Mountain Longleaf National Wildlife Refuge

Habitat Management Plan

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1.0 Introduction

1.1 Planning Process

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

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

An HMP is a step-down management plan of the Refuge Comprehensive Conservation Plan (CCP). The CCP describes the desired future conditions of a refuge or planning unit and provides long-range guidance and management direction to achieve the purpose(s) of the refuge; helps fulfill the mission of the System; maintains and, where appropriate, restores the biological integrity, diversity, and environmental health of each refuge and the System; helps achieve the goals of the National Wilderness Preservation System, if appropriate; and meets other mandates. A CCP has not been accomplished on Mountain Longleaf National Wildlife Refuge and will not be complete for several years. At the time of CCP preparation, the HMP will be reexamined and appropriate information will be incorporated into the CCP.

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

1.2 Mountain Longleaf National Wildlife Refuge

The Bob Stump National Defense Authorization Act for Fiscal Year 2003, P.L. No. 107-314, authorized the transfer, to the administrative jurisdiction of the Secretary of the Interior, 7,759 acres in order to establish Mountain Longleaf National Wildlife Refuge (Refuge). P.L. No. 107-314 established that the primary purpose of Mountain Longleaf National Wildlife Refuge was to "enhance, manage, and protect the unique mountain longleaf pine ecosystem on the property." Additional management objectives given in P.L. No. 107-314 are to: (1) conserve and enhance populations of fish, wildlife, and plants in the refuge, including migratory birds and species that are threatened or endangered, with particular emphasis on the protection of the mountain longleaf pine plant ecosystem, (2) protect and enhance the quality of aquatic habitat in the refuge, (3) provide, in coordination with the Alabama Department of Conservation and Natural Resources, the public with recreational opportunities, including hunting, fishing, wildlife observation and photography, and (4) provide opportunities for scientific research and education on land use and environmental law.

On October 23, 2003 the Calhoun County Joint Powers Authority (JPA) transferred an additional 1,257 acres to the Department of the Interior. This transfer increased the size of the Refuge to 9,016 acres (Fig. 1) and provided additional acreage for habitat restoration, wildlife management activities and public use.

Refuge establishment objectives, as described in the Preliminary Project Proposal (USFWS 1998) and the Refuge Establishment Environmental Assessment (USFWS 2003a), were (1) to preserve and enhance the natural mountain longleaf pine ecosystem; (2) to help perpetuate the neotropical migratory bird resource; (3) to preserve a natural diversity and abundance of native fauna and flora, with special emphasis on the red-cockaded woodpecker and other endangered and threatened species; and (4) to provide compatible, wildlife dependent recreational opportunities such as hunting, fishing, wildlife observation and photography, and environmental education and interpretation.

1.3 Refuge Vision

The **Refuge Vision** broadly reflects the reason for establishing the refuge, based on both legislated and planning purposes and objectives. The vision statement is as follows:

Mountain Longleaf National Wildlife Refuge will be managed to maintain and restore a naturally regenerating mountain longleaf pine ecosystem, along with providing educators, research scientists, and the public with a broad range of opportunities to appreciate and enjoy a rare and disappearing southern forest type.

The presence of the best remaining example of a fire maintained mountain longleaf pine ecosystem is recognized as the primary factor for selecting the area as a National Wildlife Refuge. With closure of the base in 1998, military related wildfires disappeared and longleaf pine forests no longer experienced recurring wildfires. Without implementation

of an active management program, these forests were expected to slowly evolve into a more hardwood dominated forest community. To meet the primary purpose of refuge establishment, priority was given to preserving and enhancing the longleaf pine ecosystem through an active management program. The proposed HMP is consistent with federal and state planning, and will provide an example as well as benchmark conditions for other longleaf pine restoration efforts in the region.

With establishment of the Refuge, natural resource management programs must be formulated and established according to Service goals and objectives. The Army however owned and managed the Refuge as part of Fort McClellan for almost one hundred years. During the last 50 years of ownership, the Army implemented and conducted a variety of natural resource programs. The present HMP attempts to identify resource programs and research accomplished under army ownership and apply this information to the differing purposes and goals of refuge management.

The HMP views the entire refuge as a single landscape unit under the classification of "forest management". Because forest stands exist as a mosaic within this single forested system, and fire historically occurred throughout the system, a refuge-wide approach is necessary to ensure restoration success. The goal of establishing and maintaining a dynamic, fire-maintained longleaf pine ecosystem requires that management applications change with time and location. It is therefore important that army remedial cleanup programs consider a range of management scenarios that can be modified as the forest evolves or is altered through natural or fire driven processes. For example, some longleaf pine stands currently require few management applications other than fire. Over time, these same forest stands will and are expected to be altered through natural processes, such as storms and high winds, insect infestations, plant diseases, lightning strikes, heavy freezes, and damaging wildfires. These previously healthy forests may now require more intense management applications, such as supplemental planting and mechanical removal, to restore healthy forest conditions.

1.4 Longleaf Pine Restoration

The definition of "restoration" differs according to the final objectives of individual management programs. The Refuge Vision provides insight to understanding program objectives on Mountain Longleaf National Wildlife Refuge. The primary goal is to restore and maintain a naturally regenerating mature longleaf pine forest. Longleaf pine forests evolved over hundreds or perhaps thousands of years to form the complex ecological system covering the Refuge. Most research and restoration on longleaf pine however has been directed at establishing even age-plantations, which are subsequently harvested for timber, and replanted or naturally seeded to form the next even-age plantation (Simberloff 1993). Success is usually measured by board-foot production. This closed canopy forest does not represent what we now understand to be a naturally regenerating longleaf pine forest. In fact, the National Vegetation Classification System (Grossman et al. 1998) considers natural longleaf pine communities not as a "forest", but as "woodlands". The classification system defines woodlands as a vegetation community

with open stands of trees forming a 25-60 percent canopy cover. Others have commonly applied the term "savannah" to the natural longleaf pine community.

It is critical that managers understand the regeneration process within natural longleaf pine forests. Stands regenerate in a mosaic of small patchwork disturbances that occur over hundreds of years. These disturbances range from single tree mortality to multiple tree losses with most patches much less than an acre in size. These small openings allow sunlight to reach the forest floor and germinate the shade intolerant seedlings. The eventual forest is made up of a complex mosaic of small overlapping even-aged patches that form, what appears to be, an all aged forest. Only a few sites in the Southeast have been studied to understand stand dynamics within natural old-growth longleaf pine forests (Varner et al. 1999). We are fortunate that one of those sites, the only one outside the Coastal Plain, is on the Refuge (Varner 2000; Varner et al. 2000). Information derived from these studies is critical to the design and success of restoration efforts on the Refuge.

Longleaf pine forests on the Refuge exhibit a number of qualities that will be advantageous to future restoration efforts; (1) existing stands of old-growth or naturally regenerated second-growth already exist on much of the Refuge; (2) the herbaceous ground layer, in many situations, is intact and comprises an extremely diverse native fire-adapted plant cover; (3) artificial planting has never occurred and genetic contamination is not an issue; and (4) fire has continually been part of the landscape under army ownership for the previous hundred years. The primary requirement for restoration on the Refuge involves the reintroduction of fire back into the forest community. Additional areas where hardwoods have encroached and invasive pines have become established, or where seedling stocking is low, will require more intensive restoration efforts.

A critical element for measuring restoration success is to view accomplishments over an extended length of time, and avoid evaluating success or failure based on short-term observations. With the presence of an adequate longleaf pine overstory and the establishment of forest openings, a longleaf pine forest can be maintained through a prescribed burning program. Managers will vary fire frequency, intensity and timing to accomplish short-term objectives that will lead to a more consistent maintenance prescribed burning schedule. Restoration is a lengthy process and, in the case of second-growth stands, may require many years to establish stand structure of a fire-maintained longleaf pine forest. Refuge forests however provide a distinct advantage for success over most longleaf pine forests, with many of the required stand qualities already in place. The existence of natural, albeit degraded, longleaf pine stands, ranging up to 250 years in age, represents one of the best case scenarios for restoration success.

1.5 Habitat Management Plan

The HMP contains a description of the proposed management program as follows:

Section 1 – Introduction

Provides an overview and introduction to plan purposes

Section 2 – Environmental Setting and Background

Provides a review of site history and a description of physical setting along with regional and local ecological issues

Section 3 – Resources of Concern

Provides a description of Refuge biological communities and ecological significance that includes endangered species and unique biological communities.

Section 4 – Habitat Goals and Objectives

Provides a overview of Refuge management goals, strategy and the formulation of management objectives.

Section 5 – Habitat Management Strategies

Provides a description of management goals and specific objectives proposed for accomplishing goals.

Section 6 – Management Strategy Documents

Provides a description of resources needed to accomplish management goals along with management constraints and regulatory compliance.

2.0 Environmental Setting and Background

2.1 Location

Mountain Longleaf National Wildlife Refuge (Refuge) is located in Calhoun County in northeastern Alabama. It is contiguous to the City of Anniston, and lies approximately 65 miles east of Birmingham and 90 miles west of Atlanta (Figure 1). The 7,759 acre refuge was legislatively established on May 31, 2003 within the former military training base of Fort McClellan. On October 23, 2003, an additional 1,257 acres were contributed by the JPA for the current total of 9016 acres. Fort McClellan was selected for closure by the Base Realignment and Closure Commission of 1995, and was effectively closed on September 30, 1999.

The Service has established Ecosystem Units using the U.S. Geological Survey's Hydrologic Unit Map as the foundation for managing and organizing its staff resources and program capabilities. The Refuge is located in the southern portion of Southern Appalachian Unit, and is included within the multi-agency Southern Appalachian Assessment (SAMAB 1996).

2.2 Management Units

A legacy of Army ownership involves the presence of "Training Area" designations. All military lands outside the cantonment area were designated and mapped by the Army as training units. Military trainers were assigned to specific areas according to the "Training Area" designations. Boundaries were clearly marked and eventually became a standard for civilian activities as well. Most research and natural resource management was also accomplished according to the training area designations. To incorporate past research and management efforts into future planning, the HMP continues to use these units which are now termed "Management Areas". "Management Area" boundaries within the Refuge as well as on adjacent JPA lands can be found on Figure 8. Units within or partially within the Refuge range from 248 to 682 acres. Boundaries typically follow a major or well recognized road and continue to be signed with the area unit numbers.

2.3 Physical Features

2.3.1 Geology

The Refuge lies within the Appalachian fold and thrust belt. Southeastward-dipping thrust faults with associated minor folding are the predominant structural features. Geologic contacts generally strike northeast/southwest to north/south parallel to the faults. Geologic formations range in age from Precambrian to Mississippian.

Almost the entire Refuge is within The Weisner Geological Formation. The Weisner Formation occurs to 2,500-foot (750-meter) depths and consists of buff shale, siltstone, sandstone, quartzite, and conglomerate. Outcrops form hills or mountains of great relief. Quartzite and conglomerate are most conspicuous where they form crests or ledges along the southeastern side of Choccolocco Mountain. The mountain runs north to south and contains deposits of limonite, manganese, bauxite, and hematite. Several historic iron ore mining sites are located within the Refuge. The quartzite beds of the Weisner Formation are highly permeable and responsible for the abundance of springs and seepages along Choccolocco Mountain.

A second formation, Newala and Longview Limestone, has been mapped adjacent to the Refuge along South Branch Cane Creek. This formation is highly permeable containing numerous solution channels. In addition, limestone outcrops adjacent to the Refuge support a calciphilic community containing rare species and unusual community types. Extensions of these communities and local limestone outcrops may eventually be found on the Refuge.

Historically, lands adjacent to or on the Refuge have been identified as containing several cave systems. No record in recent times however has located any caves on or adjacent to the Refuge. The closest known cave is Weaver Cave, about four miles east of the Refuge.

2.3.2 Topography

The entire Refuge is located within the north-south extending mountain range referred to as Choccolocco Mountain. Choccolocco Mountain is actually a 24 mile long ridge that extends from the City of Piedmont on the north to the City of Oxford on the south. Elevations on the Refuge range from a low of 880 feet above sea level (asl) on the northwest corner and along North and South Branches Cane Creek, to 2063 feet asl on Morton Mountain. Choccolocco Mountain actually forms the third highest mountain ridge in Alabama, after Cheaha and Dugger Mountains. While Choccolocco Mountain extends north to south through the Refuge, smaller saddle ridges extend west and east off of the mountain. Resulting topography is highly varied with differing aspects and slopes (Figure 2). Approximately 75 percent of the refuge contains slopes exceeding 40 percent.

2.3.3 Hydrology

Calhoun County lies within the Coosa River Drainage System. The Coosa River flows in a southwesterly direction and forms the western boundary of the county. Within the Refuge, Choccolocco Mountain forms the major surface water divide (Figure 3). East of this divide, surface water drains into Choccolocco Creek and then into the Coosa River. To the west of the mountain, surface water eventually flows into either Cane or Ohatchee Creeks, before entering the Coosa River. Most surface waters on the mountain's west face originate from headwater streams that eventually form Cane Creek. Some of the

larger named streams that flow into Cane Creek include South Branch Cane Creek, North Branch Cane Creek and Cave Creek. A small area on the northern portion of the Refuge forms headwater drains that flow into Little Tallahatchee, than Tallahatchee, and eventually Ohatchee Creek, before entering the Coosa River. Many of the headwater streams on Choccolocco Mountain are ephemeral and are dry, at least during late summer. Others, flow across karsts geology and may exhibit periodic subsurface flow, at least during dryer periods. Cave Creek actually flows through Weaver Cave to the west of the Refuge, returning to the surface about half a mile from the cave's entrance.

A significant characteristic of surface water hydrology includes springs that originate along the slopes and base of the mountain. While some are ephemeral, others are perennial and create seepage wetlands ranging up to seven acres in size. Some of the more prominent seepages are Cave Creek, Marcheta Mountain, South Branch Cane Creek and Bain's Gap Creek. Many of these seepages contain a sphagnum bog environment. Field surveys have located 24 spring seeps that meet criteria for jurisdictional wetlands (Whetstone et al. 1998).

2.3.4 Soils

Refuge soils reflect the extreme mountainous conditions of Choccolocco Ridge. The location of soil types according to the county soil survey (Harlin and Perry 1961) is provided on Figure 4.

Almost the entire Refuge was mapped as "Stony Rough Land Underlain by Sandstone". This miscellaneous land type consists of rough mountainous areas with many outcrops of sandstone and quartzite bedrock, loose rock fragments, and scattered patches of sandy soil material. In Calhoun County, it includes all of the higher parts of Choccolocco and Coldwater Mountains where the Weisner formation is common. While county-wide, slopes tend to be greater than 25 percent for this soil type, the majority of slopes on the Refuge exceed 40 percent. Soil material is generally shallow over bedrock. Runoff is high, infiltration is slow, and the capacity for available moisture is low. The Soil Conservation Service considers erosion hazard high for these soils.

County soil surveys are primarily directed at the agricultural and, to a lesser extent, the forest potential of soils. "Stony Rough Land" represents a basic non-typed soil that supports neither of these uses to any commercial extent. Surface areas range from rock outcrops to shallow sandy or cherty soils. While this variability may have slight influences on commercial products, natural plant communities may significantly vary. For example, Virginia pine may form pure stands on shallow soils over rock outcrops, but be totally absent from slightly deeper soils. This variation is compounded by topography that creates isolated pockets of deeper soils that form small micro-habitats that were beyond the ability and scope of soil scientists to map. Varner et al (2000) observed a significant variability in rockiness, soil depth and texture on lands classified as "Stony Rough Land". They concluded that this soil classification is "severely inadequate for future land management and restoration efforts at Fort McClellan". Existing soils

actually form a mosaic of slightly differing physical and biological conditions that significantly influence forest cover. Future management prescriptions should therefore consider site specific soil conditions and local variation when designing treatment and management applications within this miscellaneous land type.

Remaining soil types are found along stream corridors and the western refuge boundary. These soil generally represent slightly improving biological productivity. Anniston and Allen Stony Loams can be found along the western refuge boundary and the upper reaches of South Branch Cane Creek. These soils are typically deep, strongly acid, well drained soils that have developed in old local alluvium. They commonly occur on foot slopes and on colluvial fans at the base of Choccolocco Mountain.

Jefferson Fine and Gravelly Fine Sandy Loams are exclusively restricted to upper stream corridors along the western Refuge boundary. They are most abundant along North Branch Cane Creek, but can be found to a lesser extent along South Branch Cane Creek, Cave Creek and the headwaters of Little Tallahatchee Creek. These typically well-drained, strongly acid soils occur on small fans and foot slopes and developed from old local alluvium that washed or sloughed from surrounding ridges.

A small area of Cumberland Gravelly Loam is found along the northwest corner of the Refuge. These well-drained soils of stream terraces have developed in old alluvium and are typically more fertile than other refuge soils, and contain a moderate supply of organic matter.

2.4 History of Refuge Lands

The Army has completed Phase I cultural resource pedestrian surveys of all lands that are now part of the Refuge. Seventeen sites were identified through these surveys, and submitted to the Alabama State Historic Preservation Office (SHPO) as potentially eligible for listing on the National Register. All sites represent lithic scatters suspected of being aboriginal camp sites. A map of these sites will be maintained at the Refuge Headquarters, and reviewed for maintenance and operational activities.

Should previously unrecorded cultural resources be encountered during the thinning and/or other refuge management activities, the Refuge will cease all activities at that specific location and make all reasonable efforts to avoid or minimize damage to the site. The Office of the Regional Archaeologist will be immediately notified and advised of the nature of the discovery.

Should human remains be encountered in an unmarked grave during Refuge management activities or permitted activities, such as commercial thinning, all actions will cease at that specific location. The Refuge Manager, the Regional Archaeologist, and the Refuge Law Enforcement Officer will be contacted immediately. The SHPO, the County Medical Examiner, and the pertinent tribes will be notified pursuant to the provisions of the ***Native American Grave Protection and Repatriation Act***.

2.4.1 Prehistoric Land Use (Native American to 1832)

Prehistoric and historic habitation on the Refuge and surrounding lands has been documented by the Army (Reed et al. 1992). Native American use of refuge lands appears to have been minimal. Villages and agricultural settlement were documented along Cane and Tallahatchee Creeks to the West, and along Chocccolocco Creek to the east. Mountainous lands forming the Refuge were probably used as transportation pathways between villages, and for hunting and food gathering. All cultural resource sites discovered through army investigations involved lithic scatters believed to be temporary camp sites. A single stone snake effigy that originally extended 200 meters along the crest of Skeleton Mountain is located directly adjacent to the refuge boundary. The presence of this effigy suggests that higher elevations on the Refuge may have held religious significant to aboriginal inhabitants.

2.4.2 Historical Land Use (1832 – 1917)

Early European settlement in northeast Alabama began in earnest during the early 1830's, and culminated with removal of the Native American inhabitants, the Creeks, in 1834. At the time of European settlement, Calhoun County was in continuous forest with localized agricultural clearings along major streams. Early settlers first moved onto cleared Native American village sites and then cleared additional lands by "deadening" the original old-growth forest. Early settlers describe the country as open from annual burning by the Creek Indians (Mann 1970). The same settlers describe the use of Indian trails as roadways, but go on to say that the country was so open that wagons could travel in any direction.

Calhoun County remained an agricultural region with most upland forests remaining intact until well after the Civil War. Slightly before and during the Civil War, iron ore mining and the smelting of pig iron became a regionally important industry. Iron furnaces were fired with charcoal that was produced from the surrounding forests. The preferred tree in producing this charcoal was longleaf pine. Refuge lands were probably little affected by these operations until the establishment of the Woodstock Iron Company and the founding of Anniston in 1872. The Woodstock furnaces went on to become the second largest charcoal iron operation in the United States. This charcoal iron furnace operated from 1873 to 1887, and required a thousand acres of timber per year to supply charcoal. Refuge forests no doubt were heavily impacted through charcoal operations with easily accessible lands being stripped of their timber. Charcoaling beds can even now be found on lands adjacent to the Refuge.

With the demise of charcoal iron production, refuge forests went into a period of speculative ownership and, in some cases, actually reverted to government ownership. The Golden Age of the southern timber industry began in the 1890's and lasted until the removal of Alabama's old-growth in the 1930's. The impact on refuge lands is unclear, but speculative ownership by mining companies and the previous removal of easily

accessible forests, probably made other lands in the region more appealing to large timber companies.

2.4.3 Fort McClellan (1917-1998)

By the late 1890's, the Alabama National Guard began using Choccolocco Mountain as a target area for artillery firing practice, and in 1917 lands, including the Refuge, were purchased by the Army as Camp McClellan. With upgrading of the installation to Fort McClellan in 1929, the area was owned and operated as an Army training facility until closure in 1998. Between 1917 and purchase of Pelham Range in 1942, Choccolocco Mountain formed the backdrop for all artillery, mortar and small arms training. In 1942 Pelham Range, five miles to the west, was purchased by the Army, and all artillery and most mortar firing were relocated from the original Main Post. In recent years, only small arms firing ranges have operated on lands that became part of the Refuge. Impacts from firing ranges have included forest clearing for firing points, lead contamination from small arms fire, disposal of training and range debris, and the historical impact of explosive rounds within the mountains. At the time of base closure, Fort McClellan was home to the Army's Chemical and Military Police Training Schools. Basic training operations and extensive National Guard training were also significant missions of Fort McClellan. .

Forestry Program. Forest management and timber harvest by the Army is poorly documented prior to their 1991 Integrated Natural Resources Management Plan (Pittman et al. 1991). Based on historical descriptions in the plan, the Army operated a planing and sawmill between World War II and 1950. It was estimated that several million board feet were harvested during this period. The first forest management plan was implemented in 1952 with periodic assistance from a professional forester beginning in 1954. A revision of the plan in 1961 and a rudimentary forest inventory indicated that several million board feet of overmature longleaf pine were in need of harvesting. According to the 1991 plan, this overmature longleaf pine was "treated" between 1961 and 1969. After this period, there is no specific discussion of longleaf pine on Fort McClellan. It would appear that most harvesting or clearing of longleaf pine in recent years has involved range-clearing operations on lower slopes or at the base of the mountains.

The Army's forestry program was directed at commercial timber production as a secondary land use after training. Funds generated from the sale of timber supported most land management and all fire programs on training lands. Generally, forest management programs were directed at higher site index lands on Pelham Range, five miles west of Main Post. Lands on Main Post that eventually became the Refuge were classified as non-commercial forest land and received few of these management applications. The primary forest activity on these areas involved wildfire suppression and firebreak maintenance.

Hunting Program. Hunting programs and game management efforts on Fort McClellan are poorly documented prior to 1950. In 1949, the Post Commander appointed the first civilian game warden to protect wildlife and initiate game management programs. Early efforts seem to have involved planting *Lespedeza bicolor* on Pelham Range as habitat improvement for quail (Pittman et al. 1991). In 1952, the U.S. Fish and Wildlife Service provided the Army with general recommendations for hunting and fishing programs, along with some game management techniques. Again, game management seemed to emphasize habitat improvement for quail.

By 1964, a fish and wildlife conservation plan was developed in cooperation with the U.S. Fish and Wildlife Service and the Alabama Department of Conservation. By 1965, responsibilities for fish and game management were transferred from the Provost Marshal to the Post Engineer. In 1967, Jacksonville State University biologist, Charles W. Summerour, prepared a detailed wildlife management plan, which was implemented over the next few years.

The original cooperative plan established in 1964 was revised in 1980, 1987, 1991 and finally in 1998 (Reisz Engineering and Gene Stout and Associates 1998). The final 1998 plan reflected a change to a broader ecosystem management approach.

Fort McClellan regulated hunting seasons in accordance with Alabama hunting and fishing regulations. Game species managed by the Army and residing on lands that are now part of the Refuge included; white-tailed deer, wild turkey, raccoon, bobwhite, mourning dove, squirrels (eastern gray and eastern fox), and rabbits (eastern cottontail and Appalachian cottontail). Additional species that were not managed, but hunting opportunities were available included; opossum, red fox, gray fox and bobcat. Hunting demand and interest were identified as high only for deer and turkey. Trapping was prohibited on Fort McClellan.

Although detailed harvest data are unavailable for the Refuge, army biologists estimate that about 125-150 deer were harvested annually from Main Post in recent years. In 1991, average live weight of yearling bucks was about 100 lbs. In recent years, turkey numbers have dramatically increased within the Refuge area as well as regionally. Approximately 30 to 35 turkeys were harvested annually from Main Post in recent years.

Reclamation Program. Military training programs disturbed slopes and exposed shallow highly erodable soils on this former army installation. In addition, a number of areas served as borrow pits for road base and fill material. While little effort was taken to stabilize soils or manage surface water runoff, a single installation-wide program was accomplished by the Army in the early 1980's. Both conventional seeding and hydro-seeding techniques were used to reclaim affected areas using a strip-mine reclamation seed mixture. Detailed documentation of this effort is lacking, but the seed mixture was known to contain weeping love grass (*Eragrostis curvula*), an exotic native to South Africa that is commonly used for road and mine reclamation projects. A number of areas containing weeping love grass can be found throughout the Refuge and, in all probability, were part of this reclamation program. Locations are provided on Figure 5.

Kudzu (*Pueraria lobata*), which is an exotic invasive legume from East Asia, forms serious infestations throughout former Fort McClellan. There is no record that the Army attempted to control and eliminate this exotic. Most infestations on the former fort are located west of refuge boundaries. A single infestation within refuge boundaries is located on the former Range 21 along Bain's Gap Road. Significant areas of infestations can be found along Bain's Gap Road west and east of the Refuge. These areas constitute an ongoing concern involving the spread of kudzu onto the Refuge from roadside mowing.

Unexploded Ordnance and Environmental Contamination. Fort McClellan existed as a military training facility for over 100 years. During this time, a wide variety and number of firing ranges existed on the former base. Some of these ranges were used for training with explosive rounds, and currently represent a danger from remaining unexploded ordnance (UXO). Some ranges were only used for a few years, particularly during World Wars I and II, and have since disappeared and grown back in a forest cover. Other ranges were actively used up to base closure in 1998, and are evident to the present observer. As part of the base closure process, the Army is surveying and characterizing all training lands for the potential presence of UXO. Within the legislative transfer of land to the Service, stipulations were made that the Army remains responsible for the remediation of all UXO within the Refuge. Army investigations are entitled, Engineering Evaluations/Cost Analysis (EE/CA), and involve random sampling of lands to determine contamination, design of appropriate remediation techniques, and cost scenarios for cleanup. While a number of EE/CA investigations are in process on Fort McClellan, the Refuge is located on lands evaluated within the Charlie Area EE/CA.

The Army Charlie Area EE/CA has not been completed at the time of HMP preparation. The Service is currently working under interim land use controls on the Refuge. These interim land use controls were developed by the Army and represent conservative measures to prevent possible injury to the public and Service personnel from UXO. Refuge lands are classified according to three levels of access restrictions (Figure 6):

UXO Contaminated – Closed to public and open to surface use by Service Personnel
UXO Clean – Closed to public, but open to unrestricted management when supervised by Service personnel
UXO Clean – Open to unrestricted management

Suspected UXO contaminated lands are undergoing further investigation and possible remediation, and may have differing land use controls in final refuge land use controls.

Fort McClellan provided home to the Army's Chemical Training School. Most army training with chemical and biological agents occurred at one time or another on Fort McClellan. Prior to the 1960s, much of this training occurred in open remote areas on the fort. A number of sites, including some on the Refuge, were used for disposal and/or training using chemical decontaminants. The Army has completed investigations into

the possible presence of chemical and biological agents and has concluded none exist on Fort McClellan or the Refuge.

A second area of environmental investigation involves the characterization and remediation of RCRA related contaminants. These investigations are continuing on the Refuge, with issues involving lead and other forms of contamination on small arms firing ranges and training areas.

Previous Biological Investigations. The Army entered into a nation-wide agreement to accomplish biological inventories on military installations during the mid-1980s. Under this agreement, The Nature Conservancy inventoried and characterized natural communities on Fort McClellan during the late 1980s and early 1990s (ANHP 1994).

The Nature Conservancy inventory provided the first comprehensive characterization of flora and fauna on Fort McClellan. In addition, the investigation identified 22 animals and 11 plants that were considered endangered, threatened or rare (ANHP 1994). Thirteen natural areas comprising biological communities containing rare species were delineated on maps. In general, most natural areas included spring seepages and disjunct range extensions. Of particular significance was the designation of the "mountain longleaf pine" forest as the single most important community type on Fort McClellan. The long-term future of virtually every rare species and natural area described in the report was considered dependent on the survival of these forests.

Using the biological inventory as a baseline document, further investigations were designed to more fully characterize natural resources and design effective management and protection plans. Most studies were directed at providing a more comprehensive understanding of the mountain longleaf pine forests and their relationship to other community types on the Fort.

One of the more significant investigative programs involved a decade long relationship with Auburn University's School of Forestry and Wildlife Sciences. During this time, the Army supported two Theses on mountain longleaf pine (Maceina 1997, Varner 2000). Maceina (1997) investigated the community structure within second-growth forests and documented a slow successional shift to pine-hardwoods and hardwood community types. Associated floristic surveys revealed Fort McClellan forests represented an excellent mountain longleaf pine ecosystem remnant which continues to sustain overall herbaceous species richness. A subsequent longleaf pine restoration plan (Maceina et al. 1997) reviewed the history and status of mountain longleaf pine ecosystems, and presented management alternatives to restore and maintain these unique forests. Prescribed burning was considered critical to the future survival and maintenance of these forests. A summary of her thesis conclusions along with herbaceous plants within an undisturbed mountain longleaf pine forest on Fort McClellan is provided in Maceina (2000).

Varner (2000) authored the second Thesis that investigated the presettlement extent of mountain longleaf pine, characterized plant species composition in pristine stands,

quantified age and stand structure of selected old-growth stands and, lastly but not least, developed management recommendations for mountain longleaf pine on Fort McClellan. A summary management plan (Varner et al. 2000) provides an overall description of refuge mountain longleaf pine forests along with the distribution of these forests and old-growth stands in Northeast Alabama and Northwest Georgia. Of particular significance are the conclusions that Fort McClellan forests represent the finest remaining example of mountain longleaf pine along with 100 acres of relict old growth stands. This document has provided the basis for existing and future acquisition and management decisions on the Refuge. Additional articles and publications on Fort McClellan forests include (Varner et al. 2003, Varner et al. 2001, Varner 1999, Varner et al. 1999a, Varner et al. 1999b).

Concurrent with longleaf pine studies, a variety of additional surveys and investigations were accomplished to characterize biotic components within the forest system. Studies were directed at vascular plants (Whetstone et al. 1996; Whetstone et al. 1998), freshwater mollusks (C2 Environmental Services 1997), reptiles and amphibians (Cline and Adams 1997), birds (Keyser et al. 1998; Hill et al. 1996; Webb, D.R. 1996a; Soehren 1995; Summerour 1992), and mammals (3D/International 1996, 1997; Webb 1996b).

2.5 Regional Biological Features

2.5.1 Physiographic Description

Physiographic classification of refuge lands has long been a source of contention for both physical and biological scientists. At various times, the Refuge has been placed in the Piedmont (Osborne et. al 1989), Blue Ridge (Harper 1913; Harper 1928; ANHP 1994) and the Southern Ridge and Valley (SAMAB 1996; TNC 2003). Local or detailed studies however seem to support the contention that the Refuge is a disjunct extension of the Blue Ridge. In fact, Harper (1928) specifically identifies Choccolocco Mountain as a southern outlier of this province (Figure 7). In addition, surveys by the Alabama Heritage Program (ANHP 1994) also delineate the Refuge and Choccolocco Mountain as part of the Blue Ridge, with the Southern Ridge and Valley extending to the west. Identifying the physiographic connection of these lands is important to understanding the biological significance of the Refuge. As a southern extension of the Blue Ridge, the Refuge represents the southern most extension of one of the most biologically important regions in North America, isolated from the main body of that region, and sandwiched between the Ridge and Valley and the Piedmont. Biological communities represent a rich combination of Appalachian species along with species common to more southern provinces.

2.5.2 Landscape and Local Connections

Both regional landscape and local forest connections are important to maintaining and improving biodiversity on the Refuge. As an extension of the Blue Ridge, the Refuge and surrounding mountains historically were connected in forest to the Appalachian ecosystem to the north. The recently completed Southern Appalachian Assessment (SAMAB 1996) selected only seven counties in northeast Alabama, to include Calhoun, as part of their single region-wide ecosystem assessment area. The presence of distinctly Appalachian biota, such as the Appalachian cottontail (*Sylvilagus obscurus*) and ground juniper (*Juniperus communis*) further supports this contention. While this connection became strained or fragmented during the first half of the 20th century, conditions have improved in recent years. Observations by Harper (1913) indicated that over 90 percent of the Alabama Blue Ridge was never cleared for agriculture. Timber on much of area was cut for lumber and charcoal, and cattle historically had free-range. However, with acquisition and reforestation of cutover lands by the U.S. Forest Service in the 1930's, and a regional pattern of increasing forest cover on private lands, this forest connection has become more viable in recent years. Both the Talladega National Forest in Alabama and the Chattahoochee National Forest in Georgia provide a tenuous connection north to the Appalachian ecosystem. One measure of this connection has been increased sightings of black bear (*Ursus americanus*) in the region. Within the adjacent Talladega National Forest, frequent sightings have been reported with two separate sightings occurring on the Refuge within the past two years.

While an improving forested connection to the Appalachian proper is encouraging, the Refuge is located on an isolated outlier of the Blue Ridge known as Choccoloccco Mountain. The Blue Ridge proper in Alabama is separated from Choccolocco Mountain by the Choccolocco Creek Valley (Figure 7). This one to three mile wide stream valley is primarily cleared for agriculture and isolates Choccolocco Mountain from the main stem of the Blue Ridge. Only at the northern end of the valley, 10 miles north of the Refuge, is there a somewhat fragmented connection to the National Forest. In the lower portion of the valley, most land has been cleared for agriculture and residential development. There is a single one to two mile wide forested strip, owned by the Alabama Forest Commission, which connects directly from the Refuge to the National Forest. Until closure of Fort McClellan, this forested strip was leased by the Army as a pathway into the National Forest for military training in time of war. With closure of Fort McClellan, the long-term future of this forested strip is uncertain.

The biological importance of maintaining this forest connection to the Talladega National Forest cannot be overstated. A basic rule of ecology is the "species-area relationship", which states that, in stable, old, ecological communities, the number of species can be expected to increase with increases of contiguous acreage (Simberloff 1993). Choccolocco Mountain and the Refuge comprise a forest tract of 50,000 to 75, 000 acres. By maintaining a direct connection into the National Forest, the Refuge and Choccolocco Mountain increase biodiversity by becoming part of a much larger ecosystem. The

Talladega Division of the Talladega National Forest exceeds 200,000 acres, with significant private forest land adjoining.

The forested corridor is responsible for the dispersal of new species onto refuge lands, as well as, providing a corridor for wide ranging species. An example of this functionality is the recent documentation of black bears on the Refuge. In all probability, the forested corridor provided an access pathway to the Refuge. Another more local example is related to possible future dispersal of red-cockaded woodpeckers (*Picoides borealis*) onto refuge lands. The Talladega National Forest (Talladega Division) is designated as a Recovery Population with less than 15 active clusters (USDA Forest Service 2003). Some of these clusters are within five to seven miles of the Refuge and, with longleaf pine restoration, it is possible that birds could eventually pioneer onto the Refuge along the forested corridor. The woodpecker was know to historically inhabit the Refuge with the last remaining active cluster recorded in 1968 (Garland 1996).

2.5.3 Biological Diversity

The ecological significance Choccolocco Mountain and the Refuge are clearly related to geographic and physiographic location. As previously discussed (Section 2.4.2), the Refuge is located on an outlier of a southern extension of the Blue Ridge. This physiographic province is biologically and geographically connected to the Appalachian Region, one of the biologically richest ecosystems in North America. The Southern Appalachian region is believed to support the most biologically rich temperate forest system in the world (TNC 2003). This narrow southerly extension of the Blue Ridge is sandwiched between the Ridge and Valley to the west and the Piedmont to the east. While the juncture of three physiographic provinces could be expected to provide varied avenues for complex species associations, a second and somewhat poorly understood biological situation also occurs in the region. Longleaf pine, a forest community of the Coastal Plain, extends through the Piedmont, and deeply into the mountains of the Blue Ridge. The diversity of herbaceous plants in the ground cover makes longleaf pine forests among the most species-rich plant communities outside the Tropics (Peet and Allard 1993). Whether a relict of retreating glaciers or the result of subtle climate variation, this forest community introduces decidedly southern species deeply into the Appalachian Region.

The recently completed Cumberlands and Southern Ridge and Valley Biodiversity Plan (TNC 2003) provides a landscape scale planning document for selecting and protecting areas of high biodiversity in the Southeast. The study area extended along the Appalachian Mountains from Alabama to Virginia and West Virginia. The plan selected 160 terrestrial conservation target areas, with 29 of these areas designated as high priority action sites. The Talladega Mountains, which includes the Refuge, comprises one of the high priority biodiversity action sites. The forested corridor connecting the Refuge and Choccolocco Mountain to the Talladega Mountains is critical to maintaining this biodiversity level.

The Refuge can be described as containing characteristic Appalachian or northern community types on upper elevations and along ridgetops, with southerly, Coastal Plain, longleaf pine communities on the slopes. Along with this mosaic of overlapping communities come complex associations and transition communities, containing species common to both northern and southern regions. Species often reach both the northern and southern extension of their ranges on the Refuge. For example, ground juniper (*Juniperus communis*) reaches its southern range extension on the Refuge. In fact, high rocky ridges on the Refuge represent the only recorded locations in Alabama for this shrub. At the same time, turkey oak (*Quercus laevis*) has been recorded in longleaf pine forests adjacent to the Refuge on Joint Powers Authority property. According to Harper (1928), the most northern extent of this longleaf pine associate is along the Inner Coastal Plain in southern Bibb County. A detailed description of occurrence and distribution of northern and southern community types and species on the Refuge can be found in ANHP (1994).

Animals are often closely associated with specific plant communities and can also be expected to reach down from the Appalachians and up from the Coastal Plain. Some noteworthy Appalachian species known or suspected on the Refuge include Appalachian cottontail, wood frog (*Rana sylvatica*), scarlet tanager, ovenbird and worm-eating warbler.

2.5.4 Habitat Fragmentation

Aerial photographs of Fort McClellan are available from 1937 to present and provide an overview of past and present military activities (USCOE 1999). A review of photography indicates that refuge lands remained very much intact during the early military training period. By World War II, this changed with the construction of ranges and training areas on sections of the Refuge. Military firing ranges on northern sections of the Refuge were used during World War II , but had been abandoned by the 1960s. These areas have established a forest cover since abandonment. Bains Gap Road predated Fort McClellan, but remained forested along its entire length until range development began during or shortly after World War II. The Range 24A complex on the southern portion of the Refuge seems to have been cleared for military use in the late 1940s or early 1950s, and remained in military use until closure in 1998.

Steep mountain topography and military access restrictions have allowed a relatively unfragmented forested landscape to remain on most refuge lands. While historic logging roads and military trails exist, many are narrow with a closed canopy cover minimizing the overall effects of habitat fragmentation. Scattered wildlife foodplot openings historically existed on some parts of the Refuge. Most were abandoned years ago and contain a successionally developing second growth forest.

The ecological importance of maintaining this relatively unfragmented landscape has wide ranging implications for both native plant communities and area sensitive animal populations. To date, most research on refuge lands has focused on the impacts of forest

fragmentation to neotropical migratory birds (Soehren 1995; Webb 1996a; Hill et al.1996; Keyser et al.1998).

Research by Soehren (1995) and Webb (1996a) demonstrated that forest fragmentation of refuge lands strongly affects the total number of neotropical migratory birds and in particular the number of low nesting birds. Both researchers stressed the importance of maintaining an unfragmented forest landscape on the Refuge as well as a forested connection east to the Talladega National Forest. Further research on refuge lands investigated the relationship of fragment size to nest predation (Hill et al 1996; Keyser et al. 1998). Researchers concluded that reduced forest size increases predation on ground nests and that nest clustering increases predation of ground nests by large predators. These results suggest a causal link between increased predation rate, fragment size, and the observed abandonment of small forest fragments by neotropical migrant songbirds.

Recent research in the Southeast (Buehler and Miles 2004) has further investigated the importance of small maintained forest openings in contributing to fragmentation and declining avian populations. This study focused on the role of wildlife food plots and small openings to breeding bird populations. The study concluded that effects are variable and depend greatly on the landscape in which the forest is located. The Refuge, however, forms an isolated forested tract surrounded by agricultural, residential and urban interfaces, and represents a worst-case scenario for adverse impacts to forest interior birds from small forest openings. Recommendations for relatively intact forests within a developed landscape include “avoiding the creation of new openings and allowing existing openings to regenerate to forest”. Additional recommendations in another similar landscape involve, “Creation of new openings, including extensive daylighting of forest roads, should be conducted only in areas that already possess openings to avoid negative effects on areas with high-quality habitats for forest interior birds”.

2.5.5 Mountain Longleaf Pine Forest Region

Longleaf pine forests originally covered 92 million acres in the southeastern United States. These forests stretched from southeastern Virginia to Texas and have been referred to as the keystone of the southeastern landscape. Today, less than 3 million acres remain and the forest has been nationally identified as a critically endangered ecosystem with loss of over 98 percent of its original range. Additionally, longleaf pine forest in its original fire maintained condition has been recognized as the rarest community type in the southeastern United States (Noss et al. 1995).

Longleaf pine is a key tree species in a complex fire-dependant ecosystem long native to the Southeast. These forests primarily owe there existence lightning related wildfires, that were augmented by Native American practices of burning the forest. The former presettlement forest is believed to have evolved through lightning fires that occurred from May through July (Brown and Smith 2000) at an interval of two to eight years (Outcalt 2000).

The Mountain Longleaf Pine Forest Type is a loosely defined geographical extension of the southern longleaf pine forest (Figure 7). While the boundaries of this forest type are poorly defined, most observers agree that the Blue Ridge, Ridge and Valley and Cumberland Plateau sites are within the mountain region (Varner et al. 2003). Some observers also include the Piedmont as part of this forest type. Although longleaf pine forests once reached from Virginia to Texas, only in northeast Alabama and northwest Georgia do they extent beyond the Coastal Plain into more upland regions. Of all the longleaf pine forests, mountain longleaf is the most imperiled, comprising only about two percent of longleaf's total remnant acreage.

Mountain longleaf pine communities are identified and classified as a "rare community" type within the recently completed multi-agency Southern Appalachian Assessment (SAMAB 1996). Within this region, only two sites, the Refuge and Talladega National Forest, contain large, relatively intact, natural montane longleaf pine tracts (Stowe 2002). Only on the Refuge have remnant old-growth longleaf pine stands been identified and studied (Varner et al. 2000). Of the 100 acres of old-growth identified on former Fort McClellan, about 80 acres have been included within refuge boundaries.

Composition and stand structure of the original refuge longleaf pine forests can only be hypothesized from historical records and early descriptions of the landscape. Descriptions of Calhoun County in 1833 indicate that forests were open to such an extent that wagons could travel in any direction (Mann 1970). This was attributed to annual burning by Native Americans, which resided in the county until shortly after 1833. It is interesting to note that the observer felt compelled to provide this description for posterity in 1870, suggesting that within 40 years the landscape had significantly changed without annual burning.

The first objective and scientific characterization of the local area comes from Charles Mohr (1901), the noted Alabama botanist. His descriptions reflect the environment as it existed during the last quarter of the 19th century. Dr. Mohr describes open longleaf pine forests on the flanks of the Blue Ridge (Choccolocco Mountain) and along the cherty ridges and isolated peaks towards the Coosa River. According to Mohr, "These pine forests are open, almost entirely bare of undergrowth; only in the depressions on the flanks of the mountains a stunted growth of black-jack makes its appearance". Longleaf pine was replaced with hardwoods as he moved down the slopes to slightly richer and deeper soils. As he climbed the mountain slopes to 2000 feet, longleaf pine again disappeared with hardwoods such as chestnut oak (*Quercus montana*), American Chestnut (*Castanea dentate*) and pignut hickory (*Carya glabra*) common to the forest.

In general, the quality and size of longleaf pine seems to have been below that commonly encountered on the Coastal Plain. According to Mohr (1901), "The pine timber on these mountains is somewhat stunted; the body of the trees is short and more or less knotty, and the old trees are frequently affected by dry rot…It is little esteemed for lumber, but largely consumed for charcoal". Exceptions are noted south of Calhoun County, where localized areas of large uninfected high quality trees were described. This seems

however to be the exception and not the general rule. Roland Harper (1905) provides the following description, "The mountain longleaf pine is usually of lower stature than in the Coastal Plain, with shorter leaves and shorter more crooked branches, all of which is a natural consequence of the comparative severity of the climate".

Within Alabama's Blue Ridge Physiographic Province, Harper (1913) estimated historical forest cover as longleaf pine (20%), shortleaf pine (12%), loblolly pine (6%) and Virginia pine (3%). According to his estimates, longleaf pine had decreased to 18 percent of forest cover by the twentieth century. During the late 19th and 20 centuries, fire exclusion, logging and the failure to replant longleaf pine decimated the remaining acreage of this forest type. Recent state-wide forest inventories (Hartsell and Brown 2002), document only 9,200 acres (Calhoun, Cleburne and Cherokee Counties) of longleaf pine in Alabama's Blue Ridge north of Interstate Highway 20. Calhoun County, where the Refuge is located, contains no remaining acreage according to the inventory.
A comparison of previous forest inventories reveals a 75 percent loss of longleaf pine forest within Alabama's Blue Ridge-Talladega Mountain Province between 1972 and 1990 (Parresol and McCollum 1997). During this same period, the acreage of oak-hickory forest tripled and loblolly-shortleaf forest doubled, partly at the expense of longleaf pine.

In general, longleaf pine is considered a highly desirable tree for commercial harvest. Of the southern "yellow pines", longleaf was by far preferred by the timber industry. While large tracts in south Alabama supported a significant logging and turpentine industry, the mountain longleaf pine region seems to have been avoided until late in the exploitation of this timber resource. These lands lacked the continuity of high quality stands that could be found on relatively level and more accessible lands further to the south. Within the mountains, stands were patchy, often of poor form, and commonly located in a landscape that made logging more costly and difficult.

The same problem that impeded commercial timber harvest, seems to have also influenced the turpentine industry in the mountains. Observations by Roland Harper (1913), indicate the turpentine industry had not reached the mountain region by 1913, but he assumed, "its coming is probably only a question of time". Fifteen years later Harper (1928) revisits this issue and concludes the turpentine industry still had not reached the mountain region. It would appear that only minor, if any, turpentine operations ever took place, at least in the northern portions of the mountain region. The scattered distribution of longleaf and the steep slopes, seems to have discouraged large operators from moving into the region.

While the turpentine industry appears to have never reached refuge lands, the late 20s and 30s do represent the culmination of impacts to regional forests. The replacement of railroad and waterways with motorized trucks for log transport provided a more economical method of logging isolated stands. Together with small subsistence farming during this period, most of the remaining forests were cleared or heavily impacted through human activities. Refuge lands avoided some of these later activities and enjoyed protection to some extent under army ownership. Training activities and

commercial timber harvest did alter the fort's landscape. Some isolated forest stands on the fort however appear to have avoided some of these activities. Together with a continuing history of training related fires, critical conditions necessary to maintain this forest type remained in place, which also benefited the regeneration of a second forest on Fort McClellan.

3.0 Resources of Concern

3.1 Refuge Natural Communities

The Refuge is composed of upland ridges and slopes that support a variety of natural community types. The formation of these communities is influenced by factors that include elevation, slope, aspect and soils. In addition to geographic and physical factors, the introduction of fire has the ability to structurally change the composition of many of these natural communities.

Prior to creation of the Refuge, the Army supported a number of studies that characterized natural communities along Choccolocco Mountain (RMS 1984; ANHP 1994; Whetstone et al 1996). Using past research and simplifying community designations was considered necessary to optimize management programs. Maintaining and restoring the mountain longleaf pine community type was considered the primary objective of refuge management. Other community types were evaluated according to positive and negative impacts related to fire. Because refuge communities exist in a mosaic, management of longleaf pine with fire is applied to the entire system. Fire cannot be limited only to longleaf pine stands, but must be evaluated in relation to the entire forest mosaic. Understanding the variable effects of fire management practices is critical to establishing a program that effectively maintains and restores this fire dependent ecosystem, while protecting and managing community types that are perceived as fire sensitive. It however should be recognized that all community types on the Refuge have evolved or persisted in a fire environment, and subtle influences on these communities may be responsible for unique biological characteristics.

Community types were evaluated under several general or grouped classifications; upland pine, upland hardwood, lowland hardwood, Virginia pine, loblolly pine-disturbed and hardwood seep. Two of these community types, Virginia pine and hardwood seep, could be grouped with more general community classifications, but exhibit conditions or management concerns that justify individual consideration. Virginia pine is primarily isolated to high elevation ridges, but may be a relict of past disturbances and/or fire exclusion. Hardwood seep is a hydric extension of the lowland forest. This wetland community however supports a unique plant association and is particularly sensitive to alterations in the local environment (Walker 1993). Loblolly pine and disturbed lands represent past uses that have severely altered plant and soil structure.

Community descriptions are consistent with the National Vegetation Classification (NVC) System (Grossman et al. 1998). Recent modifications to the system have added a classification that more broadly defines the community above individual NVC “Alliance” and “Association” (Comer et al. 2003). “Ecological Systems” provide meso-scale units as a basis for analyzing vegetation patterns, habitat usage by animals and plants, and system level comparisons across multiple jurisdictions. These system level units group “Alliance” and “Association” into broader cover types. Specific NVC “Associations”

occurring within "Ecological Systems" have been identified and are available in NatureServe (2004).

3.1.1 Upland Pine Forest Community

Upland pine forest contains longleaf, shortleaf, loblolly and Virginia pines. While small or localize stands may be dominated by any one of these tree species, absence of fire has significantly altered species composition on much of the area. Historic descriptions as well as the presence of longleaf pine as a forest component suggest that longleaf pine was the dominant cover over most of Choccolocco Mountain. Regionally, Harper (1913) estimated the original pine forest cover in Alabama's Blue Ridge as longleaf pine (20%), shortleaf pine (12%), loblolly pine (6%) and Virginia pine (3%). Shallow infertile soils on refuge slopes however would be expected to have primarily supported longleaf pine below higher mountain ridges.

Upland forests therefore will be defined according to existing as well as potential for restoration. Where longleaf pine exists only as a forest component, the forest cover will be considered mountain longleaf pine. Fire will be applied to all upland pine forests, but intensive restoration (chemical injection, roller chopper, supplemental planting, timber harvest, tree felling) will only take place in forests containing longleaf pine or suspected as formerly containing longleaf pine. Exceptions to this approach exist for disturbed loblolly forest/plantations and disturbed areas containing Virginia pine. These forest stands are discussed as separate community types, and may require more intrusive and differing management applications. It however should be recognized that should natural disasters or events destroy existing forest cover at some future time, a wide array of intrusive management techniques may be required within any forest stand.

The following descriptions characterize the dominate upland pine community type, mountain longleaf pine forest. Other pine and hardwood stands within the overall longleaf pine forest will be managed and described as inclusions within this forest. They will provide variation and enhance biodiversity values of the entire forest mosaic. The NVC Ecological System classification for the mountain longleaf pine forest is "Southeastern Interior Longleaf Pine Woodland" (NatureServe 2004). The "woodland" classification designates a vegetation community with open stands of trees forming a 25-60 percent canopy cover. Peet and Allard (1993) classified 23 specific longleaf pine communities across the Southeast. Refuge forests are within their "Upland Subxeric Longleaf Woodland" subtype. Others ecologists have commonly applied the term "savannah" to the natural longleaf pine community.

The mountain longleaf pine community type exists on the refuge as a relict of historic forest cover. While fires related to army training have maintained this forest type in some areas, most of the refuge suffers from fire exclusion and hardwood encroachment. A generalized map of longleaf forest cover is provided on Figure 8. Most existing longleaf pine is located along the western slopes pf Choccolocco Mountain and on lower saddle or lateral ridges.

While coastal longleaf pine forests have been thoroughly examined, little research has taken place in mountainous regions. A brief summary of these studies was provided in Section 2.4.3. The results of these investigations provide an understanding of mountain longleaf pine community structure in both second growth (Maceina 1997) and old-growth (Varner 2000) forest stands on the Refuge. Research findings allow managers to establish management and restoration objectives based on community structure within high quality stands. These stands represent the oldest and highest quality fire maintained stands in the mountain region, and are expected to provide long-term baseline objectives, not only for refuge programs, but also for other longleaf restoration efforts in the region.

Fire. Fire history within refuge forests is poorly documented and must be hypothesized through historical observations and regional land use and burning patterns. It is apparent that refuge lands were open from annual burning by Native Americans and/or lightning strikes during the late presettlement period (Mann 1970). With settlement of the region in the 1840s, annual burning by Native Americans disappeared and a change in forest structure is suggested by local historians in the 1840 to 1870 period. Upland forests on the Refuge however appear to have remained fairly open through this period (Mohr 1901; Harper 1913), which may indicate continued burning on uplands and/or a slower encroachment and successional change to hardwoods on infertile mountain soils.

By the late 1890s the Refuge was used for artillery firing practice and eventually was purchased by the Army as Fort McClellan. Training related wildfires continued through Army ownership, but at differing frequencies and geographical locations. Most fires occurred on the western face of Choccolocco Mountain, which closely parallels the distribution of higher quality longleaf pine forests on the Refuge (Figure 8). Hardwood encroachment and a successional trend towards hardwood forests appears most pronounced with increased fire suppression within the last 50 years. Forest stands on poor or droughty soils retain longleaf for the greatest length of time in absence of fire, while more mesic soils evolve into a hardwood dominated community more quickly. Longleaf pine stands on the Refuge exist in a range of conditions from severely fire-suppressed to open and fire maintained. Condition of refuge forests is closely related to geographic location and fire frequency.

Old-growth Forest. Refuge old-growth is defined as those forest stands that contain age classes that predate European settlement. In the case of East Alabama, this includes forest stands that predate 1840 or are at least 150 years in age. Previous studies on Fort McClellan identified 101.5 acres of forest that met this criterion (Varner et al. 2000). These forest stands represent the only know old-growth longleaf pine outside of the Coastal Plain. Approximately 80 acres of these old-growth forests were included within the boundaries of the Refuge. Most of the remaining acreage, 19 acres, is located within JPA lands on Skeleton Mountain. The Skeleton Mountain old-growth stand has been identified by the Service as high priority for adding to the Refuge and is included within the approved refuge acquisition area.

Nine separate old-growth stands totaling 79.5 acres have been recorded and mapped on the Refuge (Figure 8). These stands (Table 1) consist of 64 acres of frequently burned well maintained open forest, and another 15.5 acres of fire-suppressed old-growth that exhibits hardwood encroachment with poor or patchy regeneration. Eighty percent of the high quality frequently burned old-growth is located in Management Areas 16 E and 16G. Prescribed fire is the primary prescription for maintaining and restoring theses stands. Those stands experiencing significant hardwood encroachment and/or lacking adequate stocking for seed production may require additional treatments such as chemical injection, girdling, tree felling, and supplemental planting.

Recent prescribed burning in the Southeast has revealed that fire suppressed old-growth stands containing high fuel loads can be harmed through the reintroduction of fire (Zutter et al. 2002). Heavy litter accumulation around the base of trees in fire-excluded old growth stands allows feeder roots to penetrate into the rich organic layer. These roots are then subject to lethal heating related to the duration of combustion and the downward heat pulse, and not necessarily by fireline intensity (Brown and Smith 2000). Fires burning into this deep organic layer can consume the feeder roots and affectively girdle the tree from intense and prolonged heat. It is therefore important to reduce fuel loads within areas that have not burned in recent years before implementing growing season or hot dormant season burns. Mortality is often not immediate, but can occur as a "lag effect" with trees slowly dying over the following year. While this issue has affected management in other regions of the South, the potential for harm may be less in refuge forests where fire has been a more frequent occurrence. However, because refuge fire history is poorly documented, fuel reducing cool dormant season fire will first be applied to "Management Areas" containing high or variable fuel loads.

Stand Structure. Two old-growth stands, Caffey Mountain (A1) and Red-tail Ridge (A2), were studied in detail to characterize stand structure. Both stands represent high quality fire maintained old-growth that typifies long-term management goals for Refuge forests (Table 1). Caffey Mountain is estimated to have burned at least five times over the past two decades, while Red-tail Ridge has experienced multiple annual burns for at least ten years.

These studies indicate that open longleaf pine forests described in pristine Coastal Plain stands are very similar to those existing on the Refuge. Research however has revealed that basal area, tree DBH, and snag density are much lower than values recorded from Coastal Plain old-growth stands (Varner et al. 2000). While the cause of these differences is not clearly understood, it may be related to lower site productivity and severity of the environment. Stand density was somewhat comparable to that previously recorded on Coastal Plain. The two stands contained between 115-120 trees per acre greater than one inch DBH. Differences however existed in refuge old-growth lacking large individuals, small representation in the larger age classes and small maximum heights.

Stand Condition. The distribution and quality of longleaf pine stands on former Fort McClellan and the Refuge are closely related to location of past pyrotechnic training and

frequency of wildfires. Those areas more centrally located to the former fort tend to have more open and better maintained stands. These areas typically experienced more wildfires throughout the history of Fort McClellan. Peripheral areas, particularly those along the fort's boundaries, experienced fewer fires and tend to have higher fuel loads and more hardwood encroachment.

Past research (Maceina et al. 1997; Varner et al. 2000) indicate that longleaf pine forests on the Refuge are slowly disappearing due to a decreased fire frequency and hardwood encroachment. While some of the centrally located stands are well maintained, the overall condition of refuge longleaf pine forests is declining. This decline was documented prior to the closure of Fort McClellan when training related wildfires were ongoing. With closure of the fort and disappearance of wildfires, this decline can only be expected to accelerate without implementation of an active prescribed fire program and aggressive restoration techniques.

Age Structure. Old-growth stands on the Refuge lack trees greater than 250 years in age. This age structure differs from old-growth stands on the Coastal Plain that often include trees between 300 to 500 years in age. The probable reason for this difference is the exceptionally high rate of decayed heartwood in refuge trees. This incidence often exceeds 15 percent (Varner et al. 2000) and would weaken trees making them more susceptible to wind and ice mortality. Possible reasons for increased heartwood infection in refuge forests may involve stress from growing at the geographical extreme of longleaf distribution, extremely infertile and shallow mountain soils, and/or the occurrence of catastrophic fires on steep slopes. Most mature trees on mountain slopes have experienced infrequent high intensity wildfires, and exhibit basal fire scarring that may open the tree to heartwood infection. Ages in old-growth and high quality stands on the Refuge are provided on Tables 1 and 2.

Mortality of mature and old-growth longleaf pines in the Southeast is commonly caused by lightning and wind (Palik and Pederson 1996; Platt et al. 1988). Mature and old-growth refuge forests typically contain a patchwork of overlapping even age stands that regenerated in small forest openings. Researchers believe that small gap openings and single tree mortality are critical for regeneration in old-growth longleaf pine forests (Hermann 1993; Platt et al. 1993)). Research in the Caffey Mountain (A1) and Red-tail-ridge (A2) stands has documented that patch or gap size exceeds that recorded in longleaf pine forest studies on the Coastal Plain (Varner et al. 2000). While the reason for larger forest gaps is unknown, natural reforestation of these larger patches indicates that fire was historically present, and of even greater importance than on lands containing small forest openings.

Plant Species Composition. Plant species within longleaf pine stands vary according to fire frequency and history. Maceina et al. (2000) recorded 146 species within second growth longleaf pine and transitional forest communities on the Refuge. Research by Varner et al. (2000) in Refuge old-growth stands documented 77 species on sampling plots. As would be expected, woody species were more abundant on fire suppressed stands, while herbaceous species increased with fire frequency. Common hardwoods

encroaching on longleaf pine fire suppressed stands included sassafras (*Sassafras albidum*), oaks (*Quercus* spp.), sand hickory (*Carya pallida*), red maple (*Acer rubrum*) and black gum (*Nyssa sylvatica*). Species diversity within longleaf pine old-growth stands increased with burning frequency. While only 23 species were recorded on plots in fire suppressed stands, this number increased to 48 species on occasionally burn stands and to 62 species on stands that annually burned. At the same time, percent cover of certain species also increased with burning frequency. Split-beard bluestem (*Andropogon ternaries*) went from a low of eight percent of plots in fire suppressed stands to 100 percent in frequently burned old-growth stands. Table 3 provides a detailed listing of plants from the three stands; Bee Sting Mountain (B1- fire suppressed), Caffey Mountain (A1-recurring fire), and Red-tail Ridge (A3-annual fire). Species occurrence percentages provide an overview of possible increases or decreases resulting from different burning regimes.

Plants within old-growth stands were further analyzed and simplified (Varner et al. 2000) to select indicator species of high quality pristine mountain longleaf pine forests. Forty-three plants belonging to 27 genera were selected as indicator species that could be used as benchmarks for evaluating the success of future prescribed burn and restoration programs. Using species indicators and species-form composition, restoration success can be measured against the final objective of establishing and maintaining mountain longleaf pine old-growth stands (Table 4).

Prescribed burning programs have demonstrated the importance of an open forest canopy in restoring and maintaining a diverse ground cover (USDA, Forest Service 2004). Within the Talladega National Forest consecutive growing season burns failed to reestablish the herbaceous community, which was primarily attributed to a dense forest overstory and continuous pine needle cover. The existence or creation of an open forest or savannah is critical to maintaining a diverse longleaf pine community. Without forest openings and sunlight reaching the forest floor, herbaceous plants fail to become established, even through the application of repeated growing season burns. Refuge lands are fortunate in evolving through a natural fire regime, and existing, at least in some areas, as an open forest community that has retained, at least as a relict, an herbaceous ground layer. The reintroduction of fire into the system is a critical management requirement needed to enhance and restore species diversity.

Maintaining herbaceous diversity in the ground layer raises a number of concerns involving soil disturbance activities (USDA Forest Service 2004). The complexity and richness of the herbaceous layer is expected to naturally increase over time. Disturbances have the potential of changing successional development to a simpler, less stable and less diverse stage. Large scale and long linear ground disturbing activities within the longleaf pine forests can allow annuals and exotics to become established and have been identified as negatively affecting ecosystem stability and avian populations (Engstrom 2003). Outcalt and Sheffield (1996) also recognized that longleaf pine stands on previously cultivated or mechanically prepared sites severely reduce native ground cover. Regional management strategy for selecting and managing old-growth longleaf pine stands has

stressed the importance of "minimally disturbed ground layers" and "intact soil profiles (never plowed or mechanically prepared for planting trees)" (Walker 1999).

Small scale isolated disturbances, such as UXO excavations, however have far less potential for introducing exotics and simplifying species diversity, and may actually mimic tree windfalls and other local events in the forest. About half of birds in the longleaf pine system are dependent on the ground and shrub layer. Management activities should therefore minimize ground disturbing actions within all longleaf pine stands, with particular emphasis on widespread connecting disturbances and linear intrusions.

An inventory of vascular plants in Refuge longleaf pine forests is a continuing project that utilizes past research (Maceina et al. 2000; Varner et al. 2000), along with an ongoing inventory by refuge biologists. A plant herbarium is maintained at Refuge Headquarters as a reference and aid in identifying plants.

Site Characteristics. Mountain longleaf pine is often characterized as occurring along ridge lines and south to southwesterly slopes. This is based on drying conditions along sun exposed slopes that are believed to burn at a higher intensity thus favoring longleaf pine regeneration. While there is reason to believe that these sites provide favorable conditions for longleaf pine, research (Varner et al. 2000) has revealed that longleaf also exists on other refuge aspects. It may well be that increased and varied fire frequency allows longleaf pine to expand onto somewhat less favorable sites. It is also apparent however that without fire, these same more fertile soils and less exposed aspects are the first to be reclaimed by more fire sensitive and aggressive species.

Elevation also affects and influences the distribution of longleaf pine on the Refuge. A review of refuge old-growth (Table 1) and high quality (Table 2) stands reveals that longleaf pine occurs on all elevations to a height of 1750 feet. This appears somewhat similar to findings by Harper (1913) and Mohr (1901) that indicate historical forests were below 1900-2000 foot elevations. The presumption is that climatically, perhaps because of ice damage, longleaf may never have covered the higher ridgetops along Choccolocco Mountain.

Management Plans. The first systematic attempt to establish a management plan for longleaf pine forests on former Fort McClellan was provided by Maceina et al. (1997). Using designated army training areas as management units, this plan provided a general characterization of forest cover and site characteristics, and evaluated the potential for restoration through prescribed burning. A summary of recommendations according to management area is provided on Table 5.

Varner et al. (2000) provided a more detailed characterization of stands along with further management recommendations (Tables 1, 2, 3 and 5). Longleaf pine stands were classified as

Category A: Old-growth, frequently burned
Category B: Old-growth, fire-suppressed
Category C: Frequently burned longleaf pine stand
Category D: Fire-suppressed
Category Z: Scattered individuals and/or patches of longleaf pine.

Only Category A and B old-growth were mapped with acreages. Of the 101.5 acres of old-growth documented by the study, 79.5 acres have been included within Refuge boundaries (Table 1). Three old-growth stands delineated by this study are outside Refuge boundaries on lands owned by the Joint Powers Authority (Figure 8):

B3 – Ford Hill – 1.0 acres - Management Area 17C
B7 – Skeleton Mountain – 19.0 acres – Management Area 15A
B8 – Reynolds Hill – 1.9 acres – Management Area 18A

The Reynolds Hill (B8) stand is located west of the new bypass and will be isolated on a narrow ridge between the highway and City of Anniston. This fire-suppressed stand contains individuals up to 225 years and is located in an area that has experienced few fires, at least in recent years. The stand is particularly significant in that it contains a disjunct population of turkey oak (*Quercus laevis*) as an understory. This population is the only recorded documentation of this Coastal Plain species in the Blue Ridge Physiographic Province. Because of future access and management difficulties, all lands west of the bypass, including the Reynolds Hill stand, were eliminated from the Refuge acquisition area.

The Ford Hill (B3) stand contains individual trees ranging from 88 to 228 years, and averaging 176 years. This fire suppressed stand is located within the core acquisition area and could be added to the Refuge at some future time.

The remaining old-growth stand, Skeleton Mountain (B7), is located along the south and southwesterly slopes of Skeleton Mountain. This large 19 acre stand was burned during April, 1998 and identified by Varner et al. (2000) as a candidate for exhibiting future "lag effect" mortality from an intense prescribed burn. Observations in 2004 indicated mortality from the fire had not been an issue. This stand represents the largest and best remaining tract of old-growth outside of refuge boundaries. It is located directly adjacent to the Refuge, is within the refuge acquisition area, and has been identified to the JPA as a priority acquisition area

Refuge old-growth (Table 1) and high quality (Table 2) stands represent the best remaining example of mountain longleaf pine forest on the Refuge as well as in the region. While 79.5 acres of old-growth have been mapped on the Refuge, large tracts of high quality longleaf pine forest also exist. Together, old-growth and high quality stands

represent longleaf pine forest with the best potential for restoration and maintenance through establishment of a prescribed burn program. The location and distribution of high quality longleaf pine forest on the Refuge are provided on Figure 8. This map was created using generalized stand descriptions according to "Management Area" and provides a landscape view to managing and restoring refuge forests. Adjacent lands owned by the JPA are also included on the forest map. It is important to view the entire high quality longleaf pine forest system through a mapping exercise that includes all of former Fort McClellan. Training related fires maintained these forests, and it is the location of this former training along lower mountain slopes that is in part responsible for current forest condition.

3.1.2 Upland Hardwood Forest Community

This community type includes hardwood forest that occurs in mesic to xeric environments. These forests can be found along slopes and ridgetops on Choccolocco Mountain. Upland community types include the Piedmont Monadnock Forest (ANHP 1994) and the Oak-Hickory Community (Whetstone et al 1996) described by others on the Refuge. The NVC Ecological System classification for upland hardwood forests is "Southern Piedmont Dry Oak-(Pine) Forest" (NatureServe 2004).

The presence of American chestnut (*Castanea dentate*) sprouts along mid-slopes and hills indicates that chestnut may have historically been a significant component of some forests. According to Mohr (1901), chestnut was common to the region in the mid-1800s.

A variety of oaks and hickories make up the overstory of this forest community. Rock chestnut oak (*Quercus montana*) often dominates the overstory in more xeric and/or high elevation locations. More mesic situations contain a variety of overstory trees that include rock chestnut oak, white oak (*Q. alba*), southern red oak (*Q. falcate*), post oak (*Q. stellata*), black oak (*Q. velutina*), pignut hickory (*Carya glabra*), sand hickory (*C. pallida*) and mockernut hickory (*C. tomentosa*). Common understory trees of these forests are black cherry (*Prunus serotina*), Alabama black cherry (*P. alabamensis*), hornbeam (*Carpinus caroliniana*), red maple (*Acer rubrum*), flowering dogwood (*Cornus florida*), black gum (*Nyssa sylvatica*), and persimmon (*Diospyros virginiana)*. Low-bush blueberry (*Vaccinium pallidum*) is often encountered in the shrub layer, particularly in more mesic situations. Other common shrubs include azalea (*Rhododendron canescens*), sparkleberry (*Vaccinium arboretum*), deerberry (*V. stamineum*), and hydrangea (*Hydrangea arborescens, H. quercifolia*). The herb layer is usually lacking, but commonly encountered species include pipsissewa (*Chimaphila maculate*), beggar-lice (*Desmodium* spp.) and arrow-leaf ginger (*Hexastylis arifolia*).

Most upland hardwood communities exist at elevations above longleaf pine forests, or within the mosaic of forest communities that cover mountain slopes. In all probability, the upland hardwood community has expanded onto areas historically covered by longleaf pine. A comparison of previous forest inventories reveals that upland hardwood

(oak-hickory forests) acreage in Alabama's Blue Ridge-Talladega Mountain Province tripled between 1972 and 1990 (Parresol and McCollum 1997). Fire exclusion or a less frequent fire regime has favored the expansion of these forests in more recent years. Where a loblolly seed source is available, loblolly pine also becomes a prominent tree of these new upland forests.

While a decreasing fire frequency seems to have favored upland forests (oak-hickory) on the Refuge, there is evidence that these forests also require fire to some extent (Brown and Smith 2000). Although lightning was not a consistent source of wildfire in upland hardwoods, Native Americans and early European settlers routinely set fire to the forest. Oaks and hickories were more resistant to burning because of their thick bark. Fire frequencies in oak-hickory forests in the Missouri Ozarks during early settlement ranged from two to ten years, with many areas burning annually. Many oaks in these forests are actually considered fire-dependant and are favored through active burning (Robertus et al. 1993). Without fire, oak-hickory forests on the Refuge are expected to slowly evolve into more mesic forests with the addition of many fire sensitive trees. As with longleaf pine, this change will proceed more slowly on xeric sites.

The intent of management efforts is to restore those stands where longleaf pine exists as a relict component. They will be classified as longleaf pine forest and restored through techniques that include chemical injection, tree felling, girdling, timber harvest and supplemental planting. Those stands that lack historical evidence of longleaf pine will be managed as an upland hardwood forest. In the past, fire may have favored oaks and pines over other trees in the canopy (Nature Serve 2004). Mohr (1901) describes the mountain flanks and lower ridges of Choccoloccco Mountain as exclusively longleaf with only stunted black-jack oak appearing in depressions.

3.1.3 Lowland Hardwood Forest Community

This forest is encountered along streams and around seepage areas, and covers only a minor portion of the Refuge. The lowland hardwood forest community includes the Typic Mesophytic Forest (ANHP 1994) and the Mixed Mesophytic Forest and Hardwood-Pine Terraces (Whetstone et al. 1996) described by others on the Refuge. The NVC Ecological System classification of lowland hardwood forests are "Southern Piedmont Small Floodplain and Riparian Forest" and "Southern Piedmont Mesic Forest" (NatureServe 2004).

In more mesophytic situations, this community is co-dominated by trees that include oaks, hickories, tulip poplar (*Liriodendron tulipifera*), beech (*Fagus grandifolia*), basswood (*Tilia Americana*), and chalk maple (*Acer leucoderme*). The shrub layer of more mesic forests is highly variable with regard to species composition. The Hardwood-Pine Terraces are slightly more dry-mesic and include oaks, tulip poplar, hickories (especially *Carya glabra, C. pallida and C. tomentosa*), along with pines, particularly loblolly pine. The shrub layer often contains mapleleaf viburnum (*Viburnum*

acerifolium), deerberry (*Vaccinium stamineum*), strawberry bush (*Euonymus americanus*), and Elliot's bush blueberry (*Vaccinium elliottii*).

These forests exist as a narrow border along larger streams and as upland borders around larger springs and seepages. Longleaf pine is not considered an historic tree of these communities. These forests formed inclusions within the overall longleaf pine forest mosaic, and enhanced biodiversity values on a landscape scale. Because of excessive moisture and low fuel loads, fire seldom enters these communities except during extreme drought. Prescribed burning will not target lowland hardwood communities, and in most situations fire is expected to burn to the community's edge and extinguish itself. In dryer situations, fire may cross lowland areas, but with a light intensity.

3.1.4 Virginia Pine Community

The Virginia pine community is most common along exposed ridges and thin-soiled disturbed sites at higher elevations on Choccolocco Mountain. This community type includes the Xeric Virginia Pine Ridge Forest and Dry Virginia Pine-Oak Forest (ANHP 1994) and the scrub pine community (Whetstone et al 1996) described by others. The NVC classification includes these forests within the Pinus Virginiana Forest Alliance (NatureServe 2002).

Under xeric conditions, Virginia pine exists in pure stands or in association with chestnut oak, blackjack oak (*Quercus marilandica*), sparkleberry, and chokeberry (*Aronia arbutifolia*). Slightly more mesic conditions also include post oak and southern red oak.

The historical configuration of this community on the Refuge is not clearly understood. Mohr (1901) fails to list Virginia pine as a dominant or associate of high elevation forests. Harper (1913) estimates 3 percent of Alabama's Blue Ridge was originally covered by Virginia pine. He acknowledges the presence of the tree in the mountains, but relegates it to rocky places (Harper 1913) or as frequent on sandstone cliffs, etc. (Harper 1928). It is particularly interesting to note that Harper's (1928) range map for Virginia pine provides no distribution dots on the Choccolocco Mountain Blue Ridge unit and very few within the Talladega Mountain section of the Blue Ridge. It would appear that this community type is far more common at present than historically, and may require mechanical manipulation to restore native species.

This cover type includes both early successional forests on disturbed sites, and natural forests in edaphically extreme conditions (NatureServe 2002). The prominence of Virginia pine on the Refuge may be the result of past disturbances and/or the lack of recent fire along Choccolocco Mountain ridge. Choccoloccco Mountain provides the only relatively level access road through the mountains. With Ridge Road following the length of the mountain, this area has been open to human activity and disturbance to a greater extent and longer period of time than mountain slopes. Another example occurs near Holloway Mountain in Management Area 15C. Dense stands of Virginia pine along

lower mountain slopes may be a relict of past iron mining operations that historically occurred in the area.

Virginia pine communities were probably restricted to higher ridges above the longleaf pine forest in historic times. Monoculture stands or isolated trees have invaded lower slopes and disturbed areas at the expense of longleaf pine and hardwoods. Studies of mature second-growth longleaf pine stands on the Refuge revealed that Virginia pine first appeared about 40 years ago (Maceina et al. 1998). Prescribed burning will target forest areas where longleaf pine is suspected to have occurred to reduce or eliminate Virginia pine. The short needles of Virginia pine form a relatively compact forest floor, which dries slowly and is conducive only to light surface fires. Because of the reduced fuel load in these stands, prescribe fire is usually only considered a viable control technique in mixed stands (Brown and Smith 2000). Future prescriptions for restoring these areas may require mechanical treatments such as herbicides, tree felling, girdling, timber harvest and supplemental planting.

3.1.5 Hardwood Seep Community

Spring seepages are found on mountain slopes and along the base of ridges. These communities are highly variable and range from seasonal spring seeps a few yards in diameter to larger perennial seepages up to seven acres in size. The smaller seeps often exist as a local community within a larger forest type, while larger seeps have a characteristic wetland shrub and forest overstory. The four largest seeps are associated with headwater springs of the four major refuge drainages; South Branch Cane Creek, North Branch Cane Creek, Cave Creek and Bains Gap Creek (Figure 3). A detailed field investigation by Whetstone et al. (1998) identified 24 seeps on the Refuge that met the definition of jurisdictional wetlands as defined in the 1987 Army Corps of Engineers Wetlands Delineation Manual.

Hardwood seeps are arguably the most significant and sensitive community type on the Refuge. Walker (1993) considers seepage bogs as one of the rarest habitats within the longleaf pine forest as well as particularly sensitive to soil and hydrologic disturbances. Over half of all rare plant species identified by the Alabama Natural Heritage Program (1994) on former Fort McClellan occurred in or were associated with seeps. Higher quality seeps meet the criteria of sphagnum and shrub bogs, which have been defined as "rare community" types within the recently completed multi-agency Southern Appalachian Assessment (SAMAB 1996). The assessment concludes that few existing examples of this community remain, and those that do are in a degraded condition. The NVC Ecological System classification for the hardwood seep community is "Southern and Central Appalachian Bog and Fen" (Nature Serve 2004).

While seeps on the Refuge are highly variable in size and species composition, typical overstory trees of larger seeps include tulip poplar, black gum, sweet gum (*Liquidambar styraciflua*) and green ash (*Fraxinus pensylvanica*). Red maple and sweetbay (*Magnolia virginiana*) may be common in the understory, and shrubs such as mountain laurel

(*Kalmia latifolia*), swamp dogwood (*Cornus foemina*), maleberry (*Lyonia ligustrina*), possum-haw (*Viburnum nudum*), witch hazel (*Hamamelis virginiana*), winterberry (*Ilex verticillata*), swamp azalea (*Rhododendron viscosum*), highbush blueberry (Vaccinium corymbosum) and tag alder (*Alnus serrulata*) are often present. Common herbaceous species of the seeps include sphagnum moss (*Sphagnum* spp.), cinnamon fern (*Osmunda cinnamomea*), royal fern (*O. regalis*), southern lady fern (*Athyrium filix-femina*), New York fern (*Thelypteris nova-boracensis*), netted chain fern (*Woodwardia aerolata*), cowbane (*Oxypolis rigidior*), soapwort gentian (*Gentiana saponaria*), small green wood orchid (*Platanthera clavellata)* and foamflower (*Tiarella cordifolia*). The Marcheta Mountain Seep and Cave Creek Seep contain populations of white fringeless orchid (*Platanthera integrilabia*), a Candidate for listing under the Endangered Species Act (ANHP 1994).

Because seeps are often located within or adjacent to longleaf pine communities, it is probable that all or most have historically experienced fire. Across the South, seepage slope ecosystems embedded in the longleaf forest have been identified as requiring periodic fire to maintain structure and health (Outcalt 2000). In Georgia, Wharton (1989) fails to describe mountain bogs imbedded within longleaf pine forests, but does characterize imbedded shrub and herb bogs to the south in the Coastal Plain as experiencing a three to eight year burn cycle.

The frequency and history of fire within Refuge seeps however is difficult to characterize. The larger perennial seeps remain wet or moist most of the year and fail to burn during most fire events. During wildfires or prescribed burns, army resource managers noted that fires burned only to the seeps edge leaving the seep interior unburned. An exception to this occurred in 1987 within the Marcheta Mountain Seep. During a drought period, a wildfire is believed to have burned across the seep. Observers noted that the seep glowed during the night indicating fire had burned into the seep's sphagnum layer. Observations following this fire indicated that the herbaceous layer, including the orchids, slowly decreased as time elapsed after the fire, while the shrub component slowly became denser. Historically, it is probable that these seeps or bogs periodically burned during extreme drought. Such a burn would be expected to reduce the shrub layer and open the herbaceous component to sunlight. The probable importance of fire in maintaining these communities is supported through observations by local researchers and managers (Garland 1996; Whetstone et al. 1998).

Prescribed burning will target the longleaf pine forest surrounding seepage areas. Because prescribed burns will not be accomplished or scheduled under drought conditions, fire is not expected to enter or burn within seeps. It however is critical to research and seek academic guidance on the need to introduce fire within the seepage interior at some future time. Without fire, larger seeps may actually evolve through succession into a shrub thicket, excluding many unique and rare herbaceous plants.

3.1.6 Loblolly Pine-Disturbed Community

The loblolly pine-disturbed community type includes those areas that have been heavily impacted or altered through human activity. Generally, this alteration is far beyond the scope of simple fire exclusion. With fire exclusion, some remnant of the former landscape remains, a seed-bank may still be in place and restoration through fire may be possible. Significant soil disturbances through military or other human activity creates additional restoration issues, many involving the introduction or proliferation of exotic plant species.

Areas that contain this community type include loblolly pine plantations, reclaimed quarries and former firing ranges and training areas. While loblolly pine is often an invader of roadside areas and fire excluded lands, planted loblolly pine plantations exist in Management Area16C (40 acres) and adjacent to former Range 24A (10 acres). The NVC Ecological System classification for loblolly plantations is "Cultivated Forest" (NatureServe 2004).

Reclaimed lands (Figure 5) include historic quarries and borrow pits that were regraded by the Army and planted with a seed mixture that included weeping love grass (Section 2.4.3). Areas include the former landfill and borrow pit north of Bains Gap Road (Management Area 16E), the former borrow pit along the northern refuge boundary on French-Truitt Mountain (Management Area 16F) and a small forest opening on the southwest corner of the Refuge (Management Area 15F).

The final disturbed land use type includes former firing ranges and training areas used by the Army prior to 1998 base closure. These lands were typically scraped of surface soil or planted in cultivated grasses. Disturbances adjacent to ranges often are responsible for disturbed loblolly pine forest bordering range areas. The proximity of loblolly pine seed adjacent to abandoned ranges also creates management concerns in restoring range areas. This is particularly evident on ranges with better soils where a dense cover of loblolly pine has developed in only five years. Range areas exhibiting significant disturbances include Ranges 21, 22, 27, 20, 24 Upper and 24 Alpha.

Wildfire has been variable on these lands. Some areas have consistently burned through wildfires or prescribed burns, while fire has been excluded from other areas. Few benefits other than fuel reduction will be gained by fire on these lands. Loblolly pine plantations, former firing ranges and disturbed areas bordering these lands contain soils that have experienced severe disturbance and a proliferation of exotic plants. Most of these lands however can potentially be restored to longleaf pine forest. While erosion hazards and the possibility of spreading exotics remain a concern, these areas can generally accept a wide array of restoration techniques; chemical injection, girdling, tree felling, timber harvest, brush cutter/hydro-ax, roller chopper, herbaceous reseeding, machine and hand planting.

The presence of weeping lovegrass on former borrow areas creates a new dimension to the restoration process. These lands were stripped of surface soils and were experiencing severe erosion and down-slope sedimentation when reclaimed by the Army in the 1980s. While a diverse reclamation seed mixture was used to restore the lands, only weeping lovegrass, an African exotic, became established on slopes. This grass now forms a monoculture on reclaimed lands and is the primary mechanism holding soils in place. Consideration must be given to the potential effects of this exotic species on the native system, potential dispersion of seeds to adjacent unaltered communities, and the possible need to remove the grass prior to longleaf restoration. Removal of the exotic will again expose soils increasing erosion potential and down slope sedimentation.

3.2 Wildlife

3.2.1 Reptiles and Amphibians

The Refuge is located on upland ridges and slopes along Choccolocco Mountain. The rugged upland topography with few aquatic environments limits breeding sites and habitat required by many species. Inventories completed on former Fort McClellan by the Army (Cline and Adams 1997) were used to establish a baseline for understanding habitat availability and populations on the Refuge.

Aquatic and wetland environments are limited to headwater streams, mountain seeps, wildlife watering holes and a small half acre pond along Ridge Road South. The conservation of temporary wetlands, isolated pools and seasonally flooded depressions within the longleaf pine landscape is considered critical to sustaining amphibian and reptile populations (Guyer and Bailey 1993). Watering holes on the Refuge were created by army maintenance personnel as a source of water for turkey during dry seasons. Typically, they are depressions five to fifteen feet across that were scooped out by tractors in mountain areas. Most appear to hold water throughout the year and no doubt provide important breeding habitat for amphibians. The small half acre pond along Ridge Road South, referred to as 19D Pond, appears on early topographical maps and is believed to be spring fed. This pond was the single intensively studied refuge site included in the former army biological inventory (Cline and Adams 1997). A series of drift fences and pitfall traps were established around the pond, and surveys for calling frogs were conducted. Reptiles and amphibians were also surveyed by automobile along roads, and by pedestrian surveys along streams and uplands on refuge lands.

Eighty-seven species were identified as potentially inhabiting refuge lands (Table 6). Thirty-three species were actually documented on or directly adjacent to the Refuge during the former army inventory (Table 7). This list will be updated as additional species are recorded on the Refuge.

Particularly significant species recorded on or adjacent to the Refuge during the inventory included the southern redback salamander (*Plethodon serratus/websteri*), four-toed salamander (*Hemidactylum scutatum*), northern pine snake (*Pituophis melanoleucus*

molanoleucus) and wood frog (*Rana sylvatica*). The southern redback salamander (S3) was recorded on forested slopes in Management Area 19D. The four-toed salamander (S3) was found along Reilly Lake Road near the northwest corner of the Refuge. This secretive salamander is restricted to lowland forests and would have minimal habitat available on the Refuge. The northern pine snake (S3) has been documented from upland longleaf pine forests near the Anniston Museum of Natural History. This snake is frequently found in longleaf pine forests with extensive areas of suitable habitat available on the Refuge. The wood frog (S2) has been documented from Calhoun and Cleburne counties, and would be expected to inhabit higher elevations on the Refuge, possibly using the wildlife watering holes for breeding.

3.2.2 Birds

A number of studies characterizing avian populations have been completed on lands that now form the Refuge (Summerour 1990; Summerour 1992; Soehren 1995; Hill et al. 1996; Webb 1996a; Keyser et al. 1998). Summerour (1990) developed a list of 188 species recorded on what was than Fort McClellan. It should be recognized however that former Fort McClellan included lands and habitat types that are rare or missing from the mountainous refuge area. Birds commonly associated with open water and marshes would have minimal habitat available on the Refuge, while those species requiring forest or forested edge would have greater habitat availability. The Cumberlands and Southern Ridge and Valley Biodiversity Plan (TNC 2003) designates The Talladega Mountains and the Refuge as a neotropical migratory bird "Hotspot".

Hardwood Habitat. Breeding birds on former Fort McClellan were surveyed between 1994 and 1996 (Soehren 1995; Webb 1996a). Both studies used point counts to compare small fragmented forested tracts to areas containing broad contiguous forest cover. As would be expected, the large forested areas provided breeding habitat for species that were missing from the small forest fragments. This was particularly true of ground and low nesting forest interior species and neotropical migrants. While the fragmented forested tracts were located within the fort's cantonment area, the large contiguous forest areas were on or adjacent to present refuge lands. Permanent transects were located in Management Areas 17 (A, D, C) and 15 (A, B, F). Forest cover primarily contained upland hardwoods with scattered tracts of longleaf and mixed pine hardwood stands. Of the four transects on or adjacent to the Refuge, the following birds were recorded on two or more transects; downy woodpecker, pileated woodpecker, eastern wood-pewee, great crested fly catcher, blue jay, tufted titmouse, red-eyed vireo, black-and-white warbler, worm-eating warbler, ovenbird, summer tanager, and scarlet tanager (Soehren 1995). The worm-eating warbler is included as a "Priority Bird Population" in the forthcoming Southern Piedmont Partners in Flight (PIF) Bird Conservation Plan. A list of potential and documented neotropical migratory nesting birds on the Refuge is provided on Table 8. A list of all nesting birds recorded during point counts on or adjacent to the Refuge is provided on Table 9.

Additional research on and adjacent to the Refuge further investigated the disappearance of neotropical migrants from fragmented forests (Hill et al. 1996; Keyser et al. 1998). Contiguous forest on the Refuge provided the location for assessing the impact of predation on ground and low nesting birds. Using quail and clay eggs, researchers determined that large predator activity increased with forest fragmentation. Forest interior birds seemed to have no defense against large predators, which may be partially responsible for recent population declines.

Research has identified refuge forests as important breeding habitat for neotropical migratory birds (Soehren 1995; Webb 1996a). Extensive contiguous forest containing narrow firebreaks provide nesting habitat for forest interior birds that have disappeared from smaller forest fragments. Recommendations from researchers included minimizing activities that open the forest and increase edge habitat, and eliminating or at least minimizing the width of firebreaks and roads. A consistent and reappearing recommendation involves maintaining the forested corridor that connects Choccolocco Mountain to the Talladega National Forest (Section 2.5.3).

Longleaf Pine Habitat. Breeding birds have not been censused within refuge longleaf pine forests. These areas represent a rare and disappearing component of the regional landscape, and as such potentially provide habitat for many declining species. This naturally evolving savannah-like system includes several structural characteristics that contribute to relatively high avian species richness; (1) mature trees provide foraging substrate and cavities, (2) canopy branches support large raptor nests, (3) old trees and snags containing heartwood persist for many years providing habitat for woodpeckers and nuthatches, (4) mature forests develop a vertical and horizontal heterogeneity that includes canopy gaps and wide spacing, and (5) the open forest floor develops an extremely diverse herbaceous ground cover (Engstrom 2003).

The three birds most closely associated with the longleaf pine system are red-cockaded woodpecker, brown-headed nuthatch and Bachman's Sparrow (Engstrom 1993). The Army accomplished a number of investigations searching for and characterizing red-cockaded woodpecker habitat on former Fort McClellan. (Section 3.3.1). Researchers believed fair populations of the woodpecker existed on the Refuge through the 1950s, with the last remaining active cluster documented in the early 1970s. Neither the brown-headed nuthatch or Bachman's sparrow were recorded on the Refuge during preliminary point count surveys, but habitat suitability was considered good in selected stands and the birds have been recorded on the adjacent Talladega National Forest. (Shurette 2003).

Breeding bird surveys in the Talladega National Forest were conducted in longleaf pine stands treated for hardwood midstory removal and untreated longleaf pine stands retaining their hardwood midstory. Survey results indicated no significant effects on avian diversity or species richness, but did demonstrate an obvious shift of guilds between the two treatments. The longleaf pine stand where midstory had been removed included species adapted to early successional or more open lands, and included yellow-breasted chat, eastern towhee, northern bobwhite, brown thrasher, common yellowthroat, white-eyed vireo, indigo bunting, chipping sparrow, summer tanager, pine warbler and

yellow-throated warbler. “Priority Bird Populations” designated within the Southern Piedmont Partners in Flight (PIF) Bird Conservation Plan that were present or more common in the open forest stands included Bachman’s sparrow, prairie warbler and brown-headed nuthatch. Characteristic longleaf pine species such as Bachman’s sparrow (9/0) and brown-headed nuthatch (34/3) were recorded in significantly greater numbers in treated open stands.

Game Species. Game birds inhabiting the Refuge include wood duck, wild turkey, northern bobwhite and mourning dove. A review of the Army’s hunting program prior to the refuge is provided in Section 2.4.3. Wood ducks are fairly common along the main stem of Cane Creek and Reilly Lake west of the Refuge. Habitat availability on the Refuge however is absent, and the wood duck is considered a rare transient.

Wild turkey and northern bobwhite are found throughout the Refuge. Turkey populations, in particular, have dramatically increased in recent years. Northern bobwhite are less common and primarily occur around abandoned firing ranges and mature longleaf pine stands. Quail populations declined 65.8 percent in the Southeast from 1980 to 1999, while declines in breeding numbers averaged almost 4 percent per year from 1982 to 1999 (Dimmick et al 2003). In Alabama, quail numbers are believed to have declined by as much as 85 percent since 1980 (USDA, Forest Service 2004). Research has indicated that regional population declines may be related to differential nest predation for both turkey and quail (Simberloff 1993). Forested edge, habitat fragmentation and disturbed landscapes support a wide variety of predators that prey on nests. Management objectives involving longleaf pine forest restoration are expected to increase forest interior and reduce edge habitat, potentially improving habitat suitability for both these species.

Mourning dove are commonly found around abandoned range areas on the Refuge. Although continuous forest would not be expected to support large dove populations, open stands of longleaf pine with an herbaceous ground cover, would be expected to provide better habitat than fire suppressed woodlands currently existing on much of the Refuge.

3.2.3 Mammals

Fifty-one mammal species are suspected or known to inhabit the Refuge (Table 10). Twenty-four of these species have been documented on or directly adjacent to the Refuge. Because most of the Refuge contains upland and mountain forests, habitat is available for species such as Virginia opossum, eastern chipmunk, eastern gray squirrel, coyote, common gray fox, northern raccoon and white-tailed deer. Habitat for species requiring rich woodlands and wetlands is less available, and these species tend to be absent or rare within the Refuge. An exception includes small headwater streams and seepages that provide localized and isolated wetland habitat. Within seeps, species such as beaver and muskrat are encountered. In fact, beaver represent an intrusive modifying influence within seeps that potentially can significantly degrade existing habitat. Springs

provide a constant low level flow that beavers dam, inundating sphagnum bogs and associated wetlands. Because catastrophic floods are rare in headwater areas, these dams tend to remain in place and wetlands successionally evolve into a shrub swamp.

Rare and uncommon species suspected or documented on the Refuge are provided on Table 11. The only federally listed species recorded on or adjacent to the Refuge was the endangered gray bat (Section 3.3.1). Extensive mist netting programs were conducted by the Army to determine the presence and distribution of bats on the former army fort (3D/International.1997, 1996a & 1996b). Six bat species were documented as foraging along fort streams during the course of these investigations (Table 11).

Two additional species, Appalachian cottontail and eastern fox squirrel, are listed on the Nature Conservancy Heritage Ranking system (Table 11). The Appalachian cottontail is a secretive forest dwelling rabbit that is restricted to the Appalachian Mountains. It has been documented from the Talladega Mountains east of the Refuge and is suspected to inhabit higher elevations along Choccolocco Mountain. The rabbit's preferred habitat, high elevation blueberry and mountain laurel thickets, is available along much of Choccolocco Mountain. Surveys for the species by the Army (Webb 1996b), documented one specimen strongly suspected to be Appalachian cottontail by Dr. Josh Laerm at the University of Georgia.

The southeastern fox squirrel is a characteristic species of longleaf pine forests in the southeastern United States (Engstrom 1993). They prefer and are adapted to the mature open longleaf pine forests that once covered much of the region. As these forests disappeared, fox squirrel populations also declined in the Southeast. While they have disappeared from most private lands surrounding the Refuge, fox squirrels can still be found in longleaf pine forests on Choccolocco Mountain. Proposed management objectives to restore mature longleaf pine habitat should enhance fox squirrel habitat and increase populations.

A third species, black bear, also deserves discussion. Bears have been observed along Choccolocco Mountain on at least two recent occasions. They have also been observed with increasing frequency to the east in the Talladega National Forest. While bears are currently considered transient species, their movement south from the Appalachian Mountains indicates an improving forested connection to the north. As discussed in Section 2.5.3, the viability of a biological connection to the Appalachian ecosystem would significantly strengthen refuge biodiversity values.

Game species are defined as those animals classified under "Alabama Regulations Relating to Game, Fish and Furbearing Animals". Species known to inhabit the Refuge include bear, beaver, coyote, deer, opossum, rabbit, raccoon, squirrel, fox, groundhog and bobcat. Regulated hunting seasons (2003-2004) are in place on the adjacent Choccolocco Management Area for deer, turkey, squirrel, quail, rabbit, raccoon, opossum and fox. Hunting season for bear are currently closed. The most popular species with local hunters are deer and turkey. A review of the Army's hunting program is provided in Section 2.4.3.

3.3 Endangered, Threatened and Rare Species

3.3.1 Federally Listed Species

Gray Bat. The endangered gray bat is the only federally listed species know to frequent refuge lands. Field investigations were conducted by the Army between 1995 and 1997 to determine the distribution and use of army lands by gray bats (3D/International 1996a, 1996b, 1997). This effort involved mist netting along streams and radiotelemetric investigations to identify foraging and roosting areas. A summary and final evaluation of study findings can be found in the Biological Assessment prepared for closure of Fort McClellan (3D/International 1998).

Mist netting studies documented that gray bats use both Cane and Choccolocco Creeks for foraging. The capture of a reproductive female and three adult males during summer 1996 indicated at least one maternity colony and one bachelor colony were located within 22 miles of Fort McClellan. Mist netting in August 1995 also indicated gray bats foraged during the transient period following maternity season. Subsequent radiotelemetry studies in 1997 revealed two bachelor roosts under Highway 21 bridges at Cave and Cane Creek bordering the fort, and two transitional cave roosts a short distance west of the fort. Foraging on the Main Post portion of Fort McClellan was primarily confined to the golf course and forested areas north and south of Baltzell Gate. A single radiosignal was detected north of the headwaters of South Branch Cane Creek on the Refuge.

The study classified all stream corridors on Fort McClellan according to potential foraging value for gray bats. This classification was based on the physical characteristics of stream corridors and was categorized into high, moderate or low quality habitat. Only low quality habitat was identified as existing on lands that eventually became the Refuge. According to the Biological Assessment, a low quality rating indicated suitable flyways were not available and measures were not necessary for protecting gray bats under the Endangered Species Act. The U.S. Fish and Wildlife Service concurred on this approach in a letter to the Army dated February 6, 1997.

Red-cockaded Woodpecker. The endangered red-cockaded woodpecker (RCW) is adapted to mature open longleaf pine forest, and historically inhabited the Refuge and other longleaf pine forests in northeast Alabama. As longleaf pine disappeared from the region, the woodpecker also experienced serious population declines. RCWs within the adjacent Talladega National Forest were not uncommon into the early 1960s, and at least fair populations are suspected to have existed on the Refuge into the 1950s (Summerour 1992). The last active RCW cluster on Fort McClellan was recorded in the late 1960s or early 1970s. There is no record of activity within this cluster after 1972. Subsequent surveys on Fort McClellan in 1992 (Summerour 1992) and 1998 (Reisz 1998) failed to find any active or recently inactive RCW clusters.

The 1992 survey by Dr. William Summerour was conducted by a respected ornithologist with decades of experience and familiarity with Fort McClellan terrain. While old-growth suitable for cavity excavation was identified, Summerour did not believe adequate

foraging habitat and acreage was available to sustain a RCW population. He did recognize the possibility of RCWs pioneering from the adjacent Talladega National Forest.

The 1998 survey also identified conditions responsible for the disappearance of RCWS from the fort. Habitat quality was considered moderate to poor, with the thick midstory primarily responsible for habitat degradation. The study concluded that some good RCW habitat existed on the fort and, with midstory control, habitat quality and availability would increase. As in the previous survey, the possibility of birds pioneering from the National Forest was considered a possibility with habitat improvement programs.

The last remaining RCW cluster was located in Management Area 16B, adjacent to the Refuge boundary on Joint Powers Authority property. A visit to this historic site substantiates some of the impacts responsible for the bird's disappearance from former Fort McClellan. While the site contains old-growth trees suitable for cavity tree excavation, a dense midstory has seriously altered forest composition. Lack of fire along with subsequent midstory encroachment by loblolly pine and hardwoods has seriously degraded habitat quality within the stand.

One aspect of sustaining RCW populations on the Refuge has not been adequately discussed in past studies. This involves the landscape connectivity of refuge forests with National Forest lands to the east. The Talladega National Forest is designated a RCW recovery population and contains significant acreage that eventually is planned as a regional RCW population center. As discussed in previous sections (Section 2.5.3), Choccolocco Mountain is an isolated tract of longleaf pine, forming a forested outlier west of the agricultural Choccolocco Valley. While distance, less than five miles, isolates the Refuge somewhat, the Choccolocco Corridor (Alabama Forestry Commission) provides a forested connection across the valley. With habitat and active clusters on adjacent National Forest land, this forested connection may prove critical to pioneering birds and, at some future time, form a single population center that includes Choccolocco Mountain.

At present, old-growth availability for cavities on the Refuge is probably as good as or better than on most longleaf pine forests in the Southeast. Small acreages of high quality forest on Choccolocco Mountain however indicate the Refuge is probably not capable of supporting a viable RCW population in and by itself. It may be possible at some future time to establish clusters as part of the adjacent recovery population. The probability of establishing such a population at some future date would be dependent on the continued existence of the connecting forested corridor, the success of longleaf pine restoration on the Refuge and creation of a viable RCW population on the Talladega National Forest. There is a potential over time for Forest Service birds to naturally pioneer onto the Refuge with improving habitat conditions.

White Fringeless Orchid. White-fringeless orchid (*Platanthera integrilabia*), a Candidate for federal listing, has been documented within the Marcheta Mountain Seep and the Cave Creek Seep. Within the Marcheta Mountain Seep, 252 flowering

individuals were recorded in 1993 (ANHP 1994) and 213 in 1995 (Garland 1996b). Only three individuals were documented in the Cave Creek Seep in 1993, and none were found in 1995. These two populations are included in the Service's "Candidate and Listing Priority Assignment Form" and accompanying Site Conservation Plan (White 1998) that were used for elevating the orchid to Candidate status. The conservation plan estimates the population within Marcheta Mountain Seep as 500-750 individuals, and the Cave Creek Seep as 75 individuals. These increased numbers are based on the premise that only a small fraction of the orchids actually flower each year, and therefore the actual population is much greater than flowering individuals. The Marcheta Mountain population represents one of the larger known populations of white-fringeless orchids remaining in the Southeast.

A visit in support of the Site Conservation Plan was accomplished in 1997 to document the status of Fort McClellan populations (White 1998). It appears that biologist only gained access to the Cave Creek Seep during the 1997 visit with two separate populations documented. Fifteen plants were located within a small swale in the upstream portion of the seep, while a second population of at least 20 individuals was found within poorly drained portions of the lower seep. Information needs identified in the plan include monitoring of population size, effects of plant succession, impact of fires, and resulting changes from the cessation of military activities.

Potential habitat exists for this orchid throughout seepage areas along the base and slopes of Choccolocco Mountain. A detailed discussion of mountain seeps can be found in Section 3.1.5. The Army funded field investigations to locate new seeps along with additional white fringeless orchid populations in 1997 (Whetstone et al. 1998). The study identified 24 seeps on the Refuge that met the criteria of jurisdictional wetlands as defined in the 1987 Army Corps of Engineers Wetland Delineation Manual. Additional field surveys were accomplished in late July to revisit sites that potentially could support white fringeless orchid. While no new populations were identified, the larger perennial seeps identified in the study represent potential habitat for the orchid within the Refuge. Because the orchid flowers infrequently, the identification of new populations may take several years to verify.

Refuge populations of white fringeless orchid occur in association with winterberry (*Ilex verticillata*), possum-haw (*Viburnum nudum*), azalea (*Rhododendron canescens*), cinnamon fern (*Osmunda cinnamomea*), and royal fern (*Osmunda regalis*). Though *Sphagnum* is commonly present, the orchid appears to be consistently rooted in acidic, mineral soils. White fringeless orchid appears to occupy the lower, wetter sites within the seep, usually on saturated soils though not within inundated areas (Whetstone et al. 1998).

3.3.2 Rare and Uncommon Species

Additional species are recognized as rare, disappearing or at the limits of their geographical range on the Refuge. The longleaf pine system is recognized as providing habitat for many regional rare and declining species. Walker (1993) has identified 187 rare plants associated with the longleaf pine system in the Southeast. Documented biota recorded on the Refuge are provided on Table 11. Sources for compiling the refuge list include the Nature Conservancy (ANHP 2003), Alabama Nongame Species Regulation (Section 220—2-.92 of the Alabama Regulations for 2003-2004 Game, Fish, and Fur Bearing Animals), and the federal list of endangered and threatened species. Where species are associated with a specific habitat or environment, they have been included within a SBA and are discussed in the following section.

3.3.3 Significant Biological Areas (SBA)

While the Refuge is covered by a mosaic of forest types, longleaf pine formed the most prominent forest cover during the presettlement period. Military training related wildfires continued to support at least remnants of this forest type until closure of the base in 1998. Within this fire maintained forest system, a number of isolated communities exist that are considered ecologically significant. While fire is often not associated with these localized environments, they exist within fire sustained ecosystem, and any management changes should be carefully considered before implementation.

Five isolated natural communities on the Refuge have been designated as "Significant Biological Areas" (SBA) in the HMP (Figure 9). These unique or specialized local environments support rare or unusual biota (Table 12). Four of the five areas consist of springs and seeps associated with headwaters of the four major refuge drainages. As headwater wetland communities, these areas are isolated from other wetlands in the region and receive no downstream impacts typical of most wetland systems. They provide isolated and unique habitat that is rare to the region, and, as such, are recognized as a "rare community" type within the multi-agency Southern Appalachian Assessment (SAMAB 1996). A more detailed discussion of upland seepages can be found in Section 3.1.5. The fifth SBA, Moorman Mountain Rock Ledges, provides high elevation rock faces that contain a unique and rare environment at the extreme southern tip of the Appalachian Mountains.

Boundaries of the four seepage SBAs include headwater elements of the stream along with associated seeps. In many situations, seeps are a mosaic of numerous springs and wetlands of various sizes that are concentrated in the local headwater. Generally, there is a central large seep separated by a number of smaller perennial and ephemeral seeps and springs in the immediate area. The SBA boundary attempts to delineate this concentration of unique wetland systems within one single management and protection unit. The long-term protection of seepage SBAs is also dependent on the integrity of upland slopes surrounding seepages. Physical disturbances and erosion on adjacent

slopes can be expected to degrade water quality and increase sedimentation to lower wetlands. To ensure protection of these headwaters, it is therefore critical that refuge management scenarios analyze potential impacts and benefits on a watershed basis. It is also important to note that these four seepages represent the largest and most extensive wetland areas, but other smaller and isolated seepages and springs occur throughout the Refuge, and also deserve conservation efforts (Whetstone et al. 1998).

3.3.3.1 Marcheta Mountain Seep SBA.

Description. The Marcheta Mountain Seep SBA includes springs and seepage areas within the headwaters of North Branch Cane Creek (Figure 9). Rare biota discussed in Section 3.3.2 that have been documented in the seep include white fringeless orchid, Diana, and rose gentian (Table 12). The population of white fringeless orchid, a Candidate Species, is particularly significant representing one of the largest documented populations in the Southeast (Section 3.3.1). While seepages and springs exist throughout the headwater area, the largest and most intact seep is located directly behind former Range 21. The boundaries of this 7.2 acre seep were delineated in 1995 (Garland 1996). This seep represents the best remaining example of an Appalachian bog on the Refuge.

Fire History. The entire headwater area is located within a section of the Refuge that has experienced numerous recurring wildfires, at least during recent years. The proximity of seeps to former night firing ranges (flares and tracer fire) created a high frequency of wildfires in this section of former Fort McClellan. It appears however that fire rarely entered inner or central parts of the seep. Typically, fire would burn down to the moist edges of the seep leaving an intact unburned seep within a larger burn area. The exception to this situation occurred during a drought in 1986. Resource managers describe a glowing nighttime light emanating from the bog during the fire. It is believed that the center of the bog had dried during an extreme drought, and fire actually entered into the bog consuming the dried *Sphagnum* layer. Such a fire would also kill or knock back the shrub component of the bog. A review of current conditions indicates an increasing shrub layer within the bog with herbaceous species such as orchids and ferns relegated to more open wetland edges. It is quite possible that drought related wildfires are natural processes in succesionally revitalizing these wetland systems (Section 3.1.5).

Existing Impacts and Habitat Modifications. Portions of the seep have experienced alterations through past military training. Bains Gap Road transects the area and has been in use by the military and locals inhabitants for over a century, In recent years the military has constructed several ranges (21, 22, 27, 24 Upper, 24 Lower) within or on the edge of the seep area. Concurrent with range use, safety zones for range firing almost totally excluded human access to the less disturbed sections of the seep south of Bains Gap Road. The result of these actions is an extreme variation of site conditions within the overall headwater area. Extremely high quality seeps exist behind ranges south of Bains Gap Road, while areas along Bains Gap Road and within range areas have been severely altered.

Recent alteration to the seep occurred during recent UXO characterization studies in 2002. Portions of the high quality 7.2 acre seep were used as a quarter acre characterization plot. All understory and shrub vegetation within the plot was removed for UXO sampling and, on completion of sampling, the plot was abandoned and allowed to revert to natural vegetation. The long-term ecological effects of this action are unknown. Heavy equipment used during plot sampling however became stuck in central portions of the seep. The resulting soil and organic disturbances from this action indicate recovery from physical disturbances within the seep may be extremely slow.

Future Threats. Future threats to seep integrity that should be considered in management and protection efforts include; UXO remediation program, visitor access, and fire exclusion.

3.3.3.2 Bains Gap Creek Seep SBA

Description. Bains Gap headwater and seep area is located on the east slope of Choccolocco Mountain along Bains Gap Road (Figure 9). Rare biota discussed in Section 3.3.2 that have been documented within the headwater area include Fraser's loosestrife and caddisflies (Table 12). Much of the SBA directly parallels Bains Gap Road, with some areas within 20 feet of the road surface. Springs and associated wetland are somewhat linear along the stream and lack the broad seep shrub layer found on other parts of the Refuge.

Fire History. Most military training involving tracer fire and pyrotechnics occurred west of Choccoloocco Mountain, at least during the past 50 years. As such, wildfires from military training were less frequent in this area than to the west. Occasional wildfires however did occur, probably with a 5 to 10 year frequency.

Existing Impacts and Habitat Modifications. Very little military training occurred within or in the vicinity of this SBA. Bains Gap Road however parallels the stream and provides direct access to the area. Additionally, road maintenance activities provide a pathway for exotic plants along the stream's edge. Recorded exotics along the road include memorial rose, Chinese privet, Chinese wisteria and daffodil. Historically, road maintenance activities under army ownership were credited with adversely impacting the single population of Fraser's loosestrife bordering the road.

Future Threats. Threats to the wetland area involve increased visitor access and road maintenance activities. Exotics, particularly shade tolerant species such as Chinese privet, represent the greatest threat within the shaded streamside community.

3.3.3.3 Cave Creek Seep SBA

Description. Cave Creek SBA is located in the upper reaches of Cave Creek to the north and northwest of Caffey Mountain (Figure 9). Seepages and springs occur along the headwater with a broad seepage flat in the lower portion of the site. Rare biota discussed in Section 3.3.2 that have been documented within the SBA include white

fringeless orchid (Table 12). Actually, two separate populations of the orchid were recently documented within the site (White 1998).

Fire History. The SBA is located within a section of the Refuge that has experience frequent recurring wildfires from military training exercises. Above the broad seepage flat, fires appear to burn along the stream's edge and through small seepages. The broad wetland flat however appears to experience fewer fires due to wetness, lack of fuels, and historic soil disturbances. The lower seepage area currently appears fire suppressed.

Existing Impacts and Habitat Modification. The lower broad seepage flat was cleared and/or heavily disturbed through past military training activities. These impacts are historic and related to past range operations. Historic photo records (USCOE 1999) indicate that prior to 1940 few disturbances existed within the Cave Creek headwater. By 1944, the Range 31 complex had been constructed and the entire seepage and stream, including the broad wetland flat, had been cleared or were heavily impacted. The range remained cleared through 1954, but by 1961 upper range areas, including seepage areas, had been abandoned and were in a state of recovery. Currently, higher quality portions of the seep are located around sphagnum discharge areas in the broad wetland flat or in isolated upland areas north of past disturbances. Current conditions in the broad wetland flat appear to represent about 45 years of recovery.

A firebreak parallels Cave Creek, crossing the stream and climbing a steep eroded hill upstream of the broad seepage flat. This stream crossing and exposed slopes continue to provide eroded sediments into the Cave Creek SBA.

Future Threats. Threats to seep integrity that should be considered in management and protection efforts include; UXO remediation programs, visitor access, fire suppression, and sedimentation

3.3.3.4 South Branch Cane Creek Seep SBA

Description. Headwaters of South Branch Cane Creek include significant stream, seep and lowland hardwood forest communities (Figure 9). The Army's former smoke training area, Range 24A, was located in this valley along the headwater stream. Rare biota discussed in Section 3.3.2 that have been documented in the headwater area include gray bat and caddisflies (Table 12).

Fire History. Although the headwater seep and adjacent lands have experienced recurring military wildfires, most wetland and streamside areas appear fire suppressed. It is difficult to separate human disturbances from those of fire suppression on this former range.

Existing Impacts and Habitat Modification. Military use in and adjacent to headwaters has significantly altered natural communities and soil structure. Prior to 1940, only a small clearing is identified within the headwater. This clearing, in all probability, was related to an early home-site prior to military ownership in 1917. By

1954, the area is heavily disturbed and cleared as a rifle range, which is in use through 1969. Because the area is rather isolated within the fort, a number of rather sensitive training activities were conducted at this location. Documented uses included explosive detonation training, chemical live agent training, and most recently, smoke obscurant training.

Wetland and streamside communities have experienced a wide variety of impacts in recent years, both natural and manmade. Physical alterations of seep structure occurred during past army operations. Heavy equipment cleared large areas, either for the past rifle range or the recent smoke obscurant range. Currently, the smoke obscurant range is recovering through succession with aggressive fire sensitive species such as loblolly pine dominating. Historically cleared areas adjacent to the range have been allowed to revert to a natural, albeit disturbed and/or exotic, vegetation cover during recent years.

Ground disturbance and subsequent invasion by exotics is an ongoing problem and potential threat to area. In particular, Japanese stilt grass (*Microstegium vimineum*) has spread through shaded portions of the seep.

In addition to anthropogenic impacts, beaver activity has significantly altered the physical environment within the SBA. Although not currently inhabiting the area, long linear dams were historically constructed throughout the wetland, taking advantage of low flow volumes from springs. Existing habitat is characterized by small pools of emergent vegetation separated by dense shrub barriers along dams.

While South Branch Cane Creek Seep is perhaps the most altered perennial wetland on the refuge, it continues to retain many of the unique attributes of an isolated headwater spring. This is most clearly demonstrated by the documentation of 13 rare caddisfly species that were tracked by The Nature Conservancy at the time of their biological survey in 1994. One of these caddisflies, *Hydroptila setigera*, was considered endemic with the only known specimen described from the headwater stream.

Management applications will attempt to reduce impacts from surrounding uplands that have or are contributing sediments to the seep. Long-term objectives are to return the adjacent Range 24-A training area to a forest cover. This entire area is suspected to have originally contained longleaf pine. Restoration will follow techniques described for the Loblolly Pine-Disturbed Community (Section 3.1.6). Particular care will be taken to minimize erosion and possible sedimentation into the stream system.

Future Threats. Future threats to seep and headwater integrity that should be considered in management and protection efforts include; UXO remediation program, visitor access, fire suppression, invasive plants, sedimentation and beaver.

3.3.3.5 Moorman Mountain Rock Ledges SBA

Description. Moorman Mountain Rock Ledges SBA extends from Moorman Mountain peak southwest along the mountain crest at an elevation above 1800 feet (Figure 9). Rare

biota documented along the ridge include common juniper (Table 12). This occurrence represents the only know record in Alabama and the southern range extension for this northern plant. Common juniper is commonly encountered on open rock faces or exposed rock ledges extending along the mountain crest.

Fire History. The SBA is above the elevation of longleaf pine forests, but does experience recurring wildfires that spread up the mountain from lower slopes. In fact, fire scarred trees along slopes indicate a high fire intensity during wildfires. Because ground juniper is considered a fire sensitive species, fire was initially considered a potential threat to the plant. Its presence within rock faces was considered a factor allowing the plant to survive within a fire maintained forest system. Recent observations of encroaching Virginia pine along rock faces however indicates that fire may actually be needed to control Virginia pine. The pine grows in dense stands above the juniper, shading out the rock faces and potentially eliminating the open exposed rock surfaces that juniper prefers.

Existing Impacts and Habitat Modifications. During the mid 1990s, Alabama Emergency Management Agency acquired a lease from the Army and constructed a transmission tower on Moorman Mountain. The site was cleared of vegetation and partially graded to provide a fenced leased compound around the tower. In all probability, juniper sites were lost during this construction phase. In addition, grading of ridge areas caused soil disturbances that have allowed a variety of exotic plant species to become established.

Rock faces and ledges however exist southwest of the tower and continue to support common juniper. Recent observations however indicate Virginia pine may slowly shade out juniper sites without fire. Future monitoring will evaluate the impact of prescribed fire on this community and the effectiveness of fire in controlling Virginia pine. Further efforts may involve cutting Virginia pine around the rock faces and exposing the juniper to sunlight.

Future Threats. Future threats to the SBA that should be considered for management and protection efforts include; fire exclusion, exotic plants and Virginia pine encroachment.

4.0 Habitat Management Goals

Refuge objectives were formulated for planning (USFWS 1997) and evaluating the environmental consequences of establishing (USFWS 2003a) the new refuge:

- **to preserve and enhance the natural mountain longleaf pine ecosystem;**
- **to help perpetuate the neotropical migratory bird resource;**
- **to preserve a natural diversity and abundance of native fauna and flora, with special emphasis on the red-cockaded woodpecker and other endangered species; and**
- **to provide compatible, wildlife dependent recreational opportunities such as hunting, fishing, wildlife observation and photography, and environmental education and interpretation.**

The Bob Stump National Defense Authorization Act for Fiscal Year 2003, P.L. No. 107-314, authorized the transfer, to the administrative jurisdiction of the Secretary of the Interior, 7,759 acres in order to establish Mountain Longleaf National Wildlife Refuge. P.L. No. 107-314 provided slightly differing purposes and management direction for the new refuge.

Purpose

- **To enhance, manage, and protect the unique mountain longleaf pine ecosystem on the property,**

In a manner that

- **conserves and enhance populations of fish, wildlife, and plants in the Refuge, including migratory birds and species that are threatened or endangered, with particular emphasis on the protection of the mountain longleaf pine plant ecosystem;**
- **protects and enhances the quality of aquatic habitat in the refuge;**
- **provides, in coordination with the Alabama Department of Conservation and Natural Resources, the public with recreational opportunities, including hunting, fishing, wildlife observation and photography;**
- **provides opportunities for scientific research and education on land use and environmental law; and**

- **is consistent with environmental restoration efforts conducted by the Secretary of the Army on the Refuge or on lands adjacent to the Refuge.**

The presence of the best remaining example of a fire maintained mountain longleaf pine ecosystem is recognized as the primary factor for selecting the area as a national wildlife refuge. With closure of the base in 1998, military related wildfires disappeared and longleaf pine forests no longer experienced recurring wildfires. Without implementation of an active prescribed burning program, these forests were expected to slowly evolve into a more hardwood dominated forest community. To meet the primary purpose of preserving and enhancing the longleaf pine ecosystem, **management goals** and subsequent **management objectives** are directed at maintaining and restoring forest health to the fire adapted mountain longleaf pine ecosystem. All goals and objectives are designed and evaluated according to their ecological benefit and their relationship to recurring fire. Where protective or mitigative measures are considered necessary to ensure the survival of a species or community type, they are identified and incorporated into management strategy.

Refuge forests represent a unique opportunity for scientists to manage and restore a mountain longleaf pine ecosystem. Unlike management scenarios on other lands, refuge forests are relatively intact with restoration primarily involving prescribed fire along with structural modifications to the existing forest. An overall factor of minimizing disturbance and alteration within this forest system is considered important to maintaining natural community structure and species composition. Because these forests have evolved from a site seed source, efforts will be taken to minimize changes to natural process through the collection of onsite seed and germination at a nearby seedling nursery.

The **Refuge Vision** broadly reflects the reason for establishing the Refuge, based on both legislated and planning purposes and objectives. The vision statement is as follows:

Mountain Longleaf National Wildlife Refuge will be managed to maintain and restore a naturally regenerating mountain longleaf pine ecosystem, along with providing educators, research scientists, and the public with a broad range of opportunities to appreciate and enjoy a rare and disappearing southern forest type.

The following **management goals** were designed to meet Refuge establishment purposes and define general targets in support of the Refuge Vision.

- **GOAL 1 - Provide an ecosystem management strategy that restores and maintains the mosaic cover of longleaf pine forest;**

- **GOAL 2 - Maintain fire adapted longleaf pine and associated communities through prescribed burning to approximate conditions occurring in presettlement forests;**

- **GOAL 3 – Structurally restore the longleaf pine community, where possible, to a condition that can be maintained through prescribed burning;**

- **GOAL 4 – Restore a natural forest cover on army ranges and open areas that were cleared by the military;**

- **GOAL 5 - Manage high elevation, wetland, streamside and hardwood forests as a component of the mountain longleaf pine ecosystem;**

- **GOAL 6 – Manage the Refuge as an ecological unit within a larger forested landscape connected to the Southern Appalachian Mountains;**

- **GOAL 7 - Minimize fragmentation and opening of refuge forest landscape and, where possible, restore forest connections to provide forest interior habitat for neotropical birds and wildlife;**

- **GOAL 8 - Manage and protect sensitive headwater seep wetlands and bogs as part of the mountain longleaf pine landscape;**

- **GOAL 9 - Inventory, protect and manage rare, endangered, threatened and sensitive species and natural communities as part of the mountain longleaf pine ecosystem;**

- **GOAL 10 - Inventory and control exotic and invasive species, and maintain the integrity of the native mountain longleaf pine ecosystem.**

- **GOAL 11 – Maintain and restore native wildlife associated with longleaf pine and other refuge natural communities.**

- **GOAL 12 – Maintain an adequate firebreak system that fulfills management and public use needs, while minimizing adverse ecological effects on the natural landscape.**

5.0 Habitat Management Strategies and Objectives

Management objectives are incremental steps or specific tasks for achieving management goals. Objectives should be viewed through adaptive management, and modified, added or eliminated as new information becomes available. Management objectives that are particularly critical and should be implemented in the immediate future are termed **primary objectives**. Those objectives in which additional information is needed before implementation of specific management efforts are termed **secondary objectives**. Secondary objectives are not necessarily of less ecological importance, but require additional information or completion of a **primary objective** before programs are initiated.

Strategies provide definable techniques and approaches for meeting management goals and achieving management objectives. They are discussed under **supporting rationale** as the probable approach for reaching objectives. Future information and site specific conditions may necessitate modifying techniques and strategy. It is critical again that managers view strategy through an adaptive management approach, and take advantage of lessons learned and new information as it becomes available.

While **management objectives** can be formulated at the present time, specific techniques or **strategies** in accomplishing objectives may have to be modified due to UXO land use restrictions (Section 2.4.3) and site specific conditions. Final UXO land use controls will depend on the level of eventual UXO remediation. A lower level of cleanup translates into a broader range of land use controls. As land use controls become more restrictive, the range of techniques and strategies available to accomplish objectives decreases. With fewer options to consider for restoration, unit costs, in many situations, can also be expected to increase.

Specific prescriptions for meeting **management goals** and accomplishing **management objectives** will be selected in the Annual Habitat Work Plan (AHWP). The HMP however provides a range of options with the most probable strategy described in detail. Costs associated with accomplishing **management objectives** are provided on Table 13.
The HMP provides a 15-year management scenario. Costs, where possible, will be developed according to management year (e.g. Year 1, Year 2, etc.) The accomplishment of annual management objectives is heavily dependent on annual funding and adequate staffing.

GOAL 1

Provide a an ecosystem management strategy that restores and maintains the mosaic cover of longleaf pine forest;

The primary purpose of establishing the Refuge was to maintain and restore the unique mountain longleaf pine ecosystem that persisted under Army ownership and benefited from a century of training related wildfires. Portions of these forests represent the finest remaining example of mature and old-growth mountain longleaf forest in existence. As such, examples of fire maintained forests represent benchmark goals for long-term management of the Refuge as well as longleaf pine forests in the region (Section 3.1.1). They contain the structure and characteristics that are believed to have existed throughout the region in presettlement times. As such, management scenarios consider high quality refuge forests as the benchmark and restoration objective for longleaf pine management on the Refuge. Management techniques and objectives take advantage of lessons learned in other regions, but will direct long-term goals to target conditions that currently exist on selective high quality old-growth stands.

Refuge communities exist as a mosaic of forests with soil, slope, aspect, elevation, moisture all influencing vegetational cover. Longleaf pine exists as a component of this mosaic, most commonly occurring and adapted to south or southwesterly drying slopes. This entire mosaic of community types existed and evolved through a landscape of recurring fires. It is therefore critical that management strategies consider fire as the primary factor that has and is responsible for the unique ecosystem for which the Refuge was established.

While vegetation community and longleaf pine mapping are critical to restoring refuge forests, management programs can proceed prior to acquiring detailed stand information. Existing research (Varner et al. 2000) has characterized longleaf pine stand quality according to Management Area (Figure 8). Using this information, managers can begin reintroducing prescribed fire on the Refuge. Dormant season burns should first be used to reduce fuel loads within burn and management units. Once fuel loads have been reduced and are consistent throughout the unit, growing season burns can be applied to the units for hardwood control. The reintroduction of fire is the most critical element in all longleaf pine restoration and maintenance programs. The Refuge has an approved fire management plan (USFWS 2003b).

Primary Objective 1 – Within two years, map vegetation cover types on Refuge to establish community structure and limitations for future prescribed burning.

<u>Supporting Rationale</u>

Refuge communities were described and characterized in Section 3.1. They were classified as upland pine forest, upland hardwood forest, lowland hardwood forest, Virginia pine forest, hardwood seepage, loblolly pine-disturbed communities. Community type provides important information concerning fuel loading, sensitivity or

adaptation to fire, and priority and need for future burning. This information is critical to establishing a refuge-wide prescribed burning program.

General community mapping will be accomplished through outside contracts with Service staff providing guidance on mapping criteria. The entire Refuge (9016 acres) will be mapped according to the above community designations. Hardwood seeps are variable in size, and will be mapped by Service biologists and plotted as an overlay on community maps.

Primary Objective 2 – Within two years, map condition of approximately 4,000 acres of mountain longleaf pine forest according to hardwood encroachment, stocking and the presence of fire sensitive pine species.

Supporting Rationale

Longleaf pine forest exists in a variety of stand conditions. Most variation is related to fire exclusion and, in some situations, disturbances that have introduced loblolly or Virginia pines into forest stands.

Forests will be mapped according to stand condition; (1) fire maintained, (2) midstory and/or hardwood encroachment, (3) longleaf pine stocking, and (4) the presence of off-site pines. In some situations, "encroachment" and "poor stocking" may apply to the same forest area.

(1) "Fire maintained" areas include those longleaf pine stands that can be maintained in high quality condition through seasonal prescribed burning. These forests represent high quality longleaf pine stands on the Refuge, and generally provide the benchmark for restoration efforts. (2) "Midstory and/or hardwood encroachment" occurs in fire-suppressed stands where fire alone will not restore forest structure. These areas may require additional mechanical or chemical treatments to reduce competition. Areas classified as (3) "poor stocking" represent stands where existing longleaf pine stocking is below that needed to produce an adequate number of cone bearing trees at some future time. These areas may require supplemental hand planting to reestablish an adequate overstory as a future seed source. The last classification, (4) "off-site pine presence" primarily occurs along roads and around old military ranges, and is a result of past disturbance along with possible fire suppression. Often, loblolly and Virginia pine exists at a size where fire will no longer eliminate the trees. These areas may require mechanical or chemical treatment, or possibly timber sales and replanting with longleaf pine.

Upland pine forests delineated in Management Objective 1 will be further evaluated and mapped according to these four specific management categories. Longleaf pine stand condition mapping will be accomplished through outside contracts with Service staff providing guidance on mapping criteria. Approximately 4000 acres are estimated to require mapping according to longleaf pine stand conditions. This includes all existing

longleaf pine forest along with other forest types that contain a significant component of old-growth or relict trees.

Primary Objective 3 – For three consecutive years, conduct dormant season prescribed burns on 1500 acres annually within burn units described in Refuge Fire Management Plan.

Supporting Rationale

Dormant season burns are necessary to reduce fuel loads and to establish consistent fuel loading within individual burn units or at a larger scale. Current fuel loads vary according to the location of former military ranges and wildfires, and are not consistent throughout burn units. Before seasonal growing season burns can be initiated, it is critical to eliminate high fuel loading within isolated fire suppressed stands (Section 3.1.1).

The Refuge Fire Management Plan (USFWS 2003b) established the following secure burn units; 1, 2, 4, 5, 6, 7, 8, and 9 (Figure 10). These burn units have experienced variable or few fires in the past and require dormant season burns prior to considering growing season prescribed burning. Total acreage is 4893 ($50/acre), with dormant season burns taking place during the first three years of management (1500 acres/annually). It should be recognized that burn units contain a mosaic of community types and not all areas within the units will burn. The actual acres burned will therefore be less than the total burn unit acreage

It should be recognized that cost estimates are based on the interim LUCIP (Land Use Control Implementation Plan). The interim plan provides land use controls that effectively restrict operational aspects of prescribed burning to cleared firebreaks within suspected UXO areas. Equipment and hand operations outside of cleared firebreaks are restricted. This activity curtailment requires the onsite presence of a helicopter, bucket and water storage, and personnel available to respond to fire escapes within contaminated areas. Should remediation and the final LUCIP eliminate these restrictions, more liberal procedures are expected to reduce prescribed burning costs.

Primary Objective 4 – Within two years, establish a cooperative agreement with the Calhoun County Joint Powers Authority (JPA) to provide management guidance and assistance in maintaining longleaf pine forests adjacent to the Refuge, and include approximately 300 acres of JPA lands in prescribed burning program within five years.

Supporting Rationale

Extensive areas of longleaf pine forest are located west of the Refuge boundary on JPA lands. Previous studies indicate JPA and refuge lands comprised a single forested landscape in the past. Research described in Section 3.1.1 characterized these forests, and continuity with refuge forests can be seen on Figure 8. A cooperative agreement

with the JPA will offer guidance and assistance in identifying high quality and restorable longleaf pine forests, and offer assistance in maintaining these fire adapted communities.

Approximately 300 acres ($50/acre) of longleaf pine forest on adjacent JPA lands will be considered for inclusion within the refuge prescribed burning program. The actual initiation of cooperative burn efforts however will depend on the status of UXO remediation on JPA lands. At present, firebreaks and unimproved roads on JPA contaminated areas have not been remediated. As these potential access routes and firebreaks are remediated or another boundary is established, contiguous refuge/JPA tracts will be considered for prescribed burning. During the interim, a cooperative agreement will be established with the JPA and refuge biologists will work with the Authority or their representatives in establishing a longleaf pine forest management program or plan consistent with refuge goals.

Primary Objective 5 – Within one year, establish an herbarium in the Refuge laboratory using the existing army collection and adding new specimens as needed for field work in assessing high quality longleaf pine forests.

Supporting Rationale

Monitoring and evaluating the success of prescribed burning will use pristine longleaf pine forest plant indicators (Table 4) to estimate the success of burning programs. The herbarium will provide reference collections for biologists to identify and learn plants that will be encountered during field monitoring. A herbarium was created by army biologists and has been transferred to the Service for use on the Refuge. Additional specimens will be added to the collection as the need arises and damaged sheets will be replaced.

Refuge biologists and staff will maintain the existing plant herbarium, adding new specimens as the prescribed burning program is developed and restoration progresses within longleaf pine forests.

GOAL 2

Maintain fire adapted longleaf pine and associated communities through prescribed burning to approximate conditions occurring in presettlement forests.

High quality longleaf pine stands (Figure 8) are primarily located in central portions of the Refuge in Burn Units 3 and 5 (USFWS 2003b). High quality stands contain a longleaf pine overstory with an herbaceous ground layer, and provide the benchmark for restoration efforts. As fire frequency decreases, the shrub and midstory component of these forests and other longleaf pine forests increases. The ability of prescribed fire to maintain or reestablish the herbaceous cover is difficult to estimate.

After reducing fuel loads through dormant season burns, an initial sequence of early growing season prescribed burns will be scheduled at varying intervals. It is only through early growing season burns that encroaching hardwoods, shrubs, and particularly oaks can be reduced or eliminated (Robertus et al. 1993). Preliminary studies have indicated that hardwoods are most effectively controlled by fire during the early part of the growing season (Streng et al. 1993). Prescribed burning during mid and late growing season tends to be slightly less effective. Where the opportunity exists and the primary objective is hardwood control, prescribed burning will therefore be scheduled early in the season (April-early June). Once burn units are considered restored, a maintenance burning schedule with seasonal variability will be established.

While fire is critical to long-term longleaf pine restoration, canopy cover must also be considered in planning efforts. Longleaf pine forests are often referred to as woodlands or savannah, and not as a forest. This nomenclature differentiation is related to the original fire maintained old-growth forest system, which contained a canopy cover between 25 and 60 percent (Section 3.1.1). This open canopy facilitates the establishment of a diverse fire adapted herbaceous layer, and permits sunlight to reach the shade-intolerant longleaf pine seedlings on the forest floor. One of the greatest obstacles to restoration often occurs when the native ground cover is successionally lost and the forest lacks sufficient herbaceous cover to carry light intensity fires (Brown and Smith 2000). On the nearby Talladega National Forest, repeated growing season burns failed to meet restoration objectives because of this dense canopy cover (USDA Forest Service 2004). It is therefore critical that pine and hardwood control open the longleaf pine canopy to ensure long-term restoration success. All stands failing to meet longleaf pine canopy criteria or experiencing significant hardwood encroachment should therefore be considered for treatment under Goal 3 before being classified as high quality stands in Goal 2.

Effectiveness of prescribed burns will be measured through long-term monitoring programs. Auburn University will establish permanent monitoring plots throughout longleaf pine forests on the Refuge. Utilizing these plots and high quality plant indicators (Tables 3 and 4) identified in previous research, restoration success will be monitored and measured. Photo monitoring plots will also be established prior to and after completion of prescribed burns to measure changes in forest structure.

It should be recognized that cost estimates are based on the interim LUCIP (Land Use Control Implementation Plan). The interim plan provides land use controls that effectively restrict operational aspects of prescribed burning to cleared firebreaks within suspected UXO areas. Equipment and hand operations outside of cleared firebreaks are restricted. This curtailment requires the onsite presence of a helicopter, bucket and water storage, and personnel available to respond to fire escapes within contaminated areas. Should remediation and the final LUCIP eliminate these restrictions, more liberal procedures are expected to reduce prescribed burning costs.

Primary Objective 1 – Within one year, conduct early growing season prescribed burn of Burn Unit 3, and schedule unit for future growing season burns for at least two consecutive cycles.

Supporting Rationale

Only Burn Unit 3, Caffey Mountain (Figure 10), has experienced widespread wildfire and prescribed burns, and currently contains a consistent reduced fuel load throughout the unit.

Early growing season prescribe burns will be accomplished on the 1264 acre ($50/acre) Caffey Mountain Burn Unit. Photo plots and plant species form/composition will be used to measure success of prescribed burning. Frequency of early growing season burns will be considered at two to three year intervals, depending on the accumulation of adequate fuel loads. Once adequate hardwood control is accomplished and a satisfactory herbaceous cover exists, the unit will be considered restored and maintenance burning will be implemented. At that time, seasonality of burning will be varied at three year intervals.

Approximately 690 acres in Burn Unit 3 were prescribed burned in May, 2004. Remaining unburned acreage totals 574 acres. Tentative burns for next three burn intervals, assuming recovery in three intervals, is 574 acres (Year 1), 690 (Year 2), 1264 (Year 4) and 1264 acres (Year 6).

Secondary Objective 1 – Conduct 1000 to 2000 acres annually of growing season prescribed burns after the completion of dormant season burning, with the objective of establishing high quality longleaf pine forest conditions.

Supporting Rationale

After dormant season burns have been completed and consistent fuel loads established (Goal 1 – Primary Objective 3), growing season burns will be accomplished on units containing longleaf pine. Using longleaf pine stand quality descriptions provided by Varner et al. (2000), priorities have been set according to the distribution of longleaf pine

on the Refuge. Tentative prioritization order is as follows; Burn Units 5, 6, 7, 1, 9, 4, 8, and 2 (Figure 10).

Early growing season burns will be scheduled for two to three year intervals, depending on the accumulation of an adequate fuel load. A total of 4893 acres is currently bounded by secure firebreaks. An average of 2,000 acres ($50/acre) would be burned on the two to three year interval. Once adequate hardwood control is accomplished and a satisfactory herbaceous cover exists, the unit will be considered restored and maintenance burning will be implemented (Goal 2 - Secondary Objective 3). At that time, seasonality of burning will be varied at three year intervals. Restoration success will be measured and determined according to procedures in Goal 1, Primary Objective 2.

Secondary Objective 2 – Within two years, evaluate possibility of future prescribed burning in Burn Units 10 and 11, and develop cooperative agreement for prescribed burning 200 acres with Alabama Forestry Commission.

Supporting Rationale

While Burn Unit 10 contains only scattered longleaf pine individuals or isolated patches, Burn Unit 11 contains significant longleaf stands along ridges, particularly north of Bains Gap Road. Both units however lack firebreaks on at least part of their boundary, and cannot be burned under current conditions. Both feasibility for firebreak improvements, cooperative efforts with adjacent land owners and ecological benefits of burning will be considered before including these units in the future prescribed burn program.

Planning and feasibility studies will be accomplished to determine the possibility of including Burn Units 10 and 11 in the refuge prescribed burning program. Primary emphasis will be placed on cooperative efforts with the Alabama Forestry Commission on areas that border the Refuge in Burn Unit 11. Approximately 200 acres ($50/acre) appears reasonable for cooperative burning efforts, and would be scheduled at two year intervals for the restoration phase. Additional acreage would be added to the burn program as feasibility is proven.

Secondary Objective 3 – Establish maintenance prescribed burning on a 2-3 year cycle for up to 2000 acres annually on burn units where monitoring plant form and species composition indicates stands have been restored to high quality.

Supporting Rationale

Once burn units are considered restored with herbaceous and hardwood structure indicating high quality longleaf pine stands, a maintenance burning schedule will be established. This schedule will provide seasonality of burning with three-year intervals anticipated. Monitoring of plant form and species will continue and provide information concerning the need and frequency for growing season burning.

The sequence of maintenance burning follows completion of Goal 1 - Primary Objective 3 and Goal 2 - Secondary Objective 1. Schedules will follow Secondary Objective 1 with up to 2000 acres ($50/acre) burned annually beginning in Year 8. Initiation of the maintenance burning schedule is based on successful restoration in 8 years with three growing season burns. Additional intervals of early growing season burns may be required to reach the point where burn units are classified restored and ready for maintenance.

GOAL 3

Structurally restore the longleaf pine community, where possible, to a condition that can be maintained through prescribed burning.

Stands once dominated by longleaf pine or containing longleaf pine as a component exist throughout the Refuge. In many situations, these forests represent long-term fire exclusion with resulting hardwood encroachment and/or poor stocking. The ability of managers to restore these areas depends to some degree on the intensity and frequency of prescribed burning. Some fire-suppressed forests however will require additional restoration efforts to establish a high quality longleaf pine forest. The selection of appropriate techniques depends to a large extent on erosion potential and the existing herbaceous component, but may include herbicides, tree felling, timber harvest, girdling, drum chopping, hydro-ax, brush cutter, machine and hand planting.

While fire is critical to long-term longleaf pine restoration, canopy cover must also be considered in planning efforts. Longleaf pine forests are often referred to as woodlands or savannah, and not as a forest. This nomenclature differentiation is related to the original self-maintaining old-growth forest system, which contained a canopy cover between 25 and 60 percent (Section 3.1.1). This open canopy facilitates the establishment of a diverse fire adapted herbaceous layer, and permits sunlight to reach the shade-intolerant longleaf pine seedlings on the forest floor. One of the greatest obstacles to restoration often occurs when the native ground cover is successionally lost and the forest lacks sufficient herbaceous cover to carry light intensity fires (Brown and Smith 2000). On the nearby Talladega National Forest repeated growing season burns failed to meet restoration objectives because of this dense canopy cover (USDA Forest Service 2004). It is therefore critical that midstory and hardwood control also open the longleaf pine canopy to facilitate the establishment of a herbaceous ground cover.

Restoration efforts will be accomplished through three approaches; control of hardwood-pine encroachment in longleaf pine stands, removal of off-site trees on disturbed areas, and replanting understocked longleaf pine stands. These situations were evaluated and identified for Goal 1 –Primary Objective 2. Several years of prescribed burning will provide additional information concerning those areas that cannot be restored through prescribed burning, or fail to exhibit adequate seedling recruitment.

Secondary Objective 1 - Within two years of mapping longleaf pine stand condition, schedule and reduce hardwoods and unwanted pines on at least 50 acres annually within longleaf pine stands that cannot be controlled through prescribed burning, with the objective of establishing a 25-60 percent canopy cover.

<u>Supporting Rationale</u>

Longleaf pine stands exhibiting an advance degree of hardwood and pine encroachment, and cannot be restored singularly through prescribed fire, will require more intense restoration efforts. This condition may require midstory control to the selective removal

of overstory trees. Techniques include mechanical removal, girdling or chemical injection, to the selective harvest of unwanted hardwoods and pines. In some situations, selective timber harvest contracts may be feasible.

Longleaf canopy cover should range from 25-60 percent (NatureServe 2004) after removal of undesirable midstory and overstory trees is completed. Research has demonstrated that seed dispersal distance within mature and old-growth forests is greater than in second-growth stands (Grace et al. 2004). Greater dispersal distances may be attributed to a more open savannah forest that exposes crowns to winds that carry seeds further from the tree. Most seeds were found to disperse from 10-75 m (or more) of the tree. An increased dispersal distance in old-growth forests can be expected to reduce inbreeding and increase genetic diversity of populations. .

A critical factor in selecting the appropriate control technique must consider minimizing soil and ground disturbance within the stand. Maintaining the existing herbaceous ground layer is critical to the long-term success of restoration. Disturbance of this soil layer also opens the forest to weedy annuals and exotics.

Mechanical or chemical control of competing hardwoods will be scheduled for 50 acres annually. Because final landuse controls are not available, specific techniques for accomplishing this objective may have to be selected at a later date. Mechanical control is considered the probable method ($100/acre-tree felling).

Secondary Objective 2 – Within two years of mapping longleaf pine stand condition, schedule and implement supplemental annual planting of longleaf pine seedlings on at least 20 acres annually within designated understocked longleaf pine stands to approximate density of old growth stands, 100-200 trees/acre greater than one inch DBH.

Supporting Rationale

Potential candidates for this prescription include longleaf pine stands that are restorable, singularly through fire, or after the completion of hardwood/pine encroachment control, but lack adequate stocking for an existing or future longleaf pine overstory. Adequate stocking within existing forests is defined as a canopy cover ranging from 25-60 percent (NatureServe 2004). Research on the Refuge (Varner et al. 2000), revealed that old growth forests eventually contain between 100-150 trees per acre greater than one inch DBH.

Options to seedling hand planting that deserve consideration include direct seeding. The history and potential success of direct seeding however is somewhat problematic. A seed source for both seedlings and seed will be collected from the Refuge and germinated (seedlings) at a nearby nursery. Planting with off-site seedling stock has never occurred on the Refuge and genetic contamination should be avoided. Research has demonstrated that considerable genetic variation occurs among populations from different geographic

origins, with trees from different locations adapted to local environmental conditions (Hamrick et al. 1993).

Supplemental planting requires seed collection, germination of collected seed at a nearby nursery, and hand planting in selected stands. Because seedling planting numbers will depend on existing stocking and potential site condition, acreage costs will vary. The actual planting also depends on establishing operational safety procedures with the Army on UXO contaminated lands. Approximately 20 acres ($250/acre) annually is considered a reasonable objective. Contract costs involve seedling regeneration ($250/1000), with an annual requirement of 10,000 seedlings.

The number of seedlings planted per acre is dependent on site conditions. Supplemental planting will target forest openings and gaps that allow sunlight to reach the ground, and are reasonably free of competing vegetation.

Secondary Objective 3 – Within two years of completing refuge vegetation cover mapping, schedule and remove at least 20 acres annually of disturbed off-site loblolly pine and hardwoods or loblolly plantations, replanting the areas with longleaf pine seedlings, 600 trees/acre.

Supporting Rationale

Restoration will be accomplished on disturbed lands adjacent to roadways and around former training areas and firing ranges that contain loblolly pine or unwanted hardwoods. Sites within and adjacent longleaf pine stands with suitable soils will be given priority under this task. Where feasible, timber harvest contracts will be considered as the removal technique. If undesirable trees have no commercial value, mechanical removal, girdling or chemical injection will be considered possible options. In some situations chemical site preparation followed by a prescribed burn may be needed to control shrubs and competing herbaceous vegetation prior to seedling planting. Seedlings will be geminated under contract with a nearby nursery from a seed source collected on the Refuge. The seedlings will be planted by contract or volunteers.

While most of these lands are adjacent to former army firing ranges or training areas, two small loblolly pine plantations exist on the Refuge: Management Area 16C (40 acres) and former Range 24A (10 acres). Both locations are suspected to have originally been covered by longleaf pine. These plantations will be harvested through timber sales with receipts used for site preparation and replanting of longleaf pine. Both sites contain disturbed soils. Planted longleaf pine will be treated and managed as an even aged plantation during the first years of management. As trees exert dominance and mature (~20 years), the stand will transition into an all aged stand and management will consider opening gaps and thinning trees. Planting density should approximate 600 trees/acre, with survival checks at 300 trees/acre.

Individual projects are estimated at 20 acres with a three year completion timeline (tree removal, prescribed burning and seedling planting). Acreage of disturbed loblolly pine is

relatively small and often exists as a linear buffer around former army activity areas. Restoration is expected to clear small irregularly shaped tracts and not require opening or clearing large continuous tracts of land. Requirements involve collecting seed, germinating seedlings at a nearby nursery ($250/1000) and contracting the hand planting of seedlings ($100/acre). Prescribed burn requirements would be coordinated with the ongoing refuge burn program. Total cost of individual 20 acre restoration projects are estimated at $250/acre or $5000 for each project.

GOAL 4

Restore a natural forest cover on army ranges and open areas that were cleared by the military.

Prior to 1998, several areas on the Refuge had been cleared of forest cover and were used by the Army for military training, firing ranges, borrow pits and miscellaneous uses. These areas typically contain disturbed soils, exotic or cultivated grasses, and encroaching woody plants, particularly loblolly pine. In addition, most of these areas are undergoing study and potential remediation by the Army for environmental contaminants, particularly lead and UXO. An additional issue of concern involves the presence of the exotic, weeping lovegrass on most borrow areas (Figure 5).

A preliminary assessment of cleared sites suggests that longleaf pine historically occurred throughout these areas. However, prior to treatment of individual sites a detailed evaluation of soils and conditions will review forest site suitability. If sites are suspected to have originally been covered by hardwoods, shortleaf pine, or other forest trees, these species will be considered in restoration.

Because species diversity is concentrated in the native herbaceous understory, planting longleaf pine on heavily disturbed areas and old fields does not ensure re-establishment of the longleaf ecosystem (Outcalt 2000). Some functions of a complete ecosystem however are furnished and over time native species may eventually become established within these planted forests.

The timing and accomplishment of contaminant remediation, along with potential treatment requirements for exotics (Goal 10), will determine the ability of managers to implement restoration at individual sites. As these issues are clarified and defined, there will be a critical need to restore suitable forest cover. Loblolly pine is currently invading most sites, creating a dense monoculture and providing additional seed source for this invasive pine.

Soils within these former training areas are typically disturbed with an exotic plant problem. While soil erosion and sedimentation into surrounding more natural communities remain a concern, site preparation techniques can consider a wide range of intrusive options for restoration. Examples of techniques that will be considered include timber harvest, tree felling, herbicide, girdling, drum chopper, hydro-ax, brush cutter, machine and hand planting.

Secondary Objective 1 – After completion or as part of environmental remediation, former military ranges and cleared training areas will be reforested to establish a cover similar to adjacent forests.

<u>Supporting Rationale</u>

Schedules and prescriptions for restoring and replanting cleared military sites cannot be determined at present. UXO and contaminant remediation and eventual land use constraints will create site specific restoration costs and requirements. In addition, the possibility exists to include all or part of forest restoration costs as a component of the army remedial cleanup program. Each site will be considered and assessed for forest restoration as conditions permit. Although the need for forest restoration is identified, the costs for fulfilling the requirement are unknown and not included within the current management plan

Establishing a forest cover can be expected to follow costs and procedures provided for Goal 3, Secondary Objective 3.

GOAL 5

Manage high elevation, wetland, streamside and hardwood forests as a component of the mountain longleaf pine ecosystem.

The Refuge is comprised of a mosaic of natural communities with longleaf pine representing only one cover type. Other communities include uplands hardwoods, lowland hardwoods, Virginia pine forest and wetland seepages. While longleaf pine is clearly a fire dependent forest type, other refuge communities are usually associated with the Appalachians to the north and not commonly viewed as fire adapted. While this may or may not be true to the north, it is recognized that fire has always been associated with natural communities on Choccolocco Mountain, and all existing communities have persisted and evolved in a fire environment. Research in the Southeast strongly suggests that at least upland hardwoods and seepages may depend on fire to maintain structure and species composition (Sections 3.1.2 and 3.1.5). In most situations, fuel loads within these communities are minimal or soil is damp, inhibiting fire or minimizing intensity. Where longleaf pine stands with pyrogenic fuel loads may burn intensely, other community types are less affected.

Primary Objective 1 – After prescribed burns are completed, monitor condition and changes in all forest types using at least four photo monitoring plots per burn unit at a minimum of annual visits.

Supporting Rationale

While adverse effects to forest communities on the Refuge from prescribed fire are not suspected, care will be taken to assess this situation through continuing research and observations. Both, positive and negative effects of fire will be monitored, and should protection measures be considered necessary for prescribed burning, annual burn plans will be modified to include mitigation or avoidance measures.

The effects of fire on community types, other than longleaf pine, will be monitored through photo plots and observations. Many of these communities exist within burn units and require ongoing monitoring to assess long-term management implications. Photo plots will be established as each individual prescribed burn is scheduled. After completion of vegetation cover mapping in Goal 1, plots can be more systematically located to assess all cover types of concern or interest within each burn unit.

GOAL 6

Manage the Refuge as an ecological unit within a larger forested landscape connected to the Southern Appalachian Mountains.

The significance of Choccolocco Mountain and forested connections east into the Talladega National Forest, and beyond into the Appalachian proper, is discussed in Section 2.5.2. The Refuge and Choccolocco Mountain exist as a forested outlier in a landscape extending well into the Appalachian Province. A single forested corridor, owned by the Alabama Forestry Commission, connects Choccoloccoo Mountain and the Refuge to the National Forest.

This forested connection greatly enhances refuge biological diversity and the movement and dispersion of species onto and off the Refuge (Section 2.5.3). The proximity of the endangered red-cockaded woodpecker adjacent to the corridor in the National Forest may provide future opportunities for reintroducing the woodpecker onto the Refuge as part of a larger recovery population. As the only forested link east into the Talladega Mountains, this corridor would provide critical habitat for connecting the Refuge to these populations.

Primary Objective 1 – Within two years, establish cooperative agreements with U.S. Forest Service and Alabama Forestry Commission with at least annual meetings involving regional policy and continuing research on biological connectivity, and the presence and dispersal of species to and from agency land along the Choccolocco Corridor.

Supporting Rationale

Establish a working group with participants to include Alabama Forestry Commission, U.S Forest Service, U.S. Fish and Wildlife Service and other academic and public participants interested in identifying biological values of this connection, educating the public, and formulating policy and options for ensuring the future of this connection.

GOAL 7

Minimize fragmentation and opening of refuge forest landscape and, where possible, restore forest connections to provide forest interior habitat for neotropical migratory birds and wildlife.

Forested edge, openings and disturbances to forest cover and soils are responsible for modifying habitat conditions favorable to species associated with early successional or disturbed habitats. As the regional landscape becomes more fragmented and disturbed, habitat conditions provided by forest interior become rarer. Many of the plants and animals dependent on forest interior also decline. A review of forest fragmentation as it relates to the Refuge is provided in Section 2.5.4 and 3.2.2.

Objectives are intended to maximize forest interior and minimize openings, firebreaks and other disturbances within intact forest. Generally, when an activity requires opening or clearing forest cover, an attempt will be made to place this disturbance in peripheral areas that minimize intrusion. An opening or disturbance to forest cover will be defined as an activity that opens the forest canopy creating an ecotonal edge habitat. Firebreaks that are narrow and maintain a closed canopy cover are not necessarily fragmentary.

Primary Objective 1 – Within two years, review forest openings for fragmentation, and abandon or restore, where possible, at least 20 acres annually of small openings that can be returned to a continuous forest cover.

Supporting Rationale

A variety of past land uses are responsible for opening the forest canopy, but primarily include training areas and wildlife foodplots. Nonessential openings will be restored according to their size and requirements. Small openings will be allowed to revert to forest through natural succession. Larger openings will be considered for restoration though seedling replanting. Seedling type will be selected according to habitat suitability.

Small forest openings, to include wildlife food-plots, are known to adversely impact neotropical migratory nesting birds in landscapes similar to that found in Calhoun County (Buehler and Miles 2004). A discussion of these adverse effects is provided in Section 2.5.4. The elimination of small forest openings is considered necessary to support nesting forest interior birds on the Refuge, and remain consistent with the Biological Integrity Policy for the National Wildlife Refuge System.

Forest openings will be recorded on maps and reviewed according to appropriate restoration needs. Some areas may be designated for restoration by seeding from adjacent communities and allowed to proceed through natural succession. Other larger areas may possibly require seedling planting. This may be accomplished through planting by Service personnel, volunteers or outside contracts. Approximately 20 acres

($250/acre) have been scheduled annually. Detailed procedures for contract replanting are provided under Goal 3 – Secondary Objective 3.

Primary Objective 2 – Within one year, initiate biotic inventories with a minimum of annual point counts for nesting birds in longleaf pine and transitional communities.

Supporting Rationale

Biotic inventories will primarily be accomplished through qualitative observations of flora and fauna on the Refuge. Point counts for nesting birds however will provide a measurable approach to evaluating the forest community's ability to support forest interior birds in hardwood communities, and grassland species in longleaf pine forests. Those areas supporting sensitive species may be used as models in managing or restoring other forests on the Refuge.

Point counts will be established in selected stands to measure changes in bird populations over the course of longleaf pine restoration. Support will be solicited from local universities, and standard point counts will be established before, during and after prescribed burning efforts to measure long-term effects of restoration and burning.

GOAL 8

Manage and protect sensitive headwater seep wetlands and bogs as part of the mountain longleaf pine landscape.

Spring seepages can be found along the base and slopes of Choccolocco Mountain, and constitute an ecologically significant and extremely sensitive community type (Walker 1993). Over half of all rare plant species recorded on the Refuge were found in seepage wetlands. In addition, the larger seepages meet the criteria of sphagnum and shrub bogs as described in the Southern Appalachian Assessment (SAMAB 1996). A review of spring seepages and their significance and biology is provided in Section 3.1.5.

Some of the larger spring seepages on the Refuge are classified as "Significant Biological Areas (SBA)" and are also discussed and managed through Goal 9 – Inventory, protect and manage rare, endangered, threatened, and sensitive species and natural areas.

Primary Objective 1 – Within one year, establish protection measures that ensure seepages and bogs are not adversely affected through management activities or public visitation, and inspect the four major Refuge seepages at least yearly verifying condition and recommending changes necessary to maintain biological integrity .

Supporting Rationale

Larger bogs and seepages will be signed to identify sensitive wetland habitat for both land managers and public visitors. These wetlands are particularly sensitive to visitation and can be degraded through uncontrolled public access. Because of proximity to paved roads and the presence of sensitive Candidate orchids, visitation to the Marcheta Mountain Seep will be prearranged with and accompanied by Service personnel. If visitation becomes active in other wetland areas and sites are in danger of degradation, further access restrictions will be put in place.

Seepage wetlands will be routinely visited with an annual report specifying conditions and recommendations to eliminate adverse impacts from public visitation or management activities. Where activities such as firebreak maintenance and visitation indicate potential degradation, remedial efforts will be proposed.

Primary Objective 2 – Within two years, initiate evaluations on the importance of fire for maintaining larger bogs and spring seepages by encouraging research and conducting annual photo documentation within the four major seepages.

Supporting Rationale

Because fire is often considered critical to the long-term integrity of seepage bogs (Outcalt 2000), research and guidance will be solicited from academic institutions and scientist to determine the need to reintroduce fire. The presence of the Candidate, white

fringeless orchid, necessitates careful coordination with researchers and Ecological Services.

Research will be solicited from academic institutions on the importance of fire along with possible negative effects on seepage wetlands. Research findings will be incorporated into refuge burning program and monitoring requirements. Annual photo documentation will be accomplished at permanent stations within the four major seepages. Over time, this chronology of photos will provide an understanding of plant succession with and without fire.

Secondary Objective 1 – After evaluation by researchers, managers will decide if fire is critical to the biological integrity of seepages and may, if warranted, reintroduce fire back into the systems monitoring the effects through photo documentation.

Supporting Rationale

Should fire be determined critical for maintaining selected bogs, a program will be introduced to selectively burn seepages. Because seepages are wet most of the year, prescribed burning would be limited to low-water drought periods during late summer. This would require the seepage to be located within a unit that had recently been prescribed burn to ensure fire control.

Specific prescribed burns would be scheduled for late summer drought conditions within a burn unit that had been prescribed burned that year. This technique is expected to be of interest primarily in the Marcheta Mountain and Cave Creek Seeps.

GOAL 9

Inventory, protect and manage rare, endangered, threatened, and sensitive species and natural communities as part of the mountain longleaf pine ecosystem.

The only federally listed species with documented habitat availability on the Refuge is the Candidate, white fringeless orchid (Section 3.3.1). Additional species recorded on the Refuge are recognized as rare and uncommon and are discussed in Section 3.3.2.

Protection and management of sensitive or uncommon species is accomplished through the designation of "Significant Biological Areas (SBA)" (Figure 9). Where species or groups of species are associated or dependent on localized or specialized community types, these areas have been termed SBA. A discussion of SBAs along with management constraints and existing threats can be found in Section 3.3.3. As new community types are identified that contain sensitive or rare biota, additional SBAs will be delineated and management scenarios will be added to the section.

Primary Objective 1 - Within two years, encourage inventories of rare, endangered, threatened, and sensitive species and communities within the Refuge, and prepare an annual report on the status of populations, management requirements and new species discovered during the year.

Supporting Rationale

Research and inventories will be encouraged with academic institutions, researchers, organizations, agencies and volunteers. Research results will be incorporated into Refuge inventory lists and records, and used to characterize and manage Refuge lands. Any new findings will be provided in an annual report.

Primary Objective 2 – When significant ecological communities are discovered on the Refuge that merit designation as a SBA, additions will be added to Section 3.3.3 of the HMP and all areas will be monitored through a minimum of annual inspection and photo documentation.

Supporting Rationale

Five SBAs are currently identified and mapped on the Refuge (Figure 9). As additional communities deserving designation and specific management consideration are identified, they will be added to Section 3.3.3. Individual management plans will be developed as exist for currently designated SBAs.

Sensitive and unique biological areas designated as SBAs will be monitored to determine the effects of prescribed burning, longleaf pine restoration, visitation and other management activities. Photo documentation will provide the basis for monitoring and reviewing changes and alterations to SBAs. Mitigative measures will be implemented should adverse impacts be discovered.

Primary Objective 3 – Within two years, initiate monitoring of existing white fringeless orchid populations for size, effects of plant succession, impacts of fire and resulting changes from cessation of military activities, and prepare an annual report on status and condition of populations.

Supporting Rationale

Two separate populations of the Candidate, white fringeless orchid are documented on the Refuge. A review of this species was provided in Section 3.3.1. Visits to support the Site Conservation Plan for this orchid identified the need to continue monitoring the condition of these two populations (White 1998).

Routine visits will be made to identify impacts to existing populations in the two seeps. Further research will be encouraged with academic institutions to formulate specific management requirements.

GOAL 10

Inventory and control exotic and invasive species, and maintain the integrity of the native mountain longleaf pine ecosystem.

The Refuge contains large tracts of relatively undisturbed forest where well established native plant communities minimize conditions conducive to the spread of exotic and invasive plants. These same areas however are extremely sensitive to physical alteration which can affectively modify the environment and the create conditions favorable to exotics (Section 3.1). The primary contributor to degradation appears to involve soil disturbance, with fire exclusion compounding the problem or slightly modifying eventual species composition. The issue seems to apply to all elevations and soil conditions, and is not restricted to any one habitat type. On lower elevations, exotics are particularly pervasive around former firing ranges, training areas and along Bains Gap Road. Higher elevations along Ridge Road provide similar areas of disturbance where exotics also find pathways for spread. The large leased transmission tower on Moorman Mountain provides an example of physical alteration of a rather pristine undisturbed mountain ridge environment. This area currently supports a vast array of exotic species in close association with rare and sensitive native habitats directly adjacent on undisturbed areas.

A similar invasive plant problem arises due to fire exclusion, and can be further compounded through soil disturbance. Loblolly pine (lower elevations) and Virginia pine (higher elevations) are invasive trees that displace native species eventually forming monocultures of reduced ecological value. While fire can control these invasive species in the seedling or young sapling stage, older trees become tolerant of fire. Strategies for addressing this issue are described under Goals 2 and 3.

A third issue involving exotic plants exists on borrow pits reclaimed by the Army. Former borrow areas underwent reclamation where large areas were regraded and exotic weeping lovegrass was established as a ground cover (Figure 5). A more detailed discussion of borrow areas and range areas can be found in previous sections (Sections 2.4.3 and 3.1.6).

While exotics and invasive plants represent a number of differing situations on the Refuge, they consistently include soil disturbance and, in some situations, fire exclusion as a cause for their establishment. It therefore becomes critical to consider the eventual impact of soil disturbance on all proposed management and refuge activities. Once the physical soil environment is altered, it becomes extremely difficult to reestablish native plant communities. Many of these same native plant communities are also needed for maintaining a contiguous flammable fuel load for the prescribed burning program.

Primary Objective 1 – Within two years, initiate control measures to eliminate the single infestation of Kudzu on Range 21, and provide operating procedures to ensure kudzu is not spread onto the Refuge through roadside mowing.

Supporting Rationale

Kudzu currently constitutes a minor problem on the Refuge, but can be found extensively along public roads to the west and east. The single refuge infestation on Range 21 will be treated with herbicides, and monitoring will continue to ensure that this and other infestations do not spread onto the Refuge.

Roadside mowing also constitutes a potential mechanism for spreading kudzu onto the Refuge. Extensive infestations exist along Bains Gap Road west and east of the refuge boundary, and could easily be spread through mowing. Mowing of Bains Gap Road will utilize Service equipment and avoid all off-refuge areas that are infested with kudzu. County roadside mowing will not take place within refuge boundaries.

The single kudzu infestation on Range 21 will be treated with herbicides. The initiation of this effort depends on approval from the Army concerning environmental remediation studies on the ranges. Ranges are currently being studied for chemical contamination from past military training. The application of herbicides within these areas has been identified by the Army as possibly affecting the integrity of sampling results. Additional monitoring along roads and former ranges will identify any new infestations.

Primary Objective 2 – Within three years, initiate reclamation of twenty foot test strip of weeping lovegrass on borrow pit area.

Supporting Rationale

Weeping lovegrass was planted by the Army on several borrow areas. These disturbed lands existed without plant cover and were severely eroding and depositing sediments in down slope wetland and aquatic systems. While this exotic reclamation grass does not appear to be spreading into surrounding natural communities, the potential exists for it to displace native plants. It typically forms a monoculture cover within seeded areas, and could have significant adverse effects to the diverse native ground cover in adjacent longleaf pine forests.

While eventual remediation requirements on borrow areas has not been formulated, these areas will be considered for a sequential and incremental reclamation program along with supplemental and new longleaf planting efforts on the Refuge. Because the monoculture of lovegrass is the only mechanism holding soils in place on these steep slopes, care must be taken in restoring these lands. A 20 foot strip bordering natural communities will be treated with herbicide and replanted with longleaf pine seedlings. The replanted strip will be monitored to determine if native herbaceous plants colonize the denuded ground layer and erosion remains minimal. If this approach is found successful, future treatments will incrementally reclaim further sections of these lands

Primary Objective 3 – Within two years, provide spot treatments and control measures for exotic plant species along Bains Gap Road that have the potential to spread and

displace native species, and schedule on an annual basis inspection and retreatment of reinfested areas along the road.

Supporting Rationale

Bains Gap Road constitutes a long used access route across former Fort McClellan. The disturbed margins of this roadway contain a wide range of exotic plant species. Some of the species of greatest concern along Bains Gap Road are exotic roses, Chinese privet, Chinese wisteria and, potentially, kudzu. Control measures to minimize the spread of exotic plants along Bains Gap Road include roadside mowing and minimizing the cut-back of forest cover along the road. Roadside margins open to sunlight form the environment most suitable for the spread of exotics. Maintaining a narrow cleared roadside will minimize habitat availability for most exotics. Individual infestations will be treated with herbicides for control.

Management policy will minimize the tree-line cut-back along Bains Gap Road. Exotics will be spot-treated with herbicide to eliminate existing infestations. The status of exotic plant species along Bains Gap Road will be inspected and retreated, if necessary, on an annual basis.

Primary Objective 4 – Within two years, provide monitoring and spot treatment of exotics plant species on at least 5 acres annually within former army firing ranges and training areas.

Supporting Rationale

Former army firing ranges and training areas constitute lands where long-term soil disturbances were concentrated. Exotic plants tend to be locally common in these areas. Monitoring of exotic species will continue and plants considered potential threats to surrounding native communities will be spot treated with herbicides. Most, if not all, of these areas will be included within burn units identified in the Refuge Fire Management Plan. Monitoring after fires will consider the negative or positive effects of fire on exotic species. If fire seems to enhance the spread or vitality of exotics, modifications to the fire plan or specific spot treatments will be considered.

Exotics will be spot-treated with herbicides to eliminate existing infestations**.** The status of exotic plants on former army training areas and firing ranges will be inspected and retreated, if necessary, on an annual basis. Because contaminant remediation studies have not been completed on the ranges, approval from the Army is required prior to chemical treatment of infestations.

Primary Objective 5 – Within two years, identify locations of Japanese stilt grass followed by treatment of at least 10 miles of infested firebreaks annually.

Supporting Rationale

Japanese stilt grass (*Microstegium vimineum*) is an exotic annual that has invaded disturbed wet sites and firebreaks throughout the Refuge. The primary method to prevent the spread of this highly invasive grass is through avoidance of soil disturbance or creation of new roadways or firebreaks. Firebreaks often function as a pathway, with the seeds spreading through mowing, foot traffic or by vehicle tires. Control, once the grass has become established, will be accomplished through herbicide treatment.

Secondary Objective 1 – Establish control measures to eliminate weeping lovegrass on 50 acres should research indicate the exotic poses a threat to surrounding natural communities, and reestablish longleaf pine seedlings (600 seedlings/acre) on area.

Supporting Rationale

Should research or guidance reveal that weeping lovegrass is spreading into adjacent natural communities or represents a potential threat to these communities, a restoration plan will be developed (Primary Objective 2). This plan will attempt to eliminate weeping lovegrass, and replant former borrow areas with native species that can be maintained through fire.

Approximately 50 acres of land is suitable for replanting with longleaf pine seedlings. Requirements involve collecting seed, germinating seedlings at a nearby nursery ($250/1000) and contracting the hand planting of seedlings ($100/acre). Should research indicate a need to remove weeping lovegrass prior to seedling establishment, additional requirements will be included in strategy and costs.

GOAL 11

Maintain and restore native wildlife populations associated with longleaf pine and other refuge natural communities.

Longleaf pine ecosystem restoration will occur in existing longleaf stands and restorable forests that contain a significant component of longleaf pine. Prescribed burning and understory reduction is expected to increase herbaceous cover and low growing shrubs. In most situations, a more open forest and a low shrub and herbaceous cover will increase available forage for species such as turkey and deer. Generally, the nutrient quality can be expected to also improve with prescribed burning. Turkeys, in particular, may benefit from increased herbaceous cover. Detailed discussions on the benefits of longleaf pine restoration on native wildlife is provided in Section 3.2.

Because mountain longleaf pine occurs as part of the overall forest mosaic, forest cover diversity will remain. Hardwoods have and will always occur around seepages, stream bottoms, northerly slopes and ravines. These areas will support and enhance the overall habitat quality of the entire mountain longleaf pine ecosystem. The fire maintained longleaf pine forest will provide suitable habitat for species such as the eastern fox squirrel and Bachman's sparrow, which have dramatically declined in numbers from regional habitat loss.

The increase in herbaceous ground cover is also expected to enhance habitat quality for bobwhite, a game species that has all but disappeared from many regions of the Southeast. With an increase in reforestation and the decrease of farms and fire in the Southeast, bobwhite numbers have dramatically decreased in recent years. The implementation of a prescribed burning program and more open forests should provide habitat conditions more favorable for quail.

Primary Objective 1 – Within one year, establish and continue a hunting program on the Refuge that provides recreational opportunities and maintains game species at sustainable population levels.

Supporting Rationale

Under army ownership of refuge lands, an active hunting program has been in place since early in the century. Game management activities have existed since at least 1950. An overview of army game management and hunting programs on what is now the refuge is provided in Section 2.4.3. The army hunting program was discontinued with closure of the fort in 1998.

The Service has completed a hunting plan (USFWS 2004) for the Refuge and has opened portions of the Refuge for hunting in cooperation with the Alabama Department of Conservation and Natural Resources. Safety issues related to UXO however have delayed opening the entire Refuge to hunting.

Maintaining game populations through an active hunting program not only provides recreational opportunities, but also is important in maintaining a stable ecosystem. Deer in particular have few natural population controls and can impact community structure through over-browsing. In many situations, over-browsing will selectively impact the most palatable plants to the greatest extent. Resulting community structure can then become skewed to favor plants less preferred as browse. While the overall significance of over-browsing on longleaf pine community structure is unclear, the maintenance of a stable game population is considered desirable in establishing and restoring existing forest systems on the Refuge.

Primary Objective 2 – Within two years, contact and encourage cooperative programs with academic institutions and nongovernmental organizations to educate, monitor, and establish habitat improvement projects for native wildlife within high quality longleaf pine forests on the Refuge.

Supporting Rationale

Prescribed burning within longleaf pine stands is expected to slowly modify forest understory structure favoring herbaceous plant species. Interested groups, agencies and organizations will be invited to partner in showcasing areas for wildlife species. Over time, these areas will be considered demonstration projects and used for future research and education purposes.

Cooperative efforts with academic institutions and conservation groups will be solicited to establish longleaf pine restoration education programs and demonstration projects for wildlife species.

Because most high quality longleaf pine forests on the Refuge are located within areas potentially contaminated with UXO and currently closed to the public, the implementation of this objective will depend on the status of the Army remediation program. Approval from the Army to open areas for surface uses will determine the Service's ability to initiate and establish cooperative demonstration projects.

GOAL 12

Maintain an adequate firebreak system that fulfills management and public use needs, while minimizing adverse ecological effects on the natural landscape

Firebreaks create ecotonal edge, soil disturbances and pathways for invasive plants and animals. On mountain slopes and ridges, firebreaks with exposed soils are highly susceptible to erosion, resulting in sedimentation onto lower slopes and wetlands.

Firebreaks were constructed by the Army for fire control and training access. Construction equipment varied and often involved large D9 bulldozers. The resulting firebreak configuration includes varying widths and degree of roadside disturbance. In addition, army constructed firebreaks often follow a direct line and not the terrain, creating significant erosion and sedimentation problems.

Primary Objective 1 – Within two years, review existing Refuge firebreaks for fragmentation, erosion, sedimentation and need, and restore nonessential firebreaks, where possible, to a continuous forest cover, and implement erosion protective measures annually on at least five miles of essential firebreaks to meet Alabama Best Management Practices.

Supporting Rationale

Firebreaks width, where possible, will be reduced to a single blade width. Unmaintained margins will be allowed to reseed from adjacent forest cover. Firebreaks considered nonessential to fire management or poorly engineered will be recorded on maps, gated, posted as closed and allowed to revert to a forest cover. Many of these firebreaks are not essential to prescribed burning and represent a significant erosion and sedimentation problem. They fail to meet Alabama's Best Management Practices for forest roads, and therefore fail to comply with the Clean Water Act in regards to nonpoint source pollutants (AFC 1993).

Operating procedures for maintaining essential firebreaks will establish policy for equipment operators to minimize firebreak width. Firebreaks will continually be reviewed to determine need and possibility for closure. Currently, 56 miles of firebreaks exist on the Refuge. Essential firebreaks will be maintained to minimize erosion and sedimentation, and meet Alabama Best Management Practices for forest roads (AFC 1993). Those essential firebreaks that create erosion potential will be remediated, closed and gated to the public, and available only for fire and management activities. Costs associated with achieving this objective primarily involve annual maintenance of firebreaks and construction of gates.

6.0 Management Strategy Resources and Constraints

6.1 Necessary Resources

Fiscal resources necessary to successfully meet management goals and accomplish management objectives are provided on Table 13. The ratio of contract versus Service accomplished tasks is provided separately on the table. Where possible, estimates for outside contracts are based on local costs, which are provided in Section 5.0.

6.2 Management Constraints

Proposed strategy and costs must be formulated and selected according to future effects of prescribed burning, and then applied through adaptive management to meet ever changing conditions in refuge forests. The ability of fire to restore longleaf pine forests is dependent on a wide range of variables that include fire intensity, fire frequency, environmental conditions as well as the physical parameters of refuge lands. The benefits of fire will differ according to location and stand, and will, no doubt, require prescription modifications as restoration progresses. A flexible adaptive management approach will be critical to the long-term success of longleaf pine restoration

In addition, the presence of UXO on the Refuge will require managers to modify and change preferred strategy to safely accomplish objectives within the restrictions of both interim and final land use controls. A description of UXO constraints was provided in Section 2.4.3. Refuge lands are currently classified according to three levels of access restrictions (Figure 6):

UXO Contaminated – Closed to public and open to surface use by Service Personnel
UXO Clean – Closed to public, but open to unrestricted management when supervised by Service personnel
UXO Clean – Open to unrestricted management

A third constraint of Refuge management involves the cost and ability of managers to apply prescribed fire as a longleaf pine restorations technique. Fire is a fundamental requirement of any longleaf pine restoration program, and critical to successfully restoring refuge lands. The lack of a fire management staff on the Refuge or at nearby refuges constitutes a significant constraint in meeting fire management goals. Both scheduling problems and increased costs will create difficulties in accomplishing management objectives.

6.3 Regulatory Compliance

All management activities will be accomplished according to regulatory requirements and guidelines. The draft HMP will be reviewed according to regulatory requirements of the National Environmental Policy Act (NEPA), and comments and concerns will be considered in revising the final document. As part of the NEPA review process, the draft plan will be provided to Ecological Services for review under Section 7 of the Endangered Species Act. Any changes or specific details provided in future AHMPs will be separately coordinated according to Section 7 requirements.

Phase 1 cultural resource surveys were accomplished by the Army as part of the base closure process. These surveys and findings were coordinated with the Alabama Historic Preservation Officer (SHPO). A map of cultural resource sites is maintained at the Refuge, and is reviewed for existing and new projects. Any actions suspected of impacting a cultural resource site, as well as, new sites discovered during management will be forwarded to the Regional Historic Preservation Officer/Regional Archaeologist (RHPO/RA) for review. The RHPO/RA will determine what steps, if any are necessary, to ensure compliance with Section 106 of the National Historic Preservation Act. The RHPO/RA will initiate consultation with the SHPO and the pertinent federally recognized tribes pursuant to Section 106.

Service Compatibility Determinations are only required for management activities that generate revenue or are traded for goods or services. The only management activity on the Refuge to potentially generate income is timber sales. This activity represents an option for eliminating off-site tree species prior to longleaf pine restoration. A Compatibility Determination will be prepared prior to any timber sales to ensure the proposal is compatible with the purposes for which the Refuge was established and the mission of the National Wildlife Refuge System.

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TABLES

TABLE 1

Summary of Longleaf Pine Old-growth Stands on Mountain Longleaf National Wildlife Refuge (1)

	Stand No.	Manage Area	Acres	Age	Mean Age	Slope (%)	Aspect	Elevation (ft)	Regeneration
Caffey Mt.	A1	16E	20.0	12-228	65	40-65	S	1350-1500	Low
Red-tail Ridge	A2	15D	9.0	12-238	62	20-45	SW-NW	1000-1250	None
Mt. Tylo	A3	16E&G	31.0	0-201	151	20-50	S-E	1000-1300	Well stocked
Indigo Ridge	A4	15I	4.0	0-196	-	15-45	E-NE	1000-1250	Moderate
Bee Sting Mt.	B1	14C	1.4	131-200	163	15-40	SE	1400-1650	Poor
Lightning Ridge	B2	16G	4.0	0-181	145	15-55	S-SW	1500-1750	Infrequent & Patchy
Boyer Ridge	B4	16G	2.1	0-243	156	20-45	S-SW	1500-1700	Infrequent & Patchy
Zoe's Ridge	B5	16G	2.0	0-238	193	20-40	S-SW	1400-1650	Infrequent & Patchy
Holloway Mt.	B6	15C	6.0	0-200	-	20-45	S-SE	1000-1300	None
TOTAL			79.5			15-65		1000-1750	

(1) Varner et al. 2000

TABLE 2

High Quality Longleaf Pine Forest on Mountain Longleaf National Wildlife Refuge (1)

Stand Name	Stand No.	Manage Area	Age	Mean Age	Slope (%)	Aspect	Elevation (ft)	Regeneration
Ponderosa	C1	16G	0-138	79	15-50	W-S	1200-1400	Good
Maceina Area	C2	16E	0-106		5-25	W-SW	850-1100	Very good
North Slope Reeves Mountain	C3	15I	0-100		15-45	E-N	1000-1200	Poor
CDTF Tract	C4	16C/E	0-106		5-25	W-NW	850-1100	Very good
Caffey Mt South	C6	16E	0-111	78	10-55	SE-S	1000-1500	Good
Red-tail Ridge Northwest	C9	15D	0-110	50-70	5-30	SW	800-1100	Very good
TOTAL					5-55		800-1500	

(1) Varner et al. 2000

TABLE 3

Plant Occurrence in Old-growth Stands on Mountain Longleaf National Wildlife Refuge (1)

Species	Form	Percent Plot Occurrence		
		Bee Sting Mt fire suppressed	Caffey Mt recurring fire	Red-tail Ridge annual fire
Acer rubrum	W	83	0	0
Agalinus purpurea	F	0	0	6
Andropogon tenarius	G	8	75	100
Angelica venenosa	F	0	0	6
Asarum canadense	F	8	0	0
Asclepias amplexicaulis	F	0	0	6
Asimina parviflora	W	8	20	6
Asplenium platyneuron	F	0	0	12
Aster dumosus	F	0	15	0
Aster patens	F	0	15	81
Aster undulatus	F	0	20	50
Aureolaria pedicularia	F	0	30	0
Carya pallida	W	25	30	44
Chrysopsis graminifolia	F	0	70	50
Circaea lutetiana	F	0	0	6
Clitoria mariana	F	8	30	56
Coreopsis major	F	8	100	31

Species	Form	Percent Plot Occurrence		
		Bee Sting Mt fire suppressed	Caffey Mt recurring fire	Red-tail Ridge annual fire
Desmodium viridiflorum	F	0	0	12
Diospyros virginiana	W	33	45	50
Elephantopus tomentosa	F	0	15	0
Euphorbia corollata	F	16	80	88
Galactia volubilis	F	0	20	38
Galium pilosum	F	0	0	50
Gaura longiflora	F	0	20	6
Helianthus microcephalus	F	0	70	81
Helianthus mollis	F	0	5	6
Hydrangea quercifolia	W	0	0	19
Hypericum gentianoides	F	0	10	6
Hypericum hypercoides	F	0	0	6
Hypericum punctatum	F	0	5	6
Hypoxis hirsuta	F	0	10	12
Iris verna	F	8	0	25
Krigia biflora	F	0	20	6
Kuhnia eupatorioides	F	0	15	12
Lespedeza intermedia	F	0	5	12
Lespedeza procumbens	F	0	10	6
Lespedeza stuvei	F	0	0	6
Lespedeza virginiana	F	0	0	31
Liatris graminifolia	F	0	15	19
Nyssa sylvatica	W	16	0	6
Oxalis dillenii	F	0	15	44

Species	Form	Percent Plot Occurrence		
		Bee Sting Mt fire suppressed	Caffey Mt recurring fire	Red-tail Ridge annual fire
Oxalis violacea	F	0	0	6
Oxydendron arboreum	W	8	0	0
Panicum commutatum	G	8	60	63
Panicum virgatum	G	0	5	25
Panicum spp.	G	0	20	0
Pentstemon pallidus	F	0	0	19
Phlox amoena	F	0	0	25
Pinus echinata	W	8	0	6
Pinus palustris	W	0	5	0
Poa spp.	G	0	0	6
Pteridium aquilinum	F	25	50	44
Quercus marilandica	W	0	35	12
Quercus montana	W	17	0	6
Quercus velutina	W	17	0	0
Rhus copallina	W	0	85	69
Rhus radicans	W	0	5	0
Rhus toxicodendron	W	0	25	0
Rhyncosia tomentosa	F	0	35	44
Salvia urticifolia	F	0	30	25
Sassafras albidum	W	92	95	0
Senna marilandica	F	0	30	42
Seymeria cassioides	F	0	5	0
Silphium terebenthinaceum	F	0	0	31
Sisyrhyncium angustifolium	F	0	5	12

Species	Form	Percent Plot Occurrence		
		Bee Sting Mt fire suppressed	**Caffey Mt recurring fire**	**Red-tail Ridge annual fire**
Smilax glauca	F	0	35	50
Smilax rotundifolia	F	58	0	0
Solidago erecta	F	0	55	6
Solidago odora	F	8	85	44
Specularia perfoliata	F	0	5	6
Stipa avenacia	G	8	5	62
Tephrosia virginiana	F	0	25	44
Tradescantia hirsuticaulis	F	0	0	6
Vaccinium arboreum	W	8	30	44
Vaccinium pallidum	W	50	0	0
Viola palmata	F	0	0	25
Viola pedata	F	0	0	6
TOTAL SPECIES		23	48	62
TOTAL WOODY SPECIES		12	9	10
TOTAL FORB SPECIES		8	34	47
TOTAL GRASS SPECIES		3	5	5
TOTAL ASTER SPECIES		2	13	12
TOTAL LEGUME SPECIES		1	7	10

(1) Modified from Varner (2000)

TABLE 4

Plants Indicators of Pristine Longleaf Pine Forest on Mountain Longleaf National Wildlife Refuge

Scientific Name	Common Name
Hypoxis hirsuta	
Rhus copalina	Winged Sumac
Asclepias amplexicaulis	Curly Milkweed
Aster dumosus	Bushy Aster
Aster lateriflorus	Calico Aster
Aster patens	Late Purple Aster
Aster paternus	Toothed White-topped Aster
Aster surculosus	Aster
Aster undulates	Wavy Leaved Aster
Chrysopsis graminifolia	Grass Leaved Golden Aster
Coreopsis major	Greater Tickseed
Helianthus microcephalus	Small Head Sunflower
Helianthus mollis	Prairie Sunflower
Krigia biflora	Two Flowered Cynthia
Solidago erecta	Erect Goldenrod
Solidago odora	Sweet Goldenrod
Pteridium aquilinum	Bracken Fern
Vaccinium arboretum	Sparkleberry
Clitoria mariana	Butterfly Pea
Galactia volubilis	Downy Milk Pea
Lespedeza intermedia	Slender Lespedezia
Lespedeza procumbens	Trailing Bush Clover
Lespedeza virginica	Slender Bush Clover
Rhynchosia tomentosa	Erect Snoutbean
Senna marilandica	Wild Senna
Tephrosia virginiana	Goat’s Rue
Quercus marilandica	Black Jack Oak
Hypericum gentianoides	Pineweed
Hypericum hypericoides	St. Andrew’s Cross

Scientific Name	Common Name
Hypericum punctatum	St. John's Wort
Sisyrinchium angustifolium	Stout Blue-eyed Grass
Carya pallida	Sand Hickory
Salvia urticifolia	Nettle-leaved Sage
Pinus palustris	Longleaf Pine
Andropogon tenarius	Split-beard Bluestem
Andropogon virginicus	Broom-sedge
Dichanthelium scoparium	Little Bluestem
Panicum aciculare	Panic Grass
Panicum angustifolium	Panic Grass
Panicum boscii	Panic Grass
Panicum commutatum	Panic Grass
Panicum virgatum	Switch Grass
Smilax glauca	White-leaf Catbrier

(1) Varner et al. 2000

TABLE 5

Summary of Longleaf Pine Stand Characteristics on Mountain Longleaf National Wildlife Refuge

Maceina et al. 1997					Varner et al. 2000		
Mgmt Area	**Recovery Potential**	**Slope (%)**	**Roads**	**Wind Direction**	**Stand Category**	**Stand #**	**Stand Description**
14A	Fair-poor	38	Perimeter on E, interior missing	S-SE	Z	1	Contains Scattered individuals & patches of longleaf pine
14B	Fair	35	Perimeter only	S-SE	D	7	Significant component of longleaf pine
14C	Good-poor	26-41	Perimeter on N & NE missing, no interior access	S-SW	B	1	Contains old-growth stand B1
15A	Good	13-29	Perimeter, one interior	W-SW	B	7	Contains old-growth stand B7
15C	Poor	14-22	Perimeter missing	S-SW	B	6	Contains old-growth stand B6

Maceina et al. 1997					Varner et al. 2000		
Mgmt Area	**Recovery Potential**	**Slope (%)**	**Roads**	**Wind Direction**	**Stand Category**	**Stand #**	**Stand Description**
			on W				
15D	Fair-good	13-32	Perimeter on W missing, one interior	W-SW	A C D	2 9 5	Contains frequently burned old-growth, high quality stands, and areas with a significant component of longleaf pine
15F	Good	13-23	Perimeter, some interior	N–W	Z	4	Contains scattered individuals & patches of longleaf pine
15G	Good	16	Perimeter ,one interior	SW	Z	5	Contains scattered individuals & patches of longleaf pine
15H	Good	48	Perimeter, one interior	S-SW	Z	6	Contains scattered individuals & patches of longleaf pine
15J	Fair	27	Perimeter, interior abandoned	W-SW	D Z	6 7	Contains significant component, and scattered individuals and patches of longleaf pine
15I	Good	17	Perimeter, one interior	W-SW	A C	4 3	Contains frequently burned old-growth, and high quality longleaf pine stands
16B	Poor	10-34	Perimeter and interior	W-NW	-	-	-
16C	Good	12-14	Perimeter and interior	-	C	4	Contains high quality longleaf pine stands
16E	Good	18-36	Perimeter and interior	W-SW	A A	1 3	Contains two frequently burned old-growth stands, three high quality stands,

Maceina et al. 1997					Varner et al. 2000		
Mgmt Area	**Recovery Potential**	**Slope (%)**	**Roads**	**Wind Direction**	**Stand Category**	**Stand #**	**Stand Description**
					C C C D	2 4 6 8	and one area with a significant component of longleaf pine
16F	Fair-poor	3-17	Perimeter and interior	NW	Z	8	Contains scattered individuals and patches of longleaf pine
16G	Fair-poor	26	Perimeter only	SW	A B B B C	3 2 4 5 1	Contains one frequently burned old-growth stand, three fire-suppressed old-growth stands, and one high quality longleaf pine stand
16H	Fair-poor	27	Perimeter, two interior	SW	Z	9	Contains scattered individuals and patches of longleaf pine
19C	Fair-poor	21-37	Perimeter N & W missing, some interior	S-SW	Z	17	Contains scattered individuals and patches of longleaf pine
19D	Poor	30	Perimeter on E, S & W missing, three interior	S-SW	Z	18	Contains scattered individuals and patches of longleaf pine
19E	Fair-poor	13	Perimeter on E & S missing, two interior	S	D Z	2 19	Contains significant component, and scattered individuals and patches of longleaf pine
			Perimeter on E &		D	3	Contains significant component, and

Maceina et al. 1997					Varner et al. 2000		
Mgmt Area	**Recovery Potential**	**Slope (%)**	**Roads**	**Wind Direction**	**Stand Category**	**Stand #**	**Stand Description**
20A	Fair-good	24-25	S missing, some interior	S-SE	Z	20	scattered individuals and patches of longleaf pine
20B	Poor	21-49	Perimeter on E missing, one interior	E-SE	D Z	4 21	Contains significant component, and scattered individuals and patches of longleaf pine
20C	Fair	18	Perimeter on NE & SE missing, interior missing	S-SE	Z	22	Contains scattered individuals and patches of longleaf pine

TABLE 6

Potential
Reptiles and Amphibians
on
Mountain Longleaf National Wildlife Refuge (1)

Scientific Name	Common Name	Refuge Record
Frogs and Toads		
Acris crepitans	Northern Cricket Frog	
Acris gryllus	Southern Cricket Frog	
Bufo americanus	American Toad	X
Bufo quercicus	Oak Toad	
Bufo woodhouseii	Fowler's Toad	X
Gastrophryne carolinensis	Narrowmouth Toad	X
Hyla cinerea	Green Treefrog	
Hyla chrysoscelis	Cope's Gray Treefrog	
Hyla gratiosa	Barking Frog	
Hyla squirrela	Squirrel Treefrog	
Scaphiopus holbrookii	Eastern Spadefoot Toad	
Pseudacris brachyphona	Mountain Chorus Frog	X
Pseudacris crucifer	Spring Peeper	
Pseudacris triseriata	Upland Chorus Frog	X
Rana catesbeiana	Bullfrog	X
Rana clamitans	Green Frog	X
Rana palustris	Pickerel Frog	X

Scientific Name	Common Name	Refuge Record
Rana sylvatica	Wood Frog	
Rana utricularia	Southern Leopard Frog	X
Salamanders		
Ambystoma maculatum	Spotted Salamander	
Ambystoma opacum	Marbled Salamander	
Ambystoma texanum	Smallmouth Salamander	
Ambystoma tigrinum	Eastern Tiger Salamander	
Aneides aeneus	Green Salamander	
Desmognathus aeneus	Seepage Salamander	
Desmognathus fuscus	Southern Dusky Salamander	X
Desmognathus monticola	Mountain Dusky Salamander	
Eurycea cirrigera	Southern Two-lined Salamander	
Eurycea longicauda	Long Tail Salamander	X
Eurycea lucifuga	Cave Salamander	
Hemidactylum scutatum	Four-toed Salamander	
Necturus beyeri	Gulf Coast Waterdog	
Notophthalmus viridescens	Red-spotted Newt	X
Gyrinophilus porphryriticus	Spring Salamander	X
Plethodon glutinosus	Slimy Salamander	X
Plethodon serratus	Southern Redback Salamander	X
Plethodon websteri	Webster's Salamander	X
Pseudotriton montanus	Mud Salamander	
Pseudotriton ruber	Southern Red Salamander	X
Lizards		
Anolis carolinensis	Green Anole	X

Scientific Name	Common Name	Refuge Record
Cnemidophorus sexlineatus	Six-lined Racerunner	
Eumeces anthracinus	Coal Skink	
Eumeces egregius	Mole Skink	
Eumeces fasciatus	Five-lined Skink	
Eumeces inexpectus	Southeastern Five-lined Skink	
Eumeces laticeps	Broad Headed Skink	
Ophiasaurus attenuatus	Slender Glass Lizard	X
Sceloporus undulatus	Fence Lizard	X
Scincella laterale	Ground Skink	
Snakes		
Agkistrodon contortrix	Copperhead	X
Agkistrodon piscivorus	Cottonmouth	
Carphophis amoenus	Worm Snake	X
Cemophora coccinea	Scarlet Snake	X
Coluber constrictor	Black Racer	
Crotalus horridus	Timber Rattlesnake	X
Diadophis punctatus	Ringneck Snake	X
Elaphe guttata	Cornsnake	X
Elaphe obsoleta	Gray Rat Snake	X
Heterodon platirhinos	Eastern Hognose Snake	X
Heterodon simus	Southern Hognose Snake	
Lampropeltis calligaster	Mole Kingsnake	
Lampropeltis getula	Eastern Kingsnake	X
Masticophis flagellum	Coachwhip	
Micurus fulvius	Coral Snake	

Scientific Name	Common Name	Refuge Record
Nerodia erythrogaster	Yellow Belly Water Snake	
Nerodia rhombifer	Diamondback Water Snake	
Nerodia sipedon	Midland Water Snake	X
Opheodrys aestivus	Rough Green Snake	
Pituophis melanoleucus melanoleucus	Northern Pine Snake	Adjacent
Regina rigida	Glossy Crayfish Snake	
Regina septemvittata	Queen Snake	
Sistrurus milliarius	Pigmy Rattlesnake	
Storeria dekayi	Midland Brown Snake	
Storeria occiptitomaculata	Redbelly Snake	
Tantilla coronata	Southern Crowned Snake	
Thamnophis sauritus	Eastern Ribbon Snake	
Thamnophis sirtalis	Garter Snake	X
Virginia striatula	Rough Earth Snake	
Virginia valarie	Smooth Earth Snake	X
Turtles		
Apalone spinifer	Spiny Softshell Turtle	
Chelydra serpentina	Common Snapping Turtle	
Chrysemys picta	Painted Turtle	
Deirochelys reticularia	Chicken Turtle	
Graptemys geographica	Common Map Turtle	
Kinosternon subrubrum	Eastern Mud Turtle	
Sternotherus minor	Loggerhead Musk Turtle	
Sternotherus odoratus	Stinkpot Turtle	
Terrepene carolina	Eastern Box Turtle	X

Scientific Name	Common Name	Refuge Record
Trachemys scripta	Yellow Bellied Slider	

(1) Adapted from Cline and Adams (1997)

TABLE 7

Reptiles and Amphibians Documented on Mountain Longleaf National Wildlife Refuge (1)

Scientific Name	Common Name	Refuge Location	Habitat	Status (3)
Bufo americanus	American Toad	19D Pond	Upland Pond	
Bufo woodhousii	Fowler's Toad	19D Pond	Ponds with emergent plants	
Gastrophryne carolinesis	E. Narrowmouth Toad	19D Pond	Ephemeral Pools and Ponds	
Pseudacris triseriata	Upland Chorus Frog	19D Pond	Upland Wetlands	
Pseudacris brachyphona	Mountain Chorus Frog	Rocky Hollow Rd (2)	Upland Wetland	
Rana catesbeiana	Southern Bullfrog	19D Pond	Upland Wetlands	
Rana clamitans	Green Frog	19D Pond	Upland Wetlands	
Rana palustris	Pickerel Frog	Bains Gap Rd., 19D Pond	Upland Wetlands	
Rana utricularia	Southern Leopard Frog	Bains Gap Rd, 19D Pond	Upland Wetlands	

Scientific Name	Common Name	Refuge Location	Habitat	Status (3)
Desmognathus fuscus	S. Dusky Salamander	19D Creek	Temporal to Permanent Streams	
Eurycea longicauda	Long Tail Salamander	Bains Gap Road	Upland Wetlands and Seeps	
Gyrinophilus porphryriticus	Spring Salamander	Bains Gap Rd	Permanent Streams	
Notopthalmus viridescens	Red Spotted Newt	19D Pond	Upland Ponds	
Plethodon dorsalis	ZigZag Salamander	Near 19D Pond	Upland Wetlands and Seeps	
Plethodon glutinosus	Slimy Salamander	Forested Upland in 19E	Upland Forest	
Plethodon serratus/websteri	S. Redback Salamander	Forested Upland in 19D	Upland Permanent Stream	G5S3
Pseudotriton ruber	S. Red Salamander	Bains Gap Rd	Upland Permanent Streams	
Anolis carolinensis	Green Anole	19D Pond	Upland Forest	
Sceloporus undulatus	Eastern Fence Lizard	Moorman Mt., 19D Pond	Mesic to Xeric Forest	
Ophisaurus attenuatus	E. Slender Glass Lizard	Bains Gap Rd	Mesic Forest	
Agkistrodon contortrix	Copperhead	Bains Gap Rd	Upland and Lowland forest	
Carphophis amoenus	Worm Snake	19D Pond	Mesic Hardwood Forest	
Cemophora coccinea	Northern Scarlet Snake	Bains Gap Rd	Well Drained Areas	
Crotalus horridus	Timber Rattlesnake	Bains Gap Rd	Upland Forest	

Scientific Name	Common Name	Refuge Location	Habitat	Status (3)
Diadophis punctatus	Southern Ringneck Snake	Compartment E	Upland and Lowland forest	
Elaphe guttata guttata	Corn Snake	Rocky Hallow Rd (2)	Upland Forests and Fields	
Elaphe obselata spiloides	Gray Rat Snake	19D Pond, Rocky Hollow Rd (2)	Upland and Lowland Forest	
Heterodon platirhinos	Eastern Hognose Snake	Rocky Hollow Rd (2)	Upland and Lowland Forest	
Lampropeltis getula	Eastern King Snake	Bains Gap	Upland Mesic Forest	
Nerodia sipedon pleuralis	Midland Water Snake	19D Pond	Permanent Ponds/Lakes	
Thamnophis sirtalis	Eastern Garter Snake	Bains Gap Rd	Upland and Lowland Wetlands	
Virginia valeriae	E. Smooth Earth Snake	19D Pond	Upland and Lowland forest	
Terrepene carolina	Eastern Box Turtle	19D	Upland and Lowland Forest	

(1) Modified from Cline and Adams (1997) to include only those species documented within the Refuge

(2) Rocky Hollow Road records were considered refuge documentation. Rocky Hollow Road parallels the refuge boundary, and habitat between the refuge and road are similar and contiguous.

(3) Alabama Natural Heritage Program (2003)

TABLE 8

Neotropical Migrants Potentially Breeding on Mountain Longleaf National Wildlife Refuge (1)

Common Name	Forest Interior	Forest Interior & Edge	Forest-Edge & Scrub	Field-Edge	Recorded on Fort McClellan	
					Soerhen (1995)	Webb (1996a)
Broad-winged Hawk	Yes	No	No	No		
Yellow-billed Cuckoo	No	Yes	No	No	Yes	Yes
Black-billed Cuckoo	No	Yes	No	No		
Common Nighthawk	No	No	No	Yes		
Whip-poor-will	No	Yes	No	No		
Chuck-will's-widow	No	Yes	No	No		
Ruby-throated Hummingbird	No	Yes	No	No		
Eastern Kingbird	No	No	No	Yes		
Great Crested Flycatcher	No	Yes	No	No	Yes	Yes
Eastern Wood-pewee	No	Yes	No	No	Yes	Yes
Acadian Flycatcher	Yes	No	No	No	Yes	Yes

Common Name	Forest Interior	Forest Interior & Edge	Forest-Edge & Scrub	Field-Edge	Recorded on Fort McClellan	
					Soerhen (1995)	Webb (1996a)
Purple Martin	No	No	No	Yes		
Barn Swallow	No	No	No	Yes		
Northern Rough-winged Swallow	No	No	No	Yes		
Chimney Sift	No	No	No	Yes	Yes	Yes
Blue-gray Gnatcatcher	No	Yes	No	No	Yes	Yes
Wood Thrush	No	Yes	No	No		Yes
Red-eyed Vireo	No	Yes	No	No	Yes	Yes
Yellow-throated Vireo	No	Yes	No	No		
Prothonotary Warbler	No	Yes	No	No		
Northern Parula	No	Yes	No	No		
Yellow-throated Warbler	Yes	No	No	No		
Black-throated Green Warbler	Yes	No	No	No		
Black-and-white Warbler	Yes	No	No	No	Yes	Yes
Cerulean Warbler	Yes	No	No	No		
American Redstart	Yes	No	No	No		
Prairie Warbler	No	No	Yes	No		
Blue-winged Warbler	No	No	Yes	No		

Common Name	Forest Interior	Forest Interior & Edge	Forest-Edge & Scrub	Field-Edge	Recorded on Fort McClellan	
					Soerhen (1995)	Webb (1996a)
Yellow Warbler	No	Yes	No	No		
Swainson's Warbler	Yes	No	No	No		
Worm-eating Warbler	Yes	No	No	No	Yes	Yes
Hooded Warbler	Yes	No	No	No		
Kentucky Warbler	Yes	No	No	No	Yes	Yes
Common Yellowthroat	No	Yes	No	No		
Yellow-breasted Chat	No	No	Yes	No	Yes	Yes
Louisiana Waterthrush	Yes	No	No	No		
Ovenbird	Yes	No	No	No	Yes	Yes
Orchard Oriole	No	No	Yes	No		
Summer Tanager	No	Yes	No	No	Yes	Yes
Scarlet Tanager	Yes	No	No	No	Yes	Yes
Dickcissel	No	No	No	Yes		
Blue Grosbeak	No	No	Yes	No		
Indigo Bunting	No	No	Yes	No	Yes	Yes
Chipping Sparrow	No	No	No	Yes	Yes	Yes

(1) Adapted from Soehren (1994), originally adapted from Hammel (1992)

TABLE 9

Breeding Bird Surveys on or directly adjacent to Mountain Longleaf National Wildlife Refuge Large Forested Tracts (1)

Common Name	Federal	State	Nature Conservancy (2)
Wild Turkey			
Yellow-billed Cuckoo			
Chimney Swift			
Red-bellied Woodpecker			
Downy Woodpecker			
Pileated Woodpecker			
Eastern Wood-pewee			
Great Crested Fly Catcher			
Blue Jay			
Tufted Titmouse			
White-breasted Nuthatch			
Red-eyed Vireo			
Black-and-white Warbler			
Worm-eating Warbler			G5S3B
Ovenbird			
Kentucky Warbler			
Yellow-breasted Chat			
Summer Tanager			

Common Name	Federal	State	Nature Conservancy (2)
Scarlet Tanager			
Northern Cardinal			
Indigo Bunting			

(1) Soerhen (1995) and Webb (1996a)

(2) Nature Conservancy Heritage Ranking: G5-Demonstrably secure globally, S3B-Species uncommon during breeding season in Alabama

TABLE 10

Mammals Suspected or Documented on Mountain Longleaf National Wildlife Refuge

Common Name	Scientific Name	Status			Recorded on Refuge (4)
		Federal (1)	Alabama (2)	NC (3)	
Virginia Opossum	*Didelphis virginiana*				X
Southern Short-tailed Shrew	*Blarina carolinensis*				
Least Shrew	*Cryptotis parva*				
Southeastern Shrew	*Sorex longirostris*				
Eastern Mole	*Scalopus aquaticus*				
Gray Bat	*Myotis grisecens*	LE	SP	G3S2	X (5)
Little Brown Myotis	*Myotis lucifugus*			G5S3	
Northern Long-eared Bat	*Myotis septentrionalis*			G4S2	
Indiana Bat	*Myotis sodalis*	LE	SP	G2S2	
Eastern Red Bat	*Lasiurus borealis*				X (5)

Common Name	Scientific Name	Status			Recorded on Refuge (4)
		Federal (1)	Alabama (2)	NC (3)	
Hoary Bat	*Lasiurus cinereus*				
Seminole Bat	*Lasiurus seminolus*				X (5)
Silver-haired Bat	*Lasionycteris noctivagans*				
Eastern Pipistrelle	*Pipistrellus subflavus*				X (5)
Big Brown Bat	*Eptesicus fuscus*				X (5)
Evening Bat	*Nycticeius humeralis*				X (5)
Rafinesque's Big-eared Bat	*Corynorhinus rafinesquii*		SP	G4S2	
Brazilian Free-tailed Bat	*Tadarida brasiliensis*			G5S3	
Nine-banded Armadillo	*Dayspus novemcinctus*				X
Swamp Rabbit	*Sylvilagus aquaticus*				
Eastern Cottontail	*Sylvilagus floridanus*				X
Appalachian Cottontail	*Sylvilagus obscurus*			G4S1	X
Eastern Chipmunk	*Tamias striatus*				X
Woodchuck	*Marmota monax*				X
Eastern Gray Squirrel	*Sciurus carolinensis*				X
Eastern Fox Squirrel	*Sciurus niger*			G5S4	X
Southern Flying Squirrel	*Glaucomys volans*				X

Common Name	Scientific Name	Status			Recorded on Refuge (4)
		Federal (1)	Alabama (2)	NC (3)	
American Beaver	*Castor canadensis*				X
Marsh Rice Rat	*Oryzomys palustris*				
Eastern Harvest Mouse	*Reithrodontomys humulis*				
Cotton Mouse	*Peromyscus gossypinus*				
White-footed Mouse	*Peromyscus leucopus*				
Oldfield Mouse	*Peromyscus polionotus*				
Golden Mouse	*Ochrotomys nuttalli*				
Hispid Cotton Rat	*Sigmodon hispidus*				
Eastern Wood Rat	*Neotoma floridana*				
Woodland Vole	*Microtus pinetorum*				
Common Muskrat	*Ondatra zibethicus*				X
Meadow Jumping Mouse	*Zapus hudsonius*		SP	G5S3	
Coyote	*Canis latrans*				X
Red Fox	*Vulpes vulpes*				X
Common Gray Fox	*Urocyon cinereoargenteus*				X
American Black Bear	*Ursus americanus*				X
Northern Raccoon	*Procyon lotor*				X

Common Name	Scientific Name	Status			Recorded on Refuge (4)
		Federal (1)	Alabama (2)	NC (3)	
Long-tailed Weasel	*Mustela frenata*			G5S3	
American Mink	*Mustela vison*				
Northern River Otter	*Lontra canadensis*				
Eastern Spotted Skunk	*Spilogale putorius*			G5S3	
Striped Skunk	*Mephitis mephitis*				
Bobcat	*Lynx rufus*				X
White-tailed Deer	*Odocoileus virginianus*				X

(1) LE=Listed Endangered

(2) SP=State Protected (Nongame Species Regulation)

(3) Nature Conservancy Heritage Ranking system - G2=Imperiled globally, G3=Either very rare and local throughout its range or found locally in a restricted range, G4=Apparently secure globally, G5=Demonstrably secure globally, S2=Imperiled in state because of rarity or because of some factors making it very vulnerable to extirpation from Alabama, S3=Rare or uncommon in Alabama, S4=Demonstrably secure in Alabama and essentially ineradicable under present conditions.

(4) Recorded observations include lands adjacent to the Refuge where species and habitat suggests that they may also inhabit or range onto the Refuge

(5) Refuge Observations were taken from mist netting captures on Fort McClellan (3D/International 1996; 3D/International 1997). While no stations were located directly on the Refuge, sites were adjacent on Fort McClellan and along Cane Creek to the west. All captures represented bats that at the minimum possibly forage on the Refuge.

TABLE 11

Rare and Uncommon Biota Documented on Mountain Longleaf National Wildlife Refuge

Common Name	Scientific Name	Status			Refuge Location
		Federal	State	TNC	
Mammals					
Gray Bat	*Myotis grisecens*	E	SP	G3S2	Mist netted and radio-tracked along streams and forests west of Refuge. Radio-detection near the headwaters of South Branch Cane Creek on Refuge.
Appalachian Cottontail	*Sylvilagus obscurus*			G4S1	Tentative documentation of specimen along Ridge Road. Recorded from Talladega Mts to east and suspected to inhabit higher elevations on Refuge.
Eastern Fox Squirrel	*Sciurus niger*			G5S4	Present in mature longleaf and shortleaf pine forests on Refuge
Birds					

Common Name	Scientific Name	Status			Refuge Location
		Federal	State	TNC	
Worm-eating Warbler	*Helmitheros vermivorus*			G5S3	Recorded along breeding bird transects in Management Areas 15 A and 15F.
Reptiles and amphibians					
Southern Redback Salamander	*Plethodon serratus/websteri*			G5S3	Collected in forested upland in Management Area 19D
Insects					
Caddisflies				X	18 rare species collected from the headwaters of Bains Gap Creek and South Branch Cane Creek
Diana	*Speyeria diana*			G3S2	Two females were observed in the Marcheta Mountain Seep in 1993.
Plants					
Sky-blue Aster	*Aster azureus*			G5S1	Collected along the west slopes of Frederick Mountain in Management Areas 16G and 14B.
Ground Juniper	*Juniperus communis*			G5S1	Located on rock ledges along the summit of Moorman Mt., habitat designated as Moorman Mountain Natural Area.
Fraser's Loosestrife	*Lysimachia fraseri*			G2S1	Recorded along the upper reaches of Bains Gap Creek, although not observed in the last few years. Area designated Bains Gap Creek Seep Natural Area.

Common Name	Scientific Name	Status			Refuge Location
		Federal	State	TNC	
White Fringeless Orchid	*Platanthera integrilabia*	C		G2G3S2	Populations in Marcheta Mountain Seep Natural Area and Cave Creek Seep Natural Area. Potential habitat throughout seepages in mountains.
Rose Gentian	*Sabatia capitata*			G2S2	Upland border of Marcheta Mt. Seep directly behind former Range 21. Site included within boundaries of Marcheta Mt. Seep Natural Area.
Flat-topped Hawthorn	*Crataegus triflora*			G2S2	Two populations exist within a hundred yards of refuge boundary and species is highly suspected on Refuge. Grows on exposed limestone outcrops.

(1) E=Federally Listed Endangered

(2) SP=State Protected (Alabama Nongame Species Regulation, Section 220-2-.92 of the Alabama Regulations for 2003-2004 Game, Fish, and Fur Bearing Animals).

(3) Nature Conservancy Heritage Ranking system - G2=Imperiled globally, G3=Either very rare and local throughout its range or found locally in a restricted range, G4=Apparently secure globally, G5=Demonstrably secure globally, S1=Critically imperiled in Alabama because of extreme rarity or because of some factors making it especially vulnerable to extirpation from Alabama, S2=Imperiled in state because of rarity or because of some factors making it very vulnerable to extirpation from Alabama, S3=Rare or uncommon in Alabama, S4=Demonstrably secure in Alabama and essentially ineradicable under present conditions.

TABLE 12

Natural Areas
on
Mountain Longleaf National Wildlife Refuge

Natural Area	Manage. Area	Rare Spp.	Significance
Cave Creek Seep	16C and 16E	White Fringeless Orchid	Headwaters and associated seepages along Cave Creek
Marcheta Mountain Seep	15I	White Fingeless Orchid, Diana, Rose Gentian	Headwaters and associated seepages along North Branch Cane Creek
South Branch Cane Creek Seep	15H and 15G	Gray Bat, Caddisflies	Headwaters and associated seepages along South Branch Cane Creek
Bains Gap Creek Seep	14A and 14B	Fraser's Loosestrife, Caddisflies	Headwaters and associated seepages along Bains Gap Creek
Moorman Mountain Rock Ledges	16G	Ground Juniper	Exposed rock faces extending along Moorman Mountain Summit

Table 13

Management Strategy Costs
on
Mountain Longleaf National Wildlife Refuge

GOAL	OBJECTIVE	COST ($)	PERCENTAGE		FREQUENCY INTERVAL	RONS
			SERVICE	CONTRACT		
G-1	Primary Obj - 1	60,000	10	90	One-time	
G-1	Primary Obj - 2	60,000	10	90	One-time	
G-1	Primary Obj - 3					
	Year 1	81,300	100	0		
	Year 2	81,300	100	0		
	Year 3	81,300	100	0		
G-1	Primary Obj - 4	15,000	100	0	Annual	
G-1	Primary Obj - 5	2,000	100	0	Annual	
G-2	Primary Obj - 1					
	Year 1	28,700	100	0		
	Year 2	34,500	100	0		
	Year 4	63,200	100	0		
	Year 6	63,200	100	0		
G-2	Secondary Obj - 1					
	Year 3-15	100,000	100	0	Annual	
G-2	Secondary Obj - 2	10,000	100	0	Two Year	
G-2	Secondary Obj - 3					
	Year 8-15	100,000	100	0	Annual	
G-3	Secondary Obj - 1	10,000	50	50	Annual	

GOAL	OBJECTIVE	COST ($)	PERCENTAGE		FREQUENCY INTERVAL	RONS
			SERVICE	CONTRACT		
G-3	Secondary Obj - 2	10,000	80	20	Annual	
G-3	Secondary Obj - 3	7,000	25	75	Annual	
G-4	Secondary Obj - 1	1,000	100	0	Annual	
G-5	Primary Obj - 1	1,000	100	0	Annual	
G-6	Primary Obj - 1	1,000	100	0	Annual	
G-6	Primary Obj - 2	8,000	50	50	Annual	
G-6	Primary Obj - 3	2,000	20	80	Annual	
G-7	Primary Obj - 1	3,000	100	0	Annual	
G-7	Primary Obj - 2	4,000	25	75	Annual	
G-7	Secondary Obj - 1	10,000	100	0	Ten Year	
G-8	Primary Obj - 1	3,000	0	100	Annual	
G-8	Primary Obj - 2	3,000	100	0	Annual	
G-8	Primary Obj - 3	3,000	25	75	Annual	
G-9	Primary Obj - 1	3,000	25	75	Annual	
G-9	Primary Obj - 2	20,000	0	100	One-time	
G-9	Primary Obj - 3	2,000	20	80	Annual	
G-9	Primary Obj - 4	2,000	20	80	Annual	
G-9	Secondary Obj - 1	15,000	20	80	One-time	
G-10	Primary Obj - 1	5,000	50	50	Annual	

TABLE 14

Schedule and Accomplishment Targets for Management Objectives

GOAL	OBJECTIVE	ACCOMPLISHMENT TARGET	YEAR														
			01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
1-P1	Vegetation Mapping	Map 9016 Acres															
1-P2	Longleaf Pine Mapping	Map Approximately 4000 Acres															
1-P3	Dormant Season Prescribed Burns	Burn 1500 Acres/Annually															
1-P4	Cooperative Agreement with JPA	Burn 300 Acres/5 Years	?	?	?	?	?										
1-P5	Plant Herbarium	Maintain and update/annually															
2-P1	Growing Season Burn - Unit 3	Burn 1264 acres/2 Years															
2-S1	Growing Season Burns - Refugewide	Burn 2000 Acres/Annually															
2-S2	Burn Units 10 & 11 - Feasibility	Burn 200 Acres/2 Years															
2-S3	Prescribed Burning - Maintenance	Burn 2000 Acres Annually															
3-S1	Longleaf Restoration - Mechanical	Treat 50 Acres/Annually															
3-S2	Longleaf Restoration - Seedlings	Plant 20 Acres Annually															
3-S3	Longleaf Restoration - Removal	Treat 20 Acres/Annually															
4-S1	Restoration of Ranges	Variable Targets			?	?	?	?	?	?	?	?	?	?	?	?	?
5-P1	Fire Monitoring - Forest Condition	Photo Monitoring Plots/Annually															

GOAL	OBJECTIVE	ACCOMPLISHMENT TARGET	YEAR														
			01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
6-P1	Landscape Ecology - Agreements	Meetings/Annually															
7-P1	Forest Fragmentation - Restoration	Restore 20 Acres/annually															
7-P2	Biotic Inventories	Monitoring Report/Annually															
8-P1	Wetland Management	Monitoring Report/Annually															
8-P2	Wetland - Fire Effects	Monitoring Report/Annually															
8-S1	Wetland - Reintroduce Fire	Modify Existing Burn Plan			?												
9-P1	Endangered Species - Monitoring	Monitoring Report/annually															
9-P2	Significant Ecological Communities	Monitoring Report/Annually															
9-P3	White Fringeless Orchid - Monitor	Monitoring Report/Annually															
10-P1	Kudzu Control and Monitoring	Monitoring Report/Annually															
10-P2	Weeping Lovegrass	Research Agreement				?	?	?	?	?	?	?	?	?	?	?	?
10-P3	Exotic Plants - Control	Treat Bains Gap Rd/Annually															
10-P4	Exotic Plants - Ranges	Treat 5 Acres/Annually	?	?	?												
10-P5	Japanese Stilt Grass - Control	Treat 10 Miles/Annually															
10-S1	Weeping Lovegrass - Restoration	Treat 50 Acres & Plant Seedlings	?	?	?												
11-P1	Hunting Program	Cooperative with State/Annually	?														
11-P2	Wildlife Demonstration Projects	Individual Projects	?	?	?												
12-P1	Firebreak Management	Restore 5 miles/Annually															

FIGURES

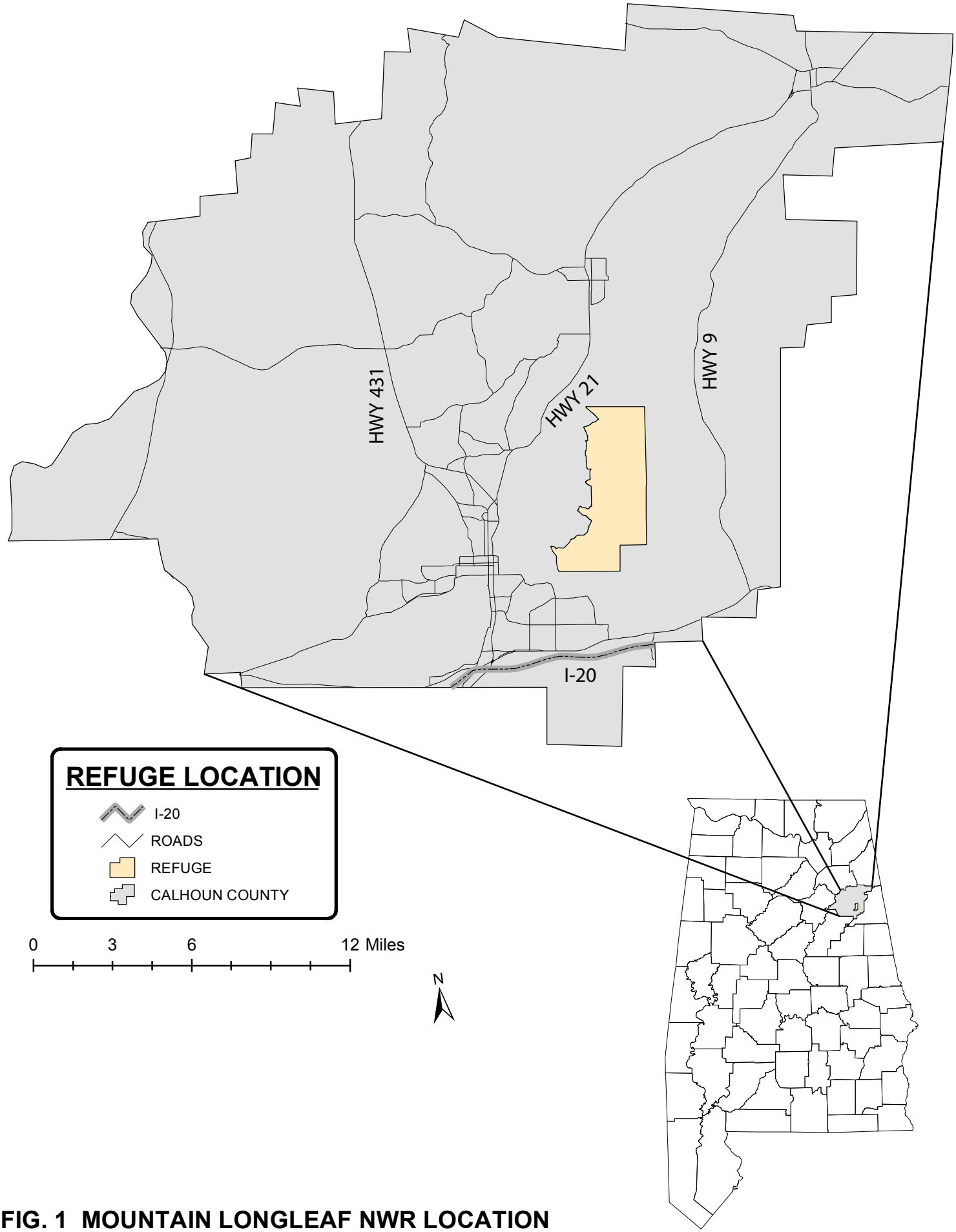


FIG. 1 MOUNTAIN LONGLEAF NWR LOCATION

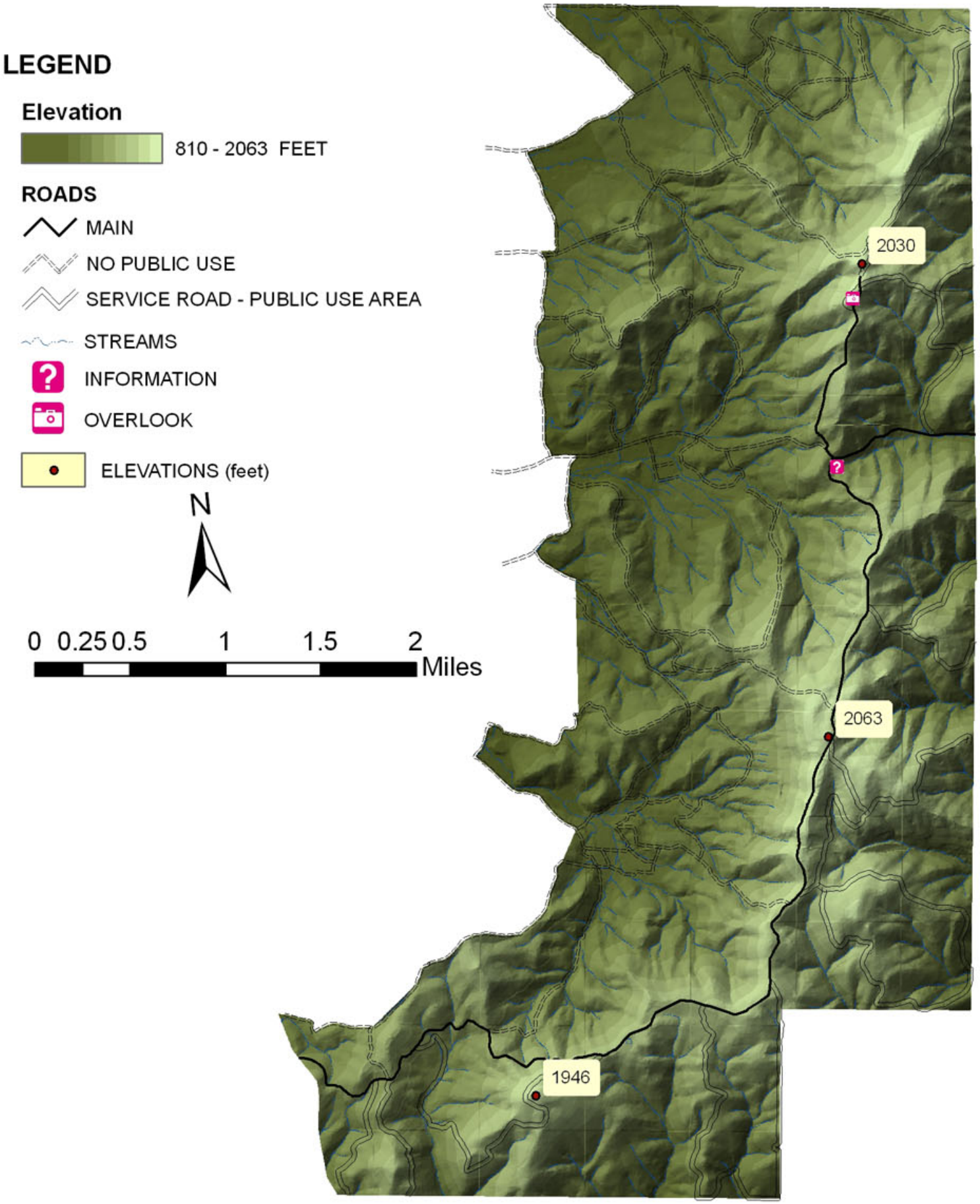


FIG. 2 ELEVATION OF REFUGE

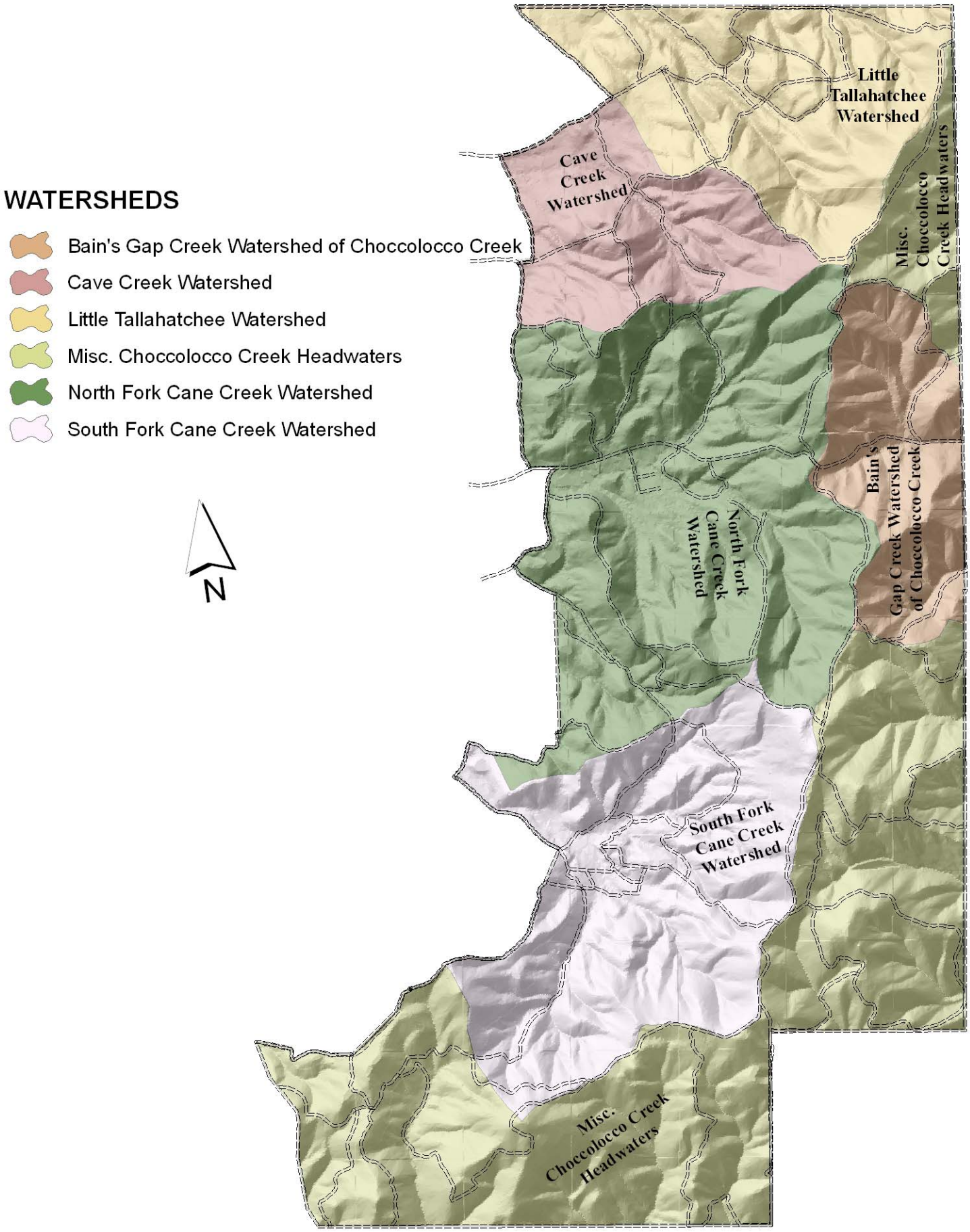


FIG. 3 REFUGE WATERSHEDS

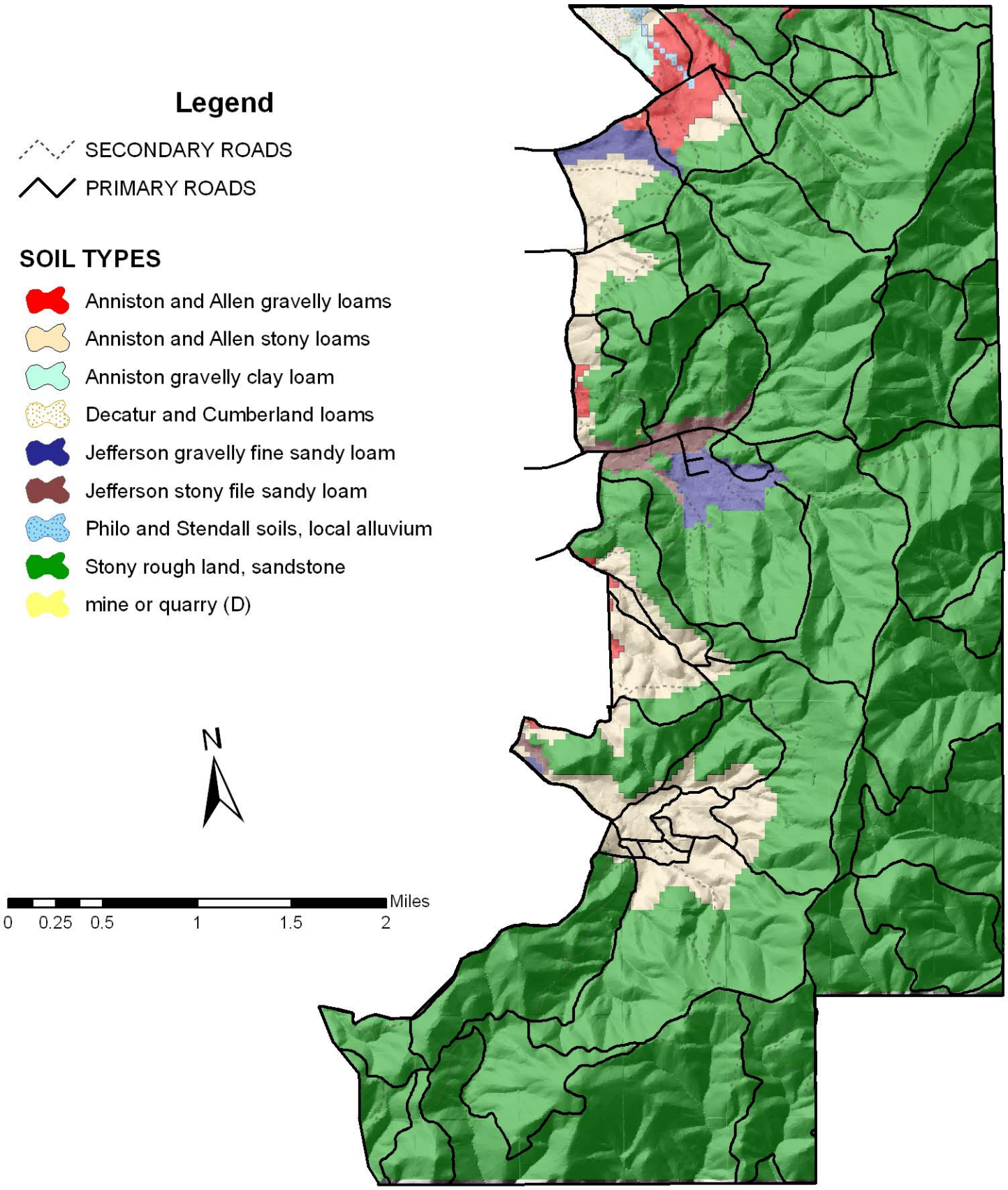


FIG. 4 REFUGE SOILS

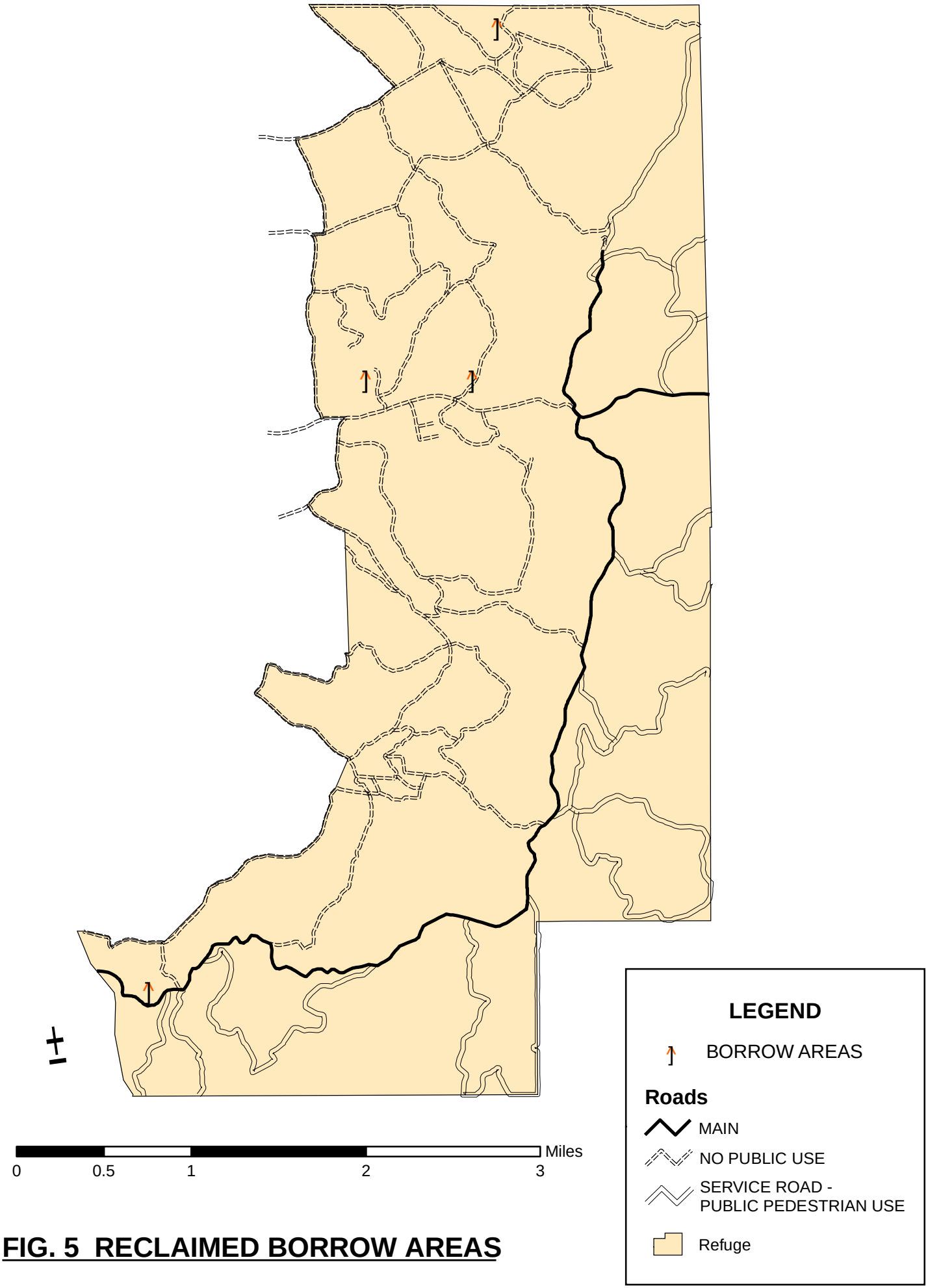


FIG. 5 RECLAIMED BORROW AREAS

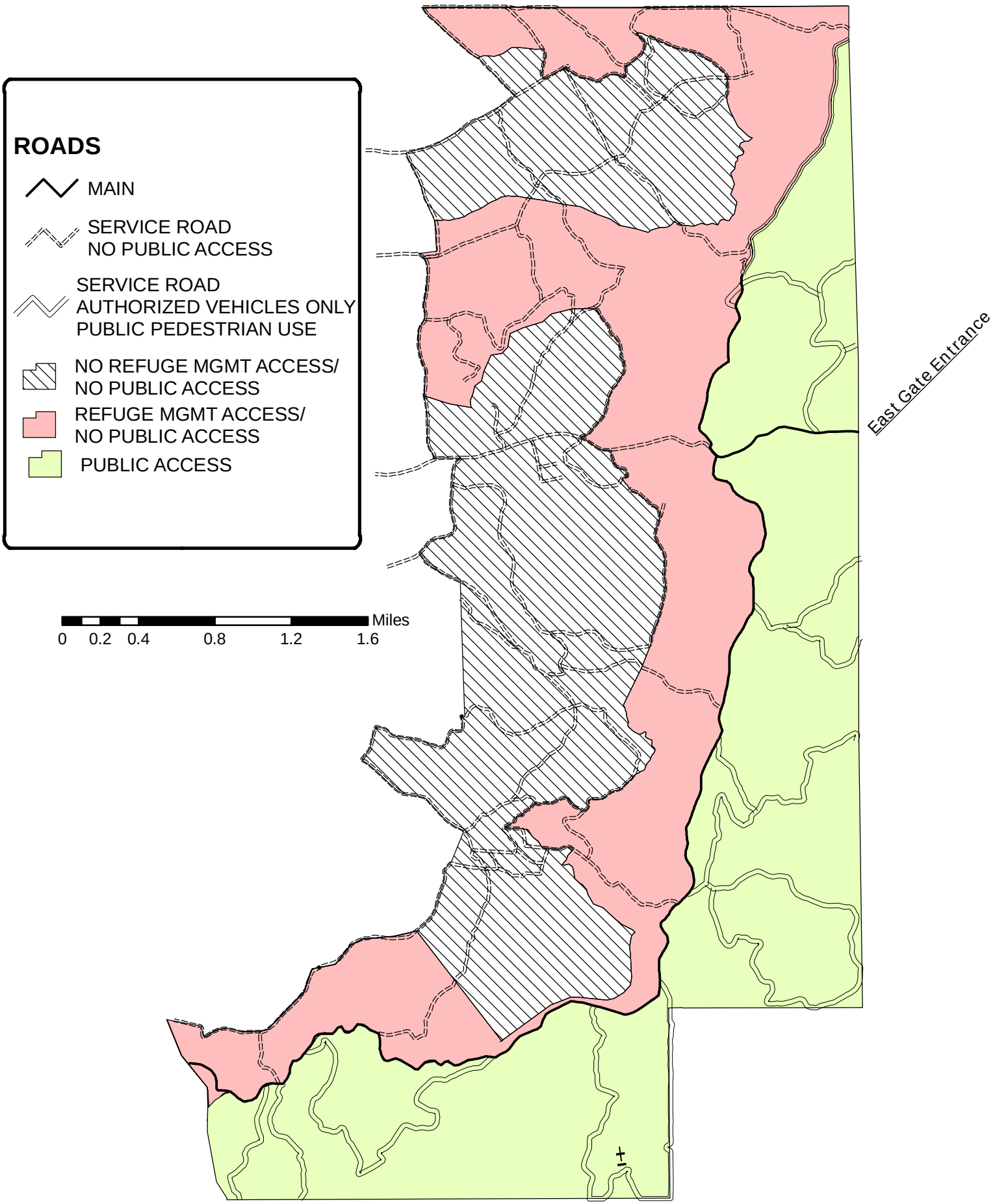


FIG. 6 REFUGE MANAGEMENT ACCESS

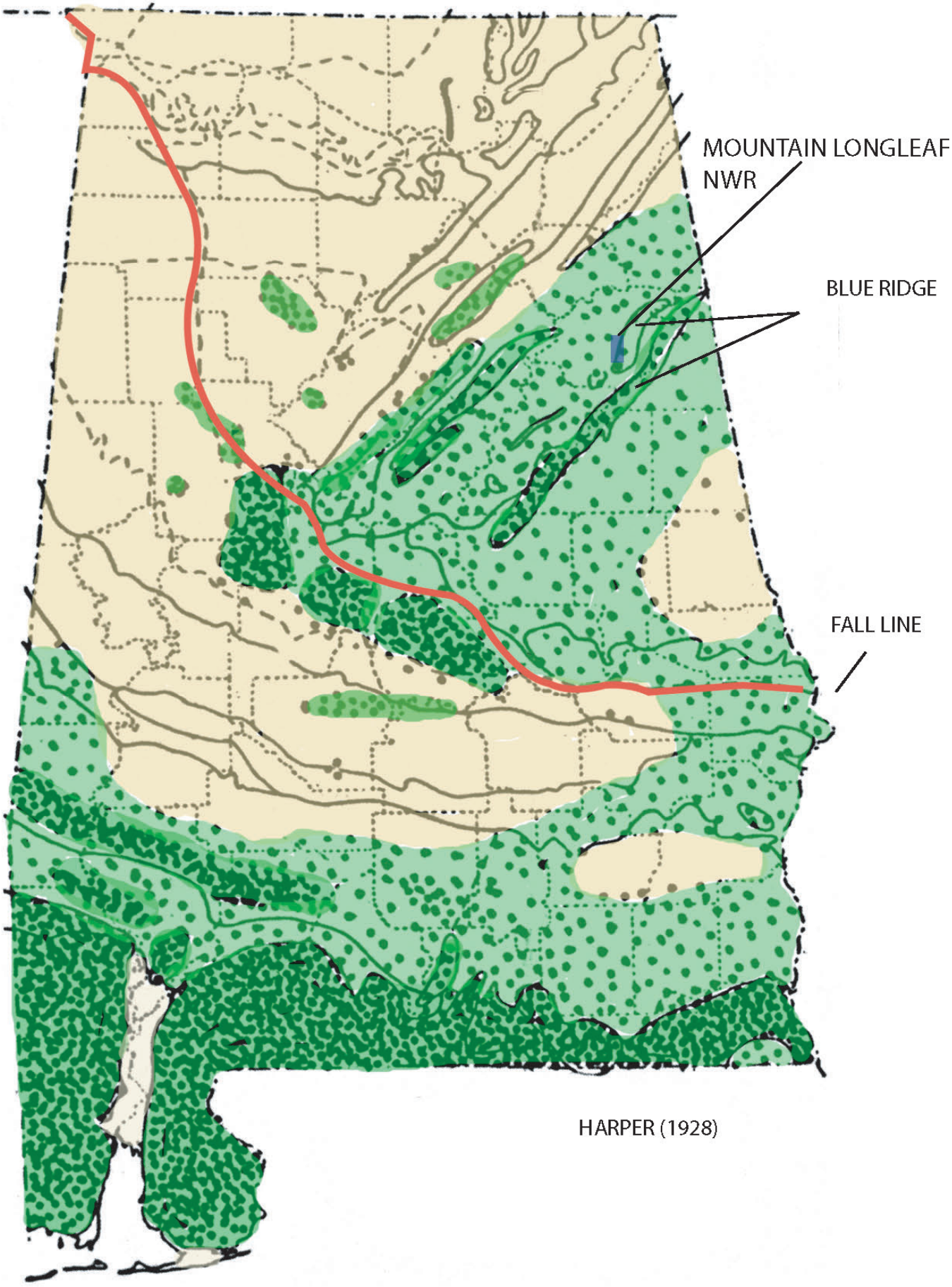
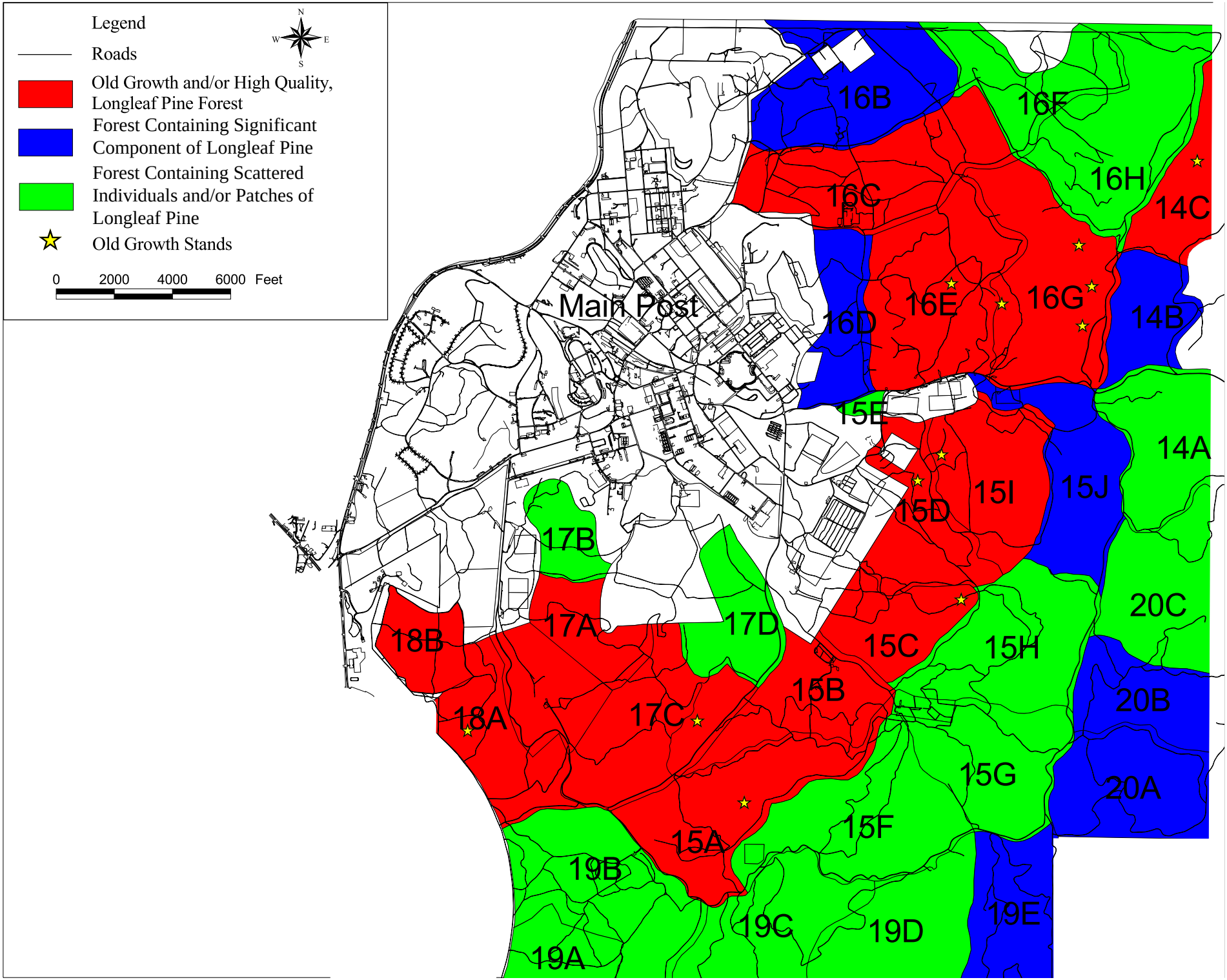


FIG. 7 MOUNTAIN LONGLEAF PINE FOREST REGION IN ALABAMA


Legend
Roads
Old Growth and/or High Quality, Longleaf Pine Forest
Forest Containing Significant Component of Longleaf Pine
Forest Containing Scattered Individuals and/or Patches of Longleaf Pine
Old Growth Stands
0 2000 4000 6000 Feet
N
W
E
S
Main Post
16B
16F
16H
16C
14C
16E
16G
14B
16D
15E
14A
15I
15J
15D
17B
20C
17A
17D
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19C
19D
19A

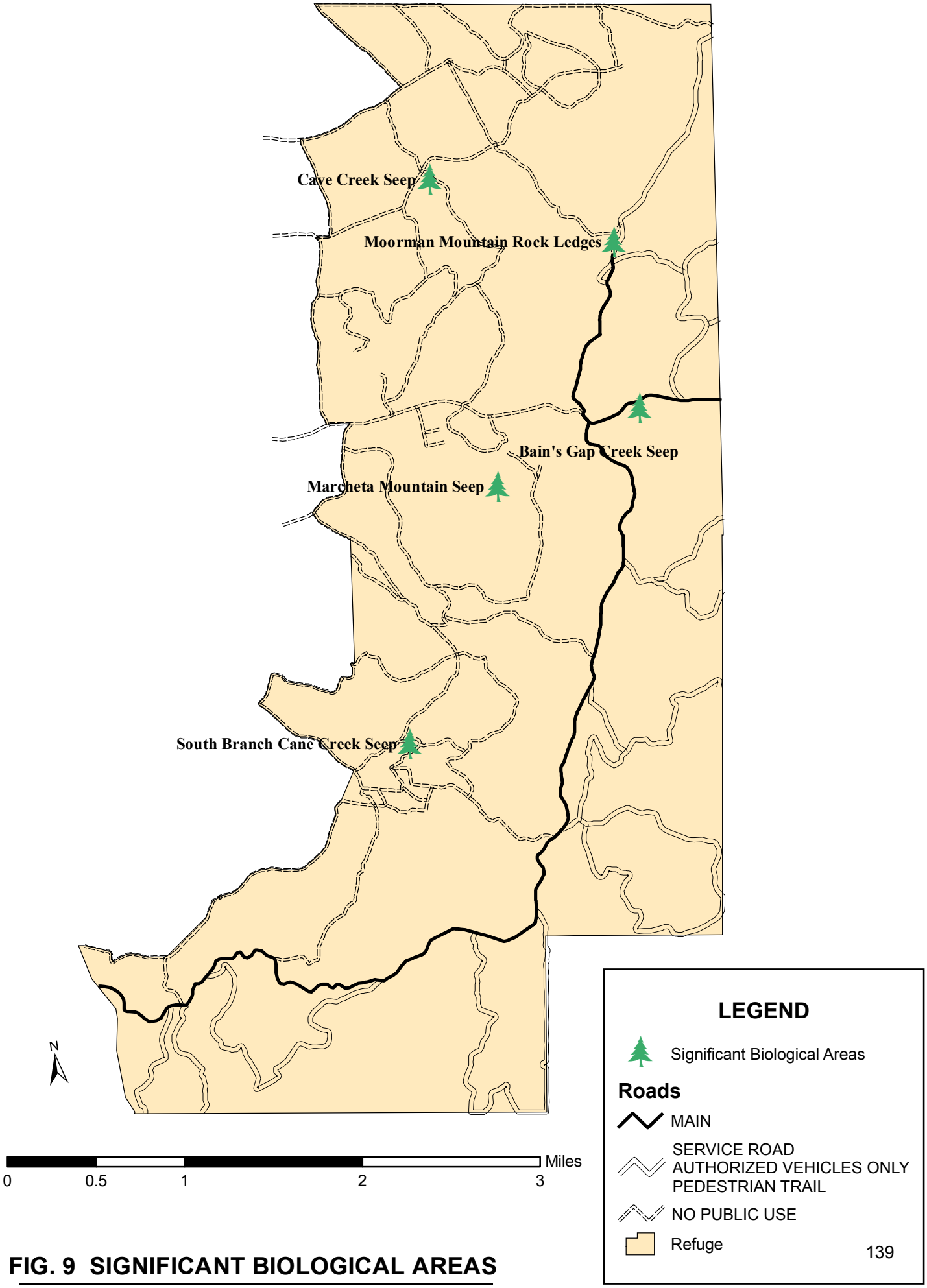
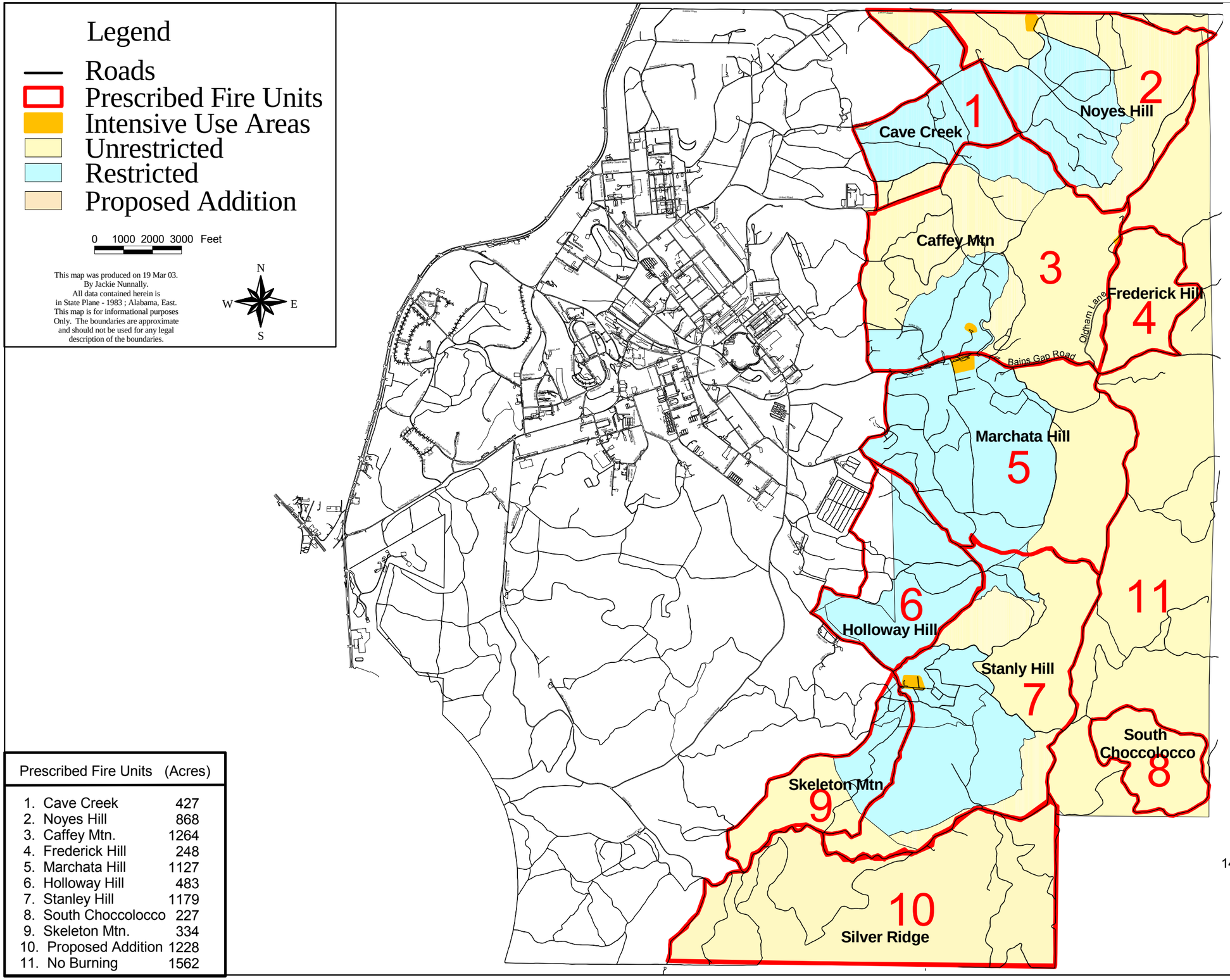


FIG. 9 SIGNIFICANT BIOLOGICAL AREAS

Mountain Longleaf Pine National Wildlife Refuge
Prescribed Fire Units



Prescribed Fire Units	(Acres)
1. Cave Creek	427
2. Noyes Hill	868
3. Caffey Mtn.	1264
4. Frederick Hill	248
5. Marchata Hill	1127
6. Holloway Hill	483
7. Stanley Hill	1179
8. South Choccolocco	227
9. Skeleton Mtn.	334
10. Proposed Addition	1228
11. No Burning	1562

140

j:/garland/TonyMar03Prescribed Fire Units