees with flagging, reflective tacks, or other similar marking devices is prohibited.

L) The use of artificial light, including headlights, to spot or locate any animal, except authorized nighttime hunting of raccoons and opossums, is strictly prohibited. Calling of wildlife prior to the opening of any hunting season or for purposes of observation and photography is prohibited. Harassing or man-driving of wildlife is prohibited.

M) Persons possessing, transporting, or carrying firearms on the refuge must comply with all provisions of state and local law. Persons may only use (discharge) firearms in accordance with refuge regulations. All persons hunting small game and turkey are required to use nontoxic shot throughout the entire refuge. Small game rifle hunters are restricted to .22 caliber rimfire or smaller rifles. We prohibit magnum ammunition while hunting small game. Deer hunters may use those weapons defined by state regulation.

N) During any state deer gun hunting season, any person hunting upland game must wear at least 500 square inches (3,200 cm2) of unbroken fluorescent-orange material visible above the waistline as an outer garment. Hunters should be aware other public uses will coincide with hunting seasons and visitors may not be wearing hunter orange. It is the hunter's responsibility to be aware of what is in the line of fire.

O) Hunting with the aid of bait or distribution of any feed, salt, or other mineral at any time is prohibited.

P) A special hunt for disabled hunters (as defined by Mississippi Admin Code Title 40 Part 2 Chapter 2 Rule 1.4 Special Use Regulations for Individuals with Disabilities) will be held annually. During this season only disabled hunters may hunt on the refuge. Hunters must have a current refuge Public Use Permit and signed General Public Use Brochure Permit, as well as a Quota Hunt Permit, if hunting white-tailed deer, and be in compliance with state and refuge regulations. Contact the refuge office for more information.

Q) All youth hunters under age 16 must be supervised by an adult 21 years of age or older, and must remain within sight and normal voice contact with the adult while hunting. Adults must comply with state regulations on supervision and one adult may supervise no more

than two youth hunters. Only the youth may handle, carry, transport, or discharge firearms. Youth hunters, hunting outside of designated youth season, are required to obtain any additional permits required.

R) All harvested wildlife are required to be checked at a refuge self-clearing check station on the same day harvested and prior to leaving the refuge.

S) Hanging and/or cleaning of wildlife is prohibited within the "Connecting People with Nature" area, parking lots, and other public use areas. Wildlife can be field-dressed where harvested.

T) The taking of frogs and turtles is prohibited.

U) Other prohibited activities:

-open fires

-camping

-target shooting

-horseback riding

V) Field trials are allowed by special use permit.

W) Use of alcoholic beverages is prohibited while hunting. The refuge adopts the most current rules and regulations regarding the use of alcohol existing within the applicable county.

Enforcement of hunt regulations is primarily carried out by the full-time refuge law enforcement officer, supplemented with assistance from other refuge officers when needed. It is estimated that 1.0 full-time equivalent position would be required to perform the minimal duties associated with refuge hunts. Cost for salaries, materials, and equipment upkeep is approximately $438,000 annually.

MEASURES TAKEN TO AVOID CONFLICTS WITH OTHER MANAGEMENT OBJECTIVES

Biological Conflicts

The potential does exist for conflicts between hunting programs and non-target wildlife. However, the level of disturbance is expected to be minimal and below that of similar non-refuge lands. Refuge officers will make every effort to maximize protection of endangered species and other non-target wildlife. A small population of endangered red-cockaded woodpeckers occurs on the refuge. All hunting seasons, with the exception of wild turkey, are conducted in the winter months when woodpeckers are not in peak breeding season. Few threatened wood storks and bald eagles occur on the refuge and encounters by hunters are rare. Hunting is conducted during the fall and winter months when wood storks are not utilizing the refuge. Areas with bald eagle nests are protected in accordance with

Service bald eagle guidelines. Restrictions on methods of hunting should aid in reducing incidental take of non-target species.

Most fishing opportunities will occur during spring and early summer when water levels are high from flooding influences. During flooded conditions, some wildlife is dispersed to higher ground while some species specifically use the flooded habitat. Any wildlife disturbance from fishing activity should be minimal due to wildlife distribution patterns and the inaccessibility of many areas of the refuge. The area available for visitors to bank fish along the river or inland ponds is small compared to that available to wildlife. Therefore, there will likely be minimal impact on wildlife due to fishing. Refuge personnel may designate specific areas as sanctuary for threatened and endangered species, waterfowl, rookeries or for other purposes, if necessary. Those areas would be closed to all public use.

Public Use Conflicts

The demand for non-consumptive wildlife-dependent use on the refuge is expected to be high. Direct conflicts between hunters and non-consumptive users are unlikely to occur, but a potential exists. Restrictions on hunting methods and restrictions on hunting near designated public use facilities and trails should aid in reducing potential conflicts. Should serious conflicts arise, considerations will be given to time and space scheduling and/or zoning.

The demand for consumptive uses is also expected to be high. While conflicts within user groups are expected to be minimal, they may occur. Should serious conflicts arise within or between user groups, consideration will be given to limiting the number of users through a lottery permit system and through time and space scheduling and/or zoning.

Other activities that will occur on the refuge simultaneously with fishing include hunting, canoeing, hiking, bird watching, wildlife observation, tours, and nature photography. No conflict is expected between anglers and non-fishing visitors.

Administrative Conflicts

If the refuge is at full staffing levels, the manpower and funding will be available to administer these activities. Presently, reductions in resources could reduce the existing hunting and fishing programs. The currently permitted hunting seasons that require significant administrative costs due to regulatory oversight (i.e., waterfowl hunting and primitive weapon and modern gun deer) will be exchanged for less costly seasons, such as an archery deer season requiring less administrative support. The visitor center will be closed on weekends and operating hours will be reduced to the work week (Monday through Friday) to match staff availability. Less labor intensive data will be collected during any hunts. Further limitations on access to inland lakes, streams, and rivers could also occur depending on availability of resources.

CONDUCT OF THE PROGRAM

Hunting and fishing will be permitted in accordance with federal regulations governing public use on national wildlife refuges as set forth in 50 CFR. Hunting and fishing will be conducted within the framework of applicable State of Mississippi regulations and federal laws regulating the take of wildlife, subject to the special conditions as published annually in 50 CFR and outlined in annual refuge-specific public use brochures, which are available to the general public. Refuge-specific hunting regulations allow for proper management of public lands and their resources. They also provide increased safety to refuge visitors. Harvest regulations fall within the state season, but may be restricted to fewer days/harvest limits.

A) Refuge-specific hunting and fishing regulations

The refuge is open every day from one hour before sunrise until one hour after sunset, except authorized uses. All lands currently outside the "closed to all public entry" areas owned and/or managed as a part of the refuge may be opened to the taking of all game species by the public with the following exception: Douglas Bluff Education Area, "Connecting People with Nature" area, moist-soil impoundments, and other designated areas. Waterfowl hunting is only allowed in the area designated on the map on designated mornings, until 12 noon, excluding federal holidays of the state waterfowl seasons. All other hunting is prohibited in the waterfowl hunting area during the waterfowl hunts. All refuge waters are open to fishing from March 1 through October 31, except for those specifically posted as "Closed To All Entry." Bank fishing is allowed year-round on the west side of the lake from the Bluff Lake Levee to the Cypress Cove Boardwalk. Additionally, the Noxubee River and borrow pit areas along Highway 25 are open year-round for recreational fishing.

Refuge-specific hunting and fishing regulations for this program:

1. *Migratory Game Bird Hunting*. We allow hunting of goose, duck, woodcock, and coot on designated areas of the refuge in accordance with state regulations subject to the following conditions:

a. All recreationalists are required to possess a $25 annual or $5 daily Refuge Public Use Permit, a signed General Public Use Brochure permit, and a $20 Waterfowl Quota Hunt permit when conducting activities on the refuge. Permits are non-transferable, and each individual may apply for only one permit. We require hunters to sign and carry the refuge General Public Use Brochure signifying they have read and understood the rules of the refuge. This permit must be in the hunter's possession at all times while on the refuge.

b. There is no early teal season.

c. Hunts and hunt dates are available at refuge headquarters and specified in the refuge brochure.

d. Personal property must be removed from the refuge daily. Hunters must remove all decoys, blind material, cameras, boats, and harvested waterfowl from the area no later than 12 noon each day.

e. All youth hunters under age 15 must be supervised by an adult 21 years of age or older, and must remain within sight and normal voice contact with the adult while hunting. Adult must comply with state regulations on supervision and one adult may supervise no more than two youth hunters.

f. Each day all waterfowl hunters must check in and out at the refuge's duck check station.

g. Possession of alcoholic beverages while hunting is prohibited.

h. Persons possessing, transporting, or carrying firearms on the refuge must comply with all provisions of state and local laws. Persons may only use (discharge) firearms in accordance with refuge regulations. Persons may only use approved nontoxic shot in shotgun shells , .22 caliber rimfire or smaller rifles, or legal archery equipment according to state regulations. Possession of magnum ammunition while hunting small game is probited. Deer hunters may use those weapons defined by state regulation.

i. Hunting or entry into areas designated “closed areas” is prohibited (see General Public Use Brochure map).

j. During the deer firearm hunts, any person hunting woodcock or accompanying another person hunting must wear at least 500 square inches (3,250 cm^2) of unbroken fluorescent-orange material visible above the waistline as an outer garment.

k. Dogs are allowed for retrieval of migratory game birds.

l. Equestrian use and all forms of motorized off-road vehicles are prohibited.

m. Valid permit holders (signed brochure) may take incidental species (coyote, beaver, nutria, and feral hog) during any hunt with those weapons legal during those hunts.

n. No person may capture, kill, or destroy any wildlife and remove the head, claws, teeth, hide, antlers, or any or all of such parts from the body with the intent to abandon the body. The removal of any object (natural, historical, or archaeological feature, etc.) is prohibited. Collection or release of plants, animals, insects, etc., is prohibited unless granted a special use permit. Cutting or trimming branches or brush for shooting lanes is prohibited. Marking of trees with flagging, reflective tacks, or other similar marking devices is prohibited.

2. *Upland Game Hunting.* We allow hunting of squirrel, rabbit, quail, opossum, and raccoon on designated areas of the refuge in accordance with state regulations subject to the following conditions:

a. Conditions 1c, 1d, 1h, 1i, 1l, 1m, and 1n.

b. All recreationalists are required to possess a $25 annual or $5 daily refuge Public Use Permit and a signed General Public Use Brochure permit. Permits are non-transferable, and each individual may apply for only one permit. Hunters are required to sign and carry the refuge General Public Use Brochure signifying they have read and understood the rules of the refuge. This permit must be in the hunter's possession at all times while on the refuge.

c. Hunting within areas open to waterfowl hunting is prohibited while those hunts are occurring.

d. During the any state firearm hunting season, any person hunting upland game or accompanying another person hunting must wear at least 500 square inches (3,200 cm^2) of unbroken fluorescent-orange material visible above the waistline as an outer garment.

e. Hunting of squirrel, raccoon, rabbit, quail, and opossum with dogs is allowed during designated hunts.

f. Use of dogs for raccoon and opossum hunting is allowed between the hours of legal sunset and legal sunrise.

g. All youth hunters under age 16 must be supervised by an adult 21 years of age or older, and must remain within sight and normal voice contact with the adult while hunting. Adult must comply with state regulations on supervision and one adult may supervise no more than two youth hunters.

3*. Big Game Hunting. H*unting of white-tailed deer and turkey is allowed on designated areas of the refuge in accordance with state regulations subject to the following conditions:

a. Conditions 1.c, 1d, 1h, 1i, 1l, 1m, 1n, 2a, 2c, and 2f apply.

b. All recreationalists are required to possess a $25 annual or $5 daily refuge Public Use Permit, a signed General Public Use Brochure permit, and a $20 White-tailed Deer Quota Hunt permit. Permits are non-transferable, and each individual may apply for only one permit. All hunters are to sign and carry the refuge General Public Use Brochure signifying they have read and understood the rules of the refuge. This permit must be in the hunter's possession at all times while on the refuge.

c. Organized drives for deer or other game are prohibited.

d. Hunting by aid of bait or distribution of any feed, salt, or other mineral at any time is prohibited.

e. Personal property must be removed from the refuge each day except for portable stands on the refuge from September 1 through January 15. Stands must be removed by January 15, except in the designated Wilderness Area where all personal property must be removed daily. Tree stands may not be placed on endangered red-cockaded woodpecker cavity trees which are marked with white painted bands. Additionally, within the designated wilderness area, mechanical equipment is prohibited including bicycles. Each stand is required to be tagged with the owner’s name, address, and permit number.

f. A special hunt for disabled hunters (as defined by Mississippi Admin Code Title 40 Part 2 Chapter 2 Rule 1.4 Special Use Regulations for Individuals with Disabilities) may be held annually. During this season, only disabled hunters may hunt on the refuge. Hunters must have a current refuge Public Use Permit, a Quota Hunt Permit if hunting white-tailed deer, and a signed General Public Use Brochure permit. Contact the refuge office for more information.

g. Hunters are allowed to hunt from tree stands in accordance with 50 CFR 32.2(i). Hunters must use a full body safety harness at all times while hunting from a tree. It is unlawful to drive a nail, spike, or other metal object into a tree or to hunt from any tree in which such an object has been driven.

4*. Sport Fishing.* We allow sport fishing on designated areas of the refuge in accordance with state regulations subject to the following conditions:

a. Conditions 1d applies.

b. All recreationalists, including anglers, are required to possess a $25 annual or $5 daily refuge Public Use Permit, and a signed General Public Use Brochure permit. Permits are non-transferable, and each individual may apply for only one permit. All anglers are required to sign and carry the refuge General Public Use Brochure signifying they have read and understood the rules of the refuge. This permit must be in the hunter's possession at all times while on the refuge.

c. Sport fishing (rod/reel and cane poles), boating, and bowfishing are permitted on all waters of the refuge from March 1 through October 1, except for the Noxubee River and the borrow pits along Highway 25, which are open year-round. Bank fishing is open year-round on the Bluff Lake Levee around to the Cypres Cove Boardwalk (the west side of the lake). Sport fishing will be conducted in accordance with all applicable state regulations and subject to the following special conditions. No commercial fishing activities are allowed on refuge lands. Fishing tournaments are prohibited on all refuge waters.

d. Anglers must keep boat travel at idle speed, and they must not create a wake when moving.

e. Set hooks are allowed in Noxubee River and Oktoc Creek. Anglers must tag poles and set hooks with their names and addresses when using them. Anglers must remove these devices when not in use.

f. Limb lines and hand grappling are allowed in Noxubee River only.

g. Anglers must tag poles and set hooks with their names and addresses when using them in rivers, creeks, and other water bodies. Anglers must remove these devices when not in use.

h. Trot lines are allowed in Bluff Lake, Loakfoma Lake, and Noxubee River under the following conditions:

i. Trotlines must have floats and cotton strings attached to each end with the owner's name and address.

ii. No one person is allowed more than two trotlines and no more than two trotlines per boat.

iii. Anglers must tend all trotlines every 24 hours and remove them when not in use.

i. Jug fishing is allowed in Bluff and Loakfoma lakes only under the following conditions:

i. Anglers must label each jug with their names and addresses.

ii. Anglers must attend all jugs every 24 hours and remove them when not in use.

j. Taking of frogs and turtles are prohibited.

B) Anticipated Public Reaction

The public has generally supported the refuge hunting and fishing programs with exceptions usually being a demand for more hunting and fishing, more access, and longer seasons. Generally, the local public desires more hunting and fishing than less on the refuge. Public reaction from surrounding communities has been very favorable and should continue to be the same in the future. Nationally, there are some anti-hunting and anti-fishing sentiments, and many organizations are opposed to hunting and fishing on national wildlife refuges. It is possible that some objections may be voiced to some or all of the activities within this plan.

C) Application Procedures

All recreationalists are required to possess a $25 annual or $5 daily refuge Public Use Permit and a signed General Public Use Brochure permit. All persons participating in the white-tailed deer and waterfowl quota hunts will be required to purchase an additional $20 Quota Hunt Permit. Any persons conducting special events such as field trials will need to purchase a $50 Special Use Permit. Permits are nontransferable, and each hunter/angler may apply for only one permit. We require hunters/anglers to sign and carry the refuge General Public Use Brochure signifying they have read and understood the rules of the refuge. This permit must be in the hunter's/angler's possession at all times while on the refuge.

D) Description of Selection Process

None required for open refuge hunts nor fishing.

E) Media Selection for Publicizing

General public use regulations brochures are printed and dispensed at the refuge office and at various refuge parking lots. Public use regulations brochures are also available on the refuge's website and are mailed out as requested.

F) Description of Orientation

No specific effort is made toward hunter/angler orientation other than informational kiosks, brochures, and personal contacts. Pre-hunt scouting is allowed since non-consumptive wildlife observation is open year-round; however, calling of wildlife is prohibited unless actively hunting.

G) Hunter/Angler Requirements

1. Hunting and fishing will be permitted in accordance with federal regulations governing public use on national wildlife refuges as set forth in 50 CFR. Hunting and fishing will be conducted within the framework of applicable State of Mississippi regulations and other federal laws regulating the take of wildlife, subject to the special conditions as published annually in 50 CFR and outlined in annual refuge-specific public use brochures, which are available to the general public. Refuge-specific hunting regulations allow for proper management of public lands and their resources. They also provide increased safety to refuge visitors. Harvest regulations fall within the state season but may be restricted to fewer days/harvest limits.

2. The refuge is open every day from one hour before sunrise until one hour after sunset, except authorized uses. All lands currently outside the “closed to all public entry” areas owned and/or managed as a part of the refuge may be opened to the taking of all game species by the public with the following exception: Douglas Bluff Education Area, “Connecting People with Nature” area, moist-soil impoundments, and other designated areas. Waterfowl hunting is only allowed in the area designated on the map on designated mornings, until 12 noon, excluding federal holidays of the state waterfowl seasons. All other hunting is prohibited in the waterfowl hunting area during the period waterfowl hunting is actively ongoing. All refuge waters are open to fishing from March 1 through October 31, except for those areas specifically open to year-round fishing. Bank fishing is allowed year-round on the west side of the lake from the Bluff Lake Levee to the Cypress Cove Boardwalk. Additionally, the Noxubee River and borrow pit areas along Highway 25 are open year-round for recreational fishing.

3. All recreationalists are required to possess a $25 annual or $5 daily refuge Public Use Permit and a signed General Public Use Brochure permit. All persons participating in the white-tailed deer and waterfowl quota hunts will be required to purchase an additional $20 Quota Hunt Permit. Any persons conducting special events such as field trials will need to purchase a $50 Special Use Permit. Permits are nontransferable, and each hunter/angler may apply for only one permit. Hunters and anglers are required to sign and carry the refuge General Public Use Brochure, signifying they have read and understand the rules of the refuge. This permit must be in the hunter's/angler’s possession at all times while on the refuge. The General Public Use Brochure permit is primarily for the purpose of providing information on hunting and fishing regulations and other refuge specific regulations. General Public Use Brochure permits are required to be signed and carried, signifying that the hunter/angler has read and understands the rules. The Public Use Pass and General Public Use Brochure permit shall be available to all persons desiring to participate in refuge

programs. Permits are nontransferable and all signature blocks must be signed and in possession while on the refuge. Should public demand become great enough that numbers must be restricted, a lottery system may be instituted in an effort to control numbers of hunters/anglers. In addition, consideration may be given to time and space scheduling and/or zoning to allow for disabled user accessibility, youth, non-consumptive user conflicts, and/or over-use issues. Additionally, all appropriate state/federal licenses and recreational gear licenses are required.

4. Information and open dates are available at refuge headquarters and specified in the General Public Use Brochure permit.

5. Personal property, including decoys, blind material, cameras, and boats, must be removed from the refuge daily (50 CFR 27.93), unless otherwise stated in the General Public Use Brochure permit. Portable stands may be placed on the refuge from September 1 through January 15, except in the designated Wilderness Area where all personal property must be removed daily. Additionally, within the designated Wilderness Area, mechanical equipment is prohibited including bicycles. Each stand is required to be tagged with the owner's name, address, and permit number. Anglers must tend all trotlines and jugs every 24 hours and remove them when not in use. The refuge is not responsible for the theft or damage that may occur to any personal property, including damage from habitat management activities.

6. Motor vehicles are allowed only on designated routes shown on the map on the reverse side unless the road is closed by sign or gate. Vehicles must be parked adjacent to these roadways and may not block gates. No vehicles are allowed to travel off-road. Unless otherwise posted, refuge speed limits are 25 miles-per-hour. Bicycles will be allowed access to gated roads within areas open to hunting as part of accepted hunting gear.

7. Recreationalists must travel on refuge waters at idle speed only and must not produce a wake when the lakes are open to fishing and recreational use. Watercraft is not permitted in the spillways below the lakes.

8. No person may capture, kill, or destroy any wildlife and remove the head, claws, teeth, hide, antlers, or any or all of such parts from the body with the intent to abandon the body. The removal of any object (natural, historical, or archaeological feature, etc.) is prohibited. Collection or release of plants, animals, insects, etc., is prohibited unless granted a special use permit. Hunters are allowed to hunt from tree stands in accordance with 50 CFR 32.2(i). Hunters must use a full body safety harness at all times while hunting from a tree. It is unlawful to drive a nail, spike, or other metal object into a tree or to hunt from any tree in which such an object has been driven. Cutting or trimming branches or brushes for shooting lanes is prohibited. Marking of trees with flagging, reflective tacks, or other similar marking devices is prohibited.

9. The use of artificial light, including headlights, to spot or locate any animal, except authorized nighttime hunting of raccoons and opossums, is strictly prohibited. Calling of

wildlife prior to the opening of any hunting season or for purposes of observation and photography is prohibited. Harassing or man-driving of wildlife is prohibited.

10. Persons possessing, transporting, or carrying firearms on the refuge must comply with all provisions of state and local laws. Persons may only use (discharge) firearms in accordance with refuge regulations. All persons hunting small game and turkey are required to use nontoxic shot throughout the entire refuge. Small game rifle hunters are restricted to .22 caliber rimfire or smaller rifles. Possession of magnum ammunition while hunting small game is prohibited. Deer hunters may use those weapons defined by state regulation.

11. During any state deer gun hunting season, any person hunting upland game must wear at least 500 square inches (3,200 cm2) of unbroken fluorescent-orange material visible above the waistline as an outer garment. Hunters should be aware other public uses will coincide with hunting seasons and visitors may not be wearing hunter orange. It is the hunter's responsibility to be aware of what is in the line of fire. Non-hunters located within hunt areas are encouraged to wear similar clothing during open hunting seasons.

12. Hunting by aid of bait or distribution of any feed, salt, or other mineral at any time is prohibited.

13. All youth hunters under the age of 16 must be supervised by an adult 21 years of age or older, and must remain within sight and normal voice contact with the adult while hunting. Adults must comply with state regulations on supervision, and one adult may supervise no more than two youth hunters. Only the youth may handle, carry, transport, or discharge firearms. Youth hunters, hunting outside of designated youth season, are required to obtain any additional permits required.

14. All harvested wildlife are required to be checked at a refuge self-clearing check station on the same day harvested and prior to leaving the refuge.

15. Hanging or cleaning of wildlife is prohibited within the "Connecting People with Nature" area or immediately adjacent to parking lots. Wildlife should be field-dressed where harvested.

16. The taking of frogs and turtles is prohibited.

17. Other prohibited activities:

    a. open fires

    b. camping

    c. target shooting

    d. horseback riding

18. Field trials are allowed by special use permit.

19. Use of alcoholic beverages while hunting is prohibited. The refuge adopts all regulations related to alcohol use of the surrounding county.

Sam D. Hamilton Noxubee National Wildilfe Refuge

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