

Cahaba River National Wildlife Refuge Natural Community and Rare Plant Survey



A Report Prepared for the
United States Fish and Wildlife Service

By the

Alabama Natural Heritage Program
1090 South Donahue Drive
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Cover Photo: Wherry's Phlox (*Phlox pulchra*), courtesy of Bill Garland

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- Appendix 2: Completed natural community field forms (included separately)

PART I: INTRODUCTION

Cahaba River National Wildlife Refuge (CRNWR) administers approximately 3,414 acres along the Cahaba River in Bibb County, Alabama (Figure 1). The Refuge was established in 2002 for the purpose of protecting and managing a unique section of the Cahaba River and adjacent forested uplands. The river itself stretches for nearly 200 miles through some of Alabama's most spectacular scenery and is considered to be the state's longest free-flowing stream. The Refuge and surrounding area are known to contain one of the greatest concentrations of imperiled species to be found in North America, 13 of which occur nowhere else in the world. Of these, the shoals spiderlily (known locally as the Cahaba lily) has come to symbolize the beauty and significance of the region. The Refuge contains a fragmented assemblage of managed and naturally occurring uplands, interspersed with a mosaic of bottomland forests, streams, and bluffs. Prior to the inception of this project, a detailed inventory of natural communities and rare plants did not exist. This report was designed to highlight the extent, location, and condition of CRNWR's natural plant associations and rare plant species to furnish land managers with the necessary information to establish and implement appropriate conservation strategies.

PART II: NATURAL COMMUNITIES

Introduction

The primary purpose for developing and incorporating a plant community classification into this report is to provide information necessary for conservation planning and proper stewardship at CRNWR. Plant community classifications define groups of plants that share biotic and abiotic similarities, system processes, and structural characteristics. This is accomplished by grouping plants on the basis of species composition and community structure overlain on physical features and ecosystem parameters. A good example of a natural community that illustrates these features is upland mixed forest. The community name quickly provides a considerable amount of information, suggesting that the community is dry, that it is on an upland site, and that it has trees. If information is included about soil characteristics, such as texture and parent material, floristic composition can, with some field experience, also be predicted. For example, most dry upland forests underlain by sandstone in central Alabama contain shortleaf pine (*Pinus echinata*), chestnut oak (*Quercus prinus*), white oak (*Quercus alba*), sourwood (*Oxydendrum arboreum*), tree sparkleberry (*Vaccinium arboreum*), and spotted wintergreen (*Chimaphila maculata*), among many others. This exercise can be conducted for any natural community type in the state. By describing, classifying, mapping, and managing ecological communities, researchers and managers are able to track and monitor a complex suite of interactions that are not recognizable through other means.

The natural communities in CRNWR have been classified in accordance with the system developed by NatureServe and The Nature Conservancy (TNC) in cooperation with state, federal, and academic partners. This classification is a modified version of the UNESCO vegetation classification system (UNESCO 1973). The overall classification framework has seven hierarchical levels that allow it to be applied at the spatial level appropriate to a range of conservation and management activities. Five levels (formation class, formation subclass, formation group, formation subgroup, and formation) are based on vegetative structure or physiognomy, and the two finer levels (alliance and association) are derived from species composition (floristics). Only the finest level of classification – the association – receives a conservation status assessment (i.e., Global and State rarity ranks), and therefore is used in this report. The national classification has been developed to present a consistent framework for

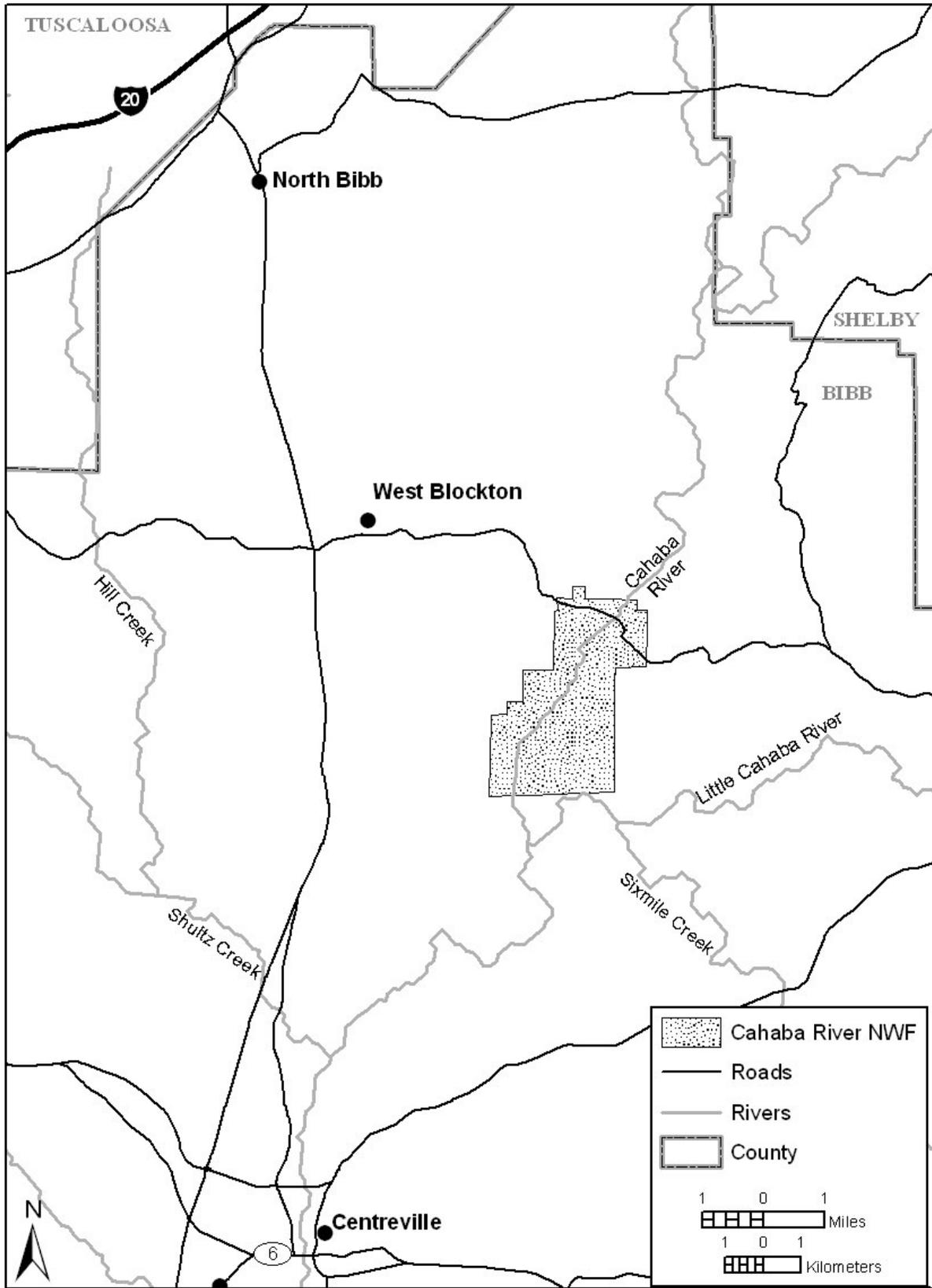


Figure 1. Regional map showing Cahaba River National Wildlife Refuge

conserving and stewarding biodiversity. An objective of TNC and many state-based natural heritage programs is to identify and conserve representative examples of all natural plant associations (TNC 1996). As such, communities become extremely important conservation targets in areas where species patterns and ecological processes are poorly understood. Plant communities can also be used as a coarse filter approach in planning the conservation of biological diversity. Descriptions of plant associations with ecosystem information can be useful in developing management regimes that maintain biodiversity across the landscape by incorporating relatively large-scale ecosystem process models during the planning process. Ecosystem transition models can be used in the restoration of degraded natural communities. The spatial arrangement of plant communities on the landscape can be used to interpret gaps in the landscape picture where plant communities are no longer extant. With this information it may be possible to conserve much of the natural diversity of an area through strategic conservation planning and stewardship.

The composition and distribution patterns of ecological communities within the Cahaba River watershed have been significantly altered by the influence of humanity. Prior to the arrival of European immigrants, the Native Americans, like humans everywhere, had shaped and modified the land to suit their purposes. Using simple but effective stone tools and controlled burning, Creek Indians and other indigenous tribes had long since cleared parts of the eastern forest for agriculture. The resulting patchwork of garden plots, abandoned fields, and woodlands had, in turn, increased habitat diversity for wildlife, thus adding to the variety and quantity of game available. Far from a virgin and primeval wilderness as many believed, North America was an already transformed landscape when Europeans first reached its shores. With the arrival of the nineteenth century came the total occupation of the region by European colonists. It was an era of forest clearing, and any virgin stand which survived that century was logged or farmed or both in the next. Prior to the last century, if a farm became depleted it was customary for the owners to move elsewhere. Farming methods were abusive to the soil and it was the expectation of a homesteader arriving on new land that he could eventually exhaust the soil and have to move westward. The idea of living with the consequences of one's agricultural practices was widely accepted only when there were no more western lands to be had, largely a phenomenon of the last century. Today, the effects of human occupation upon the natural vegetation of the region are readily apparent. To accommodate the progress of humanity, forests are continually cleared and wetlands drained, a series of events that has forever altered the landscape.

Although habitat destruction and degradation emerges as the most pervasive threat to the viability of Alabama's vegetation resources, the influence of exotic species has proven to be equally as harmful to ecosystem integrity. The following discussion of natural communities illuminates threats potentially afflicting plant associations, as well as viable management solutions specifically designed for restoring and maintaining ecological processes.

Methodology

The following natural community descriptions were based on in-house heritage information, literary references, and a series of field inspections that were conducted from March 2005 to December 2006. Natural Community Survey Forms (Appendix 2) were used to randomly describe all plant associations representative of CRNWR. These forms provided a qualitative, but highly structured format for reporting information on vegetation composition and structure, evidence of disturbance, and an assessment of the management needs and the general quality of the natural community occurrence. This information ultimately serves as documentation in the Alabama Natural Heritage Program's (ALNHP) database.

The protocol for identifying and delineating natural communities began with cursory inspections to acquire an understanding of overall size, homogeneity, dominant vegetation, and any apparent disturbance. Descriptions of these features were recorded in the appropriate fields on the survey forms. The surveyor then chose a representative point and collected data on percent cover and height for all species in each vegetation stratum within a 20 x 50 meter plot.

High quality examples of all natural communities were recorded in the ALNHP database (Table 1), following Natural Heritage protocol for processing biological information. The basic unit of this protocol is the element. An element is any exemplary or rare component of the natural environment, such as a species, natural community, bird rookery, sinkhole, or other ecological feature. An Element Occurrence (EO) represents the location of an element and is the environment which sustains a species' population or an example of a natural community. The Element Occurrence Record (EOR) is the computerized record that contains the biological and locational information regarding a specific EO, as well as an assessment of the conservation value of that EO against other EOs of its kind. Element Occurrence Records are maintained in ALNHP's Biological Conservation Database (BCD) at Auburn University. Element Occurrences documented from CRNWR appear in Appendix 1. The Program uses the BCD to track information on elements, occurrences of those elements, important conservation sites, ecological monitoring programs, and other information relevant to conservation efforts in Alabama. The BCD also is part of a global heritage network where information is used interchangeably among various heritage programs and field offices of TNC.

Nomenclature is in accordance with the classification framework designed by NatureServe and The Nature Conservancy to achieve range-wide consistency for naming and describing natural communities. Generic names (i. e., bottomland forest) and synonymies have been included to facilitate cross-walking with other in-use classifications. Species concepts and names for plants is primarily based on the Flora of North America (Flora of North America Editorial Committee, 1993+), with a Synthesis of the North American Flora (The Biota of North America Program 1999) serving as an additional reference.

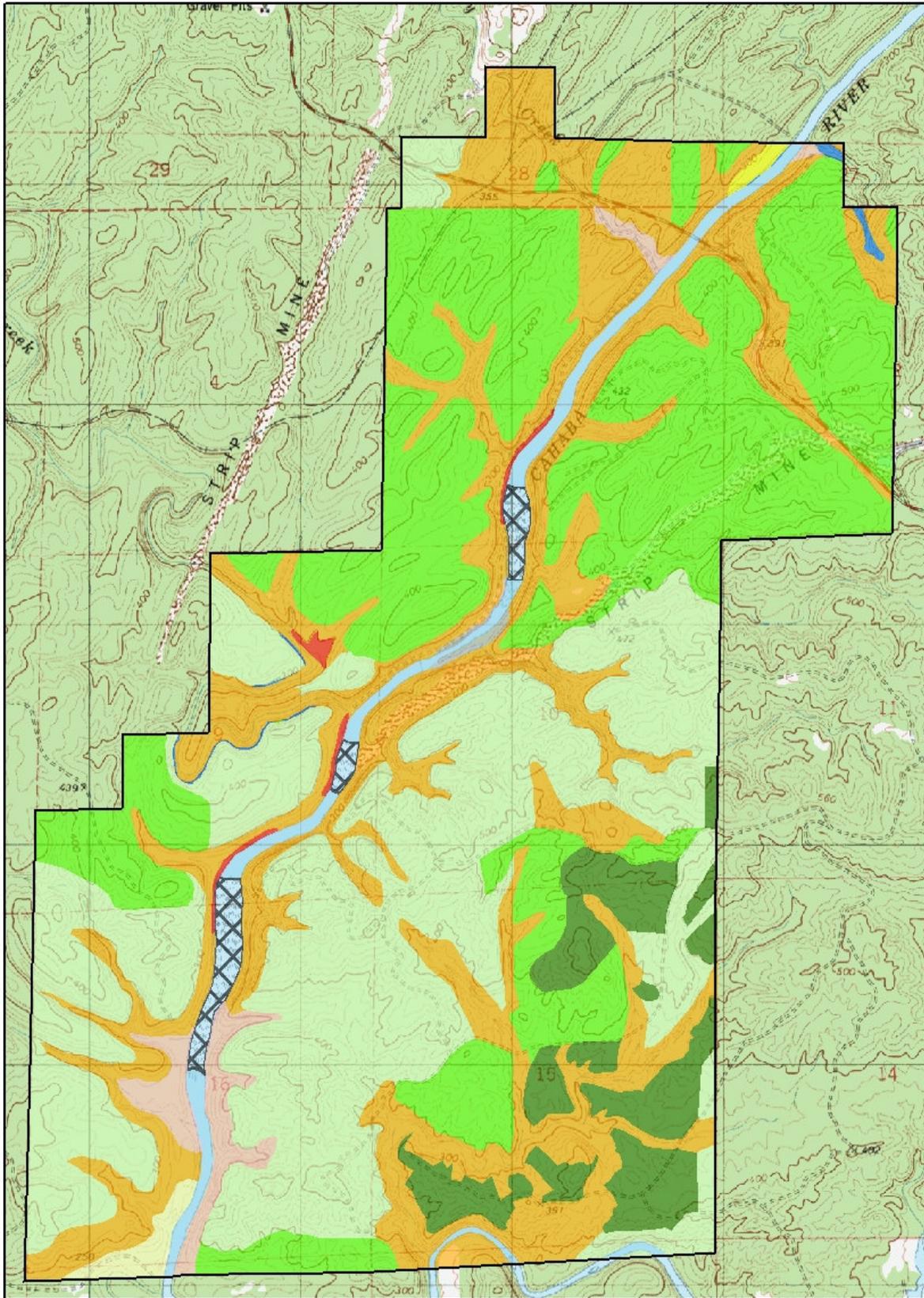
All GIS products were created using ArcView 3.3 (Environmental Systems Research Institute; Redlands, California). Digital USGS topographic quadrangle maps were downloaded from the Geological Survey of Alabama's Geospatial Data web page (<http://www.gsa.state.al.us/gsa/GIS/DATA.html>) as georeferenced Universal Transverse Mercator North American Datum 1927 (UTM NAD27) digital raster graphic files (*.tif). The CRNWR boundary GIS layer was downloaded from the United States Fish and Wildlife Service Region 4 Refuge Boundary Files web page (<http://www.fws.gov/data/r4gis/boundary.html>) and converted from a geographic projection to UTM NAD27. Plant communities, exotic species infestations, and rare plant species occurrences delineated in the field on USGS topographic maps were digitized from a heads-up display of the corresponding digital topographic map and saved as a shapefile. The maps generated for this report are included on the accompanying CD as *.tif files.

Results and Discussion

Natural history information, occurrence records, and floral accounts of natural communities associated with CRNWR were extracted from published literature, unpublished reports, anecdotal accounts, field data, aerial photography, and scientific collections. A brief summary of results is presented here; detailed discussions of natural communities and their management

needs are provided under Natural Community Descriptions. A map highlighting the general configuration and arrangement of natural communities on the Refuge appears as Figure 2.

Vegetation Key to Natural Communities of the Cahaba River National Wildlife Refuge



Natural Community

- Quercus prinus* - *Carya* spp. - *Quercus velutina* / *Vaccinium arboreum* / *Iris verna* var. *smalliana* Forest
- Quercus alba* - *Fagus grandifolia* / *Hydrangea quercifolia* - *Viburnum acerifolium* / *Carex picta* - *Polystichum acrostichoides* Forest
- Quercus hemisphaerica* - *Quercus (falcata, nigra)* / *Ilex opaca* - *Vaccinium arboreum* / *Cnidioscolus stimulosus* Forest
- Pinus palustris* - *Pinus echinata* - (*Pinus virginiana*) / *Quercus marilandica* - (*Quercus prinus*) / *Vaccinium pallidum* Woodland
- Pinus taeda* Planted Forest
- Pinus palustris* Planted Forest
- Fagus grandifolia* - *Quercus alba* / *Kalmia latifolia* - *Rhododendron canescens* - *Symplocos tinctoria* Forest
- Liquidambar styraciflua* - *Quercus (laurifolia, nigra)* - (*Pinus taeda*) / *Arundinaria gigantea* var. *gigantea* / *Carex abscondita* Forest
- Liquidambar styraciflua* - *Liriodendron tulipifera* / *Onoclea sensibilis* Forest
- Hymenocallis coronaria* - *Justicia americana* Herbaceous Vegetation
- (*Salix* spp.) / *Andropogon gerardii* - *Panicum virgatum* - *Salvia azurea* Cahaba Riverwash Herbaceous Vegetation
- Water

Figure 2. Vegetation key and legend to natural communities of the Cahaba River National Wildlife Refuge

Currently, a total of 12 natural plant associations (including roadsides) have been recognized from CRNWR, three of which were processed into Element Occurrence Records for inclusion into ALNHP’s Biological Conservation Database (Table 1). The greatest proportion of the Refuge is characterized by a complex of vegetation contained within the *Pinus palustris* – *Pinus echinata* – (*Pinus virginiana*) / *Quercus marilandica* – (*Quercus prinus*) / *Vaccinium pallidum* Woodland type, while in contrast, the (*Salix* spp.) / *Andropogon gerardii* – *Panicum virgatum* – *Salvia azurea* Cahaba Riverwash Herbaceous Vegetation assumes the smallest dimensions, encompassing no more than 5.0 acres in size.

Table 1. Natural community occurrence records from Cahaba River National Wildlife Refuge in the ALNHP database.

Scientific Name	Common Name	Global Rank	State Rank	# of EORs for CRNWR
<i>Pinus palustris</i> – <i>Pinus echinata</i> – (<i>Pinus virginiana</i>) / <i>Quercus marilandica</i> – (<i>Quercus prinus</i>) / <i>Vaccinium pallidum</i> Woodland	Montane Longleaf Pine Woodland	G2	S2	1
<i>Quercus alba</i> – <i>Fagus grandifolia</i> / <i>Hydrangea quercifolia</i> / <i>Carex picta</i> – <i>Polystichum acrostichoides</i> Forest	Cumberland Plateau Mesic White Oak – Beech Forest	G3G4	S1	1
(<i>Salix</i> spp.) / <i>Andropogon gerardii</i> – <i>Panicum virgatum</i> – <i>Salvia azurea</i> Cahaba Riverwash Herbaceous Vegetation	Cahaba Riverwash Prairie	G1	S1	1

1. Natural Community Descriptions

Natural communities are assemblages of species that occur together in space and time. These groups of plants and animals are found in recurring patterns that can be classified and described by their dominant physical and biological features. As with most vegetation classifications, the

lines between natural communities are often obscure in the field because of the overlap and intergradation among species, floral composition, and physical features. For these reasons, probably no single natural community description featured in this report will precisely match plant associations of adjacent areas. Each community is placed in one of four soil moisture classes (e. g., dry-mesic, mesic, etc.), a classification devised by the United States Department of Agriculture. Because all parts of the Refuge receive similar average annual rainfall, the differences in soil moisture are due to the ability of the soils to retain their complement of precipitation. Moisture variances are functions of slope, soil texture, porosity, and vegetation cover. For example, if all other factors are equal a site of modest slope retains its moisture more tenaciously than one of greater slope. Additionally, on a given gradient the lower portions of the slope stay wetter than points farther upslope because of downward percolation. Among environmental forces, soil moisture, whatever its governing factors, has a particularly strong influence on the vegetation that occupies a given site. So powerful, in fact, is the selecting influence of moisture that, as a rule, different species of plants inhabit xeric, mesic, and hydric sites. Since the steepness of a slope is usually the critical factor in determining soil moisture at a given Refuge location, one can expect that most of the Refuge's dry-mesic communities will be found on ridgetops and upper slopes and mesic conditions on the middle and lower slopes.

A. Dry-mesic Communities

1. Interior Longleaf Pine Woodland – (synonyms: montane longleaf pine forest). This system is distinguished from all other interior systems in having longleaf pine (*Pinus palustris*), an indicator of fire, as a dominant species. In addition to Alabama, examples are also represented in Georgia and North Carolina, occupying rolling to somewhat mountainous terrain north of the Fall Line. Historically, with the greater presence of fire, the canopy was generally believed to be open, containing a high diversity of forbs and grasses in the ground cover. Currently, however, many are closed forests characterized by a dense growth of trees and shrubs in the understory, generally to the exclusion of a substantial herbaceous component. Further, the alteration of fire regimes, combined with universal logging, has made the natural condition of vegetation somewhat uncertain. Almost certainly *Pinus palustris* was more abundant than it is at present, but very likely some component of other pines and of oaks was evident. While the dynamics of this system are strongly influenced by fire, fires likely occurred at frequencies lower than in the Coastal Plain. Fires would be fairly low intensity and would kill only a few individual plants in the fire-adapted vegetation. In light of fire repression, the reproduction of *Pinus palustris* has largely been eliminated and replaced with hardwood species that are fairly resilient to fire and have the ability to sprout. As such, the reintroduction of fire will only gradually restore this system to its original structure and composition. One association is known from CRNWR; four others have been described, all of which have a more easterly distribution.

- ◆ *Pinus palustris* – *Pinus echinata* – (*Pinus virginiana*) / *Quercus marilandica* – (*Quercus prinus*) / *Vaccinium pallidum* Woodland
[Translated Name: Longleaf Pine – Shortleaf Pine – (Virginia Pine) / Blackjack Oak – (Chestnut Oak) / Lowbush Blueberry Woodland]
(Common Name: Montane Longleaf Pine Woodland)

Historically, this association may have occupied a significant proportion of the present day Refuge, but is now generally restricted as remnants along the highest, and most inaccessible ridges. The canopy, in addition to longleaf and shortleaf pines (*Pinus palustris* and *Pinus echinata*, respectively), often includes (presumably due to a reduction of historical fire regimes) loblolly pine (*Pinus taeda*), Virginia pine (*Pinus virginiana*), and various combinations of oaks

and other hardwoods, including chestnut oak (*Quercus prinus*), blackjack oak (*Quercus marilandica*), white oak (*Quercus alba*), southern red oak (*Quercus falcata*), scarlet oak (*Quercus coccinea*), mockernut hickory (*Carya alba*), and sourwood (*Oxydendrum arboreum*). While fire is the ultimate driving force that maintains this system, the presence of steep slopes and rocky conditions, particularly west of the Cahaba River, may have also allowed the regeneration of *Pinus palustris* even with infrequent fire events. Given modern fire suppression, a panoply of trees and shrubs have also become well established in the understory, resulting in the decline of the herb layer. In accompaniment to smaller specimens of the foregoing canopy species, the following are also commonly represented: blackgum (*Nyssa sylvatica*), flowering dogwood (*Cornus florida*), southern sugar maple (*Acer barbatum*), red maple (*Acer rubrum*), mountain laurel (*Kalmia latifolia*), tree sparkleberry (*Vaccinium arboreum*), horse sugar (*Symplocos tinctoria*), and witch hazel (*Hamamelis virginiana*). Lowbush blueberry (*Vaccinium pallidum*) is locally abundant in some examples. The herbaceous component, although sparse, is exemplified by a rich diversity of species, the more noteworthy being: bracken fern (*Pteridium aquilinum* var. *pseudocaudatum*), little bluestem (*Schizachyrium scoparium*), panic-grass (*Dichanthelium commutatum*), goat's-rue (*Tephrosia virginiana*), flowering spurge (*Euphorbia corollata*), wild bergamot (*Monarda fistulosa*), whorled tickseed (*Coreopsis major*), grass-leaf golden-aster (*Pityopsis graminifolia*), and sweet goldenrod (*Solidago odora* var. *odora*). These species are all perennials, which either benefit directly from the effects of growing season fire or from the open canopy that is maintained with growing season fire.



Figure 3. *Pinus palustris* – *Pinus echinata* – (*Pinus virginiana*) / *Quercus marilandica* – (*Quercus prinus*) / *Vaccinium pallidum* Woodland

Soil of this association is primarily comprised of the Nauvoo series, which is characterized as a deep, well drained, moderately permeable soil that formed in loamy residuum weathered from sandstone or interbedded sandstone and shale. The surface layer is distinguished by a brown fine sandy loam, whereas the uppermost sublayers are defined by a yellowish red sandy clay loam.

Rare species present: Georgia aster (*Symphyotrichum georgianum*).

B. Mesic Communities

2. Upland Mixed Forest – (synonyms: pine-oak-hickory forest, southern mixed hardwoods).

Upland mixed forests are currently found throughout Alabama, but their composition varies across the state from a nearly subtropical forest in the South to a cool temperate flora in the North. In addition, the composition and abundance of species, as well as the structure and dynamics of these forests, are greatly affected by complex disturbance regimes that vary at different scales over space and time. Most recently, as well demonstrated at CRNWR, anthropogenic disturbance has complemented natural disturbance regimes, thus further modifying ecological processes. Hence, combinations of species and natural communities not present upon the Cahaba River landscape during presettlement times are currently being formed. Given the above conditions, three associations are presently recognized from the Refuge.

- ◆ *Quercus prinus* – *Carya* spp. – *Quercus velutina* / *Vaccinium arboreum* / *Iris verna* var. *smalliana* Forest
[Translated Name: Chestnut Oak – Hickory species – Black Oak / Tree Sparkleberry / Dwarf Vernal Iris Forest]
(Common Name: Lower Piedmont Chestnut Oak Forest)

This association occupies well-drained sites throughout central Alabama, typically occurring on middle to upper slopes and ridges. Its distribution on CRNWR is fairly extensive, serving as the prominent forest type along many of the slopes. The canopy is chiefly comprised of chestnut oak (*Quercus prinus*), with white oak (*Quercus alba*), southern red oak (*Quercus falcata*), post oak (*Quercus stellata*), and mockernut hickory (*Carya alba*) occurring as codominants in many stands. Although of secondary importance, the following are also characteristic trees of this association listed in the approximate order of abundance: shortleaf pine (*Pinus echinata*), beech (*Fagus grandifolia*), loblolly pine (*Pinus taeda*), black oak (*Quercus velutina*), tuliptree (*Liriodendron tulipifera*), sweetgum (*Liquidambar styraciflua*), pignut hickory (*Carya glabra*), red oak (*Quercus rubra*), and water oak (*Quercus nigra*). Understory woody vegetation is generally uniform in distribution, with no particular taxon assuming dominance. In addition to younger specimens of the foregoing canopy species, characteristic and otherwise noteworthy shrubs and trees observed here include sourwood (*Oxydendrum arboreum*), flowering dogwood (*Cornus florida*), tree sparkleberry (*Vaccinium arboreum*), lowbush blueberry (*Vaccinium pallidum*), oakleaf hydrangea (*Hydrangea quercifolia*), mountain laurel (*Kalmia latifolia*), hoary azalea (*Rhododendron canescens*), dwarf pawpaw (*Asimina parviflora*), and red buckeye (*Aesculus pavia*). Typical vines include muscadine grape (*Vitis rotundifolia*), briers (*Smilax glauca* and *Smilax rotundifolia*), and poison ivy (*Toxicodendron radicans*).

The majority of soils associated with this community are classified as the Townley-Nauvoo complex, a series combination that is represented by a deep, well drained, moderately to slowly permeable soils that originated from weathered sandstone, shale, or an interbedded mix of sandstone and shale.

Rare species present: smooth veiny peavine (*Lathyrus venosus*), Wherry's phlox (*Phlox pulchra*).

- ◆ *Quercus alba* – *Fagus grandifolia* / *Hydrangea quercifolia* – *Viburnum acerifolium* / *Carex picta* – *Polystichum acrostichoides* Forest
 [Translated Name: White Oak – Beech / Oakleaf Hydrangea – Mapleleaf Viburnum / Painted Sedge – Christmas Fern Forest]
 (Common Name: Cumberland Plateau Mesic White Oak – Beech Forest)

While frequently dispersed throughout the mountainous region of north Alabama, this association assumes a more restricted distribution and smaller dimensions as one moves south into the central portion of the state. Rare in CRNWR it is confined only to the steep, rocky north- to east-facing slopes overlooking Caffee Creek and an unnamed, west-flowing tributary proximal to the Refuge's northernmost boundary. For the most part the canopy is represented by a codominance of white oak (*Quercus alba*), beech (*Fagus grandifolia*), and tuliptree (*Liriodendron tulipifera*), although each species attains a prominent status in some locations. Seldom absent from the canopy, though of secondary importance, are several other species that further define this community, including loblolly pine (*Pinus taeda*), sweetgum (*Liquidambar styraciflua*), chestnut oak (*Quercus prinus*), southern red oak (*Quercus falcata*), water oak (*Quercus nigra*), mockernut hickory (*Carya alba*), pignut hickory (*Carya glabra*), and white ash (*Fraxinus americana*). The subcanopy is relatively diverse, containing not only smaller specimens of the above-mentioned taxa, but an array of understory associates expected in similar conditions elsewhere in the region, such as blackgum (*Nyssa sylvatica*), sourwood (*Oxydendrum arboreum*), bigleaf magnolia (*Magnolia macrophylla*), Florida maple (*Acer barbatum*), red maple (*Acer rubrum*), hop hornbeam (*Ostrya virginiana*), flowering dogwood (*Cornus florida*), and American holly (*Ilex opaca*). Mountain laurel (*Kalmia latifolia*) is most commonly represented in the shrub layer, often establishing nearly impenetrable stands. Additional shrubs to be encountered are horse sugar (*Symplocos tinctoria*), hoary azalea (*Rhododendron canescens*), silky camellia (*Stewartia malacodendron*), oakleaf hydrangea (*Hydrangea quercifolia*), witch hazel (*Hamamelis virginiana*), Elliott's blueberry (*Vaccinium elliotii*), dwarf pawpaw (*Asimina parviflora*), and strawberry-bush (*Euonymus americanus*). Herbs are generally sparse, with Christmas fern (*Polystichum acrostichoides*), marginal wood fern (*Dryopteris marginalis*), painted sedge (*Carex picta*), dwarf crested iris (*Iris cristata*), heartleaf ginger (*Hexastylis arifolia* var. *arifolia*), round-lobed hepatica (*Anemone americana*), partridgeberry (*Mitchella repens*), and bluestem goldenrod (*Solidago caesia*) serving as principal species.

Characteristic soils have been identified as either the Gorgas or Montevallo series, or a combination of the two. Both series occur on steep slopes and consist of shallow, well drained, moderately permeable soils that formed in residuum from sandstone, siltstone, or shale. The A horizon is generally a grayish brown silt loam or loamy sand, whereas the B horizons assume a yellowish brown notation and are also comprised of either a silt loam or loamy sand.

Rare species present: silky camellia (*Stewartia malacodendron*) and slender bunchflower (*Melanthium latifolium*).



Figure 4. *Quercus alba* – *Fagus grandifolia* / *Hydrangea quercifolia* – *Viburnum acerifolium* / *Carex picta* – *Polystichum acrostichoides* Forest.

- ◆ *Quercus hemisphaerica* – *Quercus (falcata, nigra)* / *Ilex opaca* – *Vaccinium arboreum* / *Cnidioscolus stimulosus* Forest
 [Translated Name: Upland Laurel Oak – Oak (Southern Red, Water) / American Holly – Tree Sparkleberry / Tread-Softly Forest]
 (Common Name: Sand Laurel Oak Upland Forest)

Primarily confined to the Gulf Coastal Plain, this association assumes a sporadic distribution along the northern periphery of its range in central Alabama. The occurrence of this community on CRNWR is restricted to relatively level areas along the west side of the Cahaba River and Caffee Creek, where alluvial deposition has influenced and defined the plant life. The prominence of upland laurel oak (*Quercus hemisphaerica*), water oak (*Quercus nigra*), and loblolly pine (*Pinus taeda*) in the canopy layers serve to distinguish this association from others on the Refuge. Similarly, a suite of secondary species are also represented in the canopy and subcanopy, further illuminating an affiliation with the Gulf Coast region; characteristic trees include shortleaf pine (*Pinus echinata*), tuliptree (*Liriodendron tulipifera*), white oak (*Quercus alba*), sand post oak (*Quercus margarettiae*), and hop hornbeam (*Ostrya virginiana*). The shrub component invites inspection as well, for associated with typical species such as sweetleaf (*Symplocos tinctoria*), American holly (*Ilex opaca*), tree sparkleberry (*Vaccinium arboreum*), and flowering dogwood (*Cornus florida*) are individuals of titi (*Cyrilla racemiflora*), a principal component of various wetlands along the Gulf Coast. Herbs, which are few and sparse, include tread-softly (*Cnidioscolus stimulosus*), dwarf iris (*Iris verna* var. *smalliana*), longleaf spikegrass (*Chasmanthium sessiliflorum*), and giant cane (*Arundinaria gigantea* var. *gigantea*).

Rare species present: spring coralroot (*Corallorhiza wisteriana*).

3. Forest Plantations – (synonyms: planted forest, pine plantation). Plantations of trees have been planted throughout CRNWR, prior to the establishment of the Refuge. To promote

restoration efforts longleaf pine (*Pinus palustris*) was planted during the winter of 2004 and 2005 in clearcuts confined to the southeastern corner of the Refuge. Two types are noted, both of which range from seedling stage to approximately 50 years of age.

- ◆ *Pinus taeda* Planted Forest
[Translated Name: Loblolly Pine Planted Forest]
(Common Name: Loblolly Pine {Plantation})

Plantations of loblolly pine have been extensively planted throughout what is now CRNWR prior to its acquisition in 2002. While represented by various age classes, all examples illustrate similar structural and compositional features. Loblolly pine (*Pinus taeda*) occupies a commanding position in the canopy, occasionally accented by various hardwoods such as tuliptree (*Liriodendron tulipifera*), sweetgum (*Liquidambar styraciflua*), mockernut hickory (*Carya alba*), and southern red oak (*Quercus falcata*). The subcanopy and shrub layers are primarily comprised of early successional deciduous species, which includes the above-mentioned hardwood species, as well as flowering dogwood (*Cornus florida*), sourwood (*Oxydendrum arboreum*), blackgum (*Nyssa sylvatica*), persimmon (*Diospyros virginiana*), and oakleaf hydrangea (*Hydrangea quercifolia*). The greatest diversity is found in the herb layer, which is dominated by members of the grass (Poaceae), composite (Asteraceae), and legume (Fabaceae) families. Typical grasses include little bluestem (*Schizachyrium scoparium*), various beardgrasses (*Andropogon virginicus* and *Andropogon glomeratus*), switchgrass (*Panicum virgatum*), panic-grasses (*Dichanthelium* spp.), and Indian grass (*Sorghastrum nutans*). Composites commonly include bushy aster (*Symphyotrichum dumosum*), late purple aster (*Symphyotrichum patens* var. *patens*), silvery aster (*Symphyotrichum concolor*), white-topped aster (*Sericocarpus tortifolius*), whorled tickseed (*Coreopsis major*), roundleaf thoroughwort (*Eupatorium rotundifolium*), golden-asters (*Pityopsis* spp.), and sweet goldenrod (*Solidago odora* var. *odora*). Characteristic legumes include goat's-rue (*Tephrosia virginiana*), pencil flower (*Stylosanthes biflora*), tick-trefoils (*Desmodium* spp.), and butterfly pea (*Centrosema virginiana*). Other conspicuous species include bracken fern (*Pteridium aquilinum* var. *pseudocaudatum*), Adam's needle (*Yucca flaccida*), common cinquefoil (*Potentilla simplex*), mountain mints (*Pycnanthemum* spp.), and hairy phlox (*Phlox amoena*).

- ◆ *Pinus palustris* Planted Forest
[Translated Name: Longleaf Pine Planted Forest]
(Common Name: Longleaf Pine Plantation)

A significant proportion of cleared land in the southeastern corner of the Refuge has been recently planted with longleaf pine in an effort to restore the landscape to its original vegetation type. Because of the recent clearcutting that had taken place just prior to USFWS ownership, these areas are now beset with impenetrable tangles of briars and brambles, as well as an array of other early successional species.

C. Wet-mesic Communities

4. Bottomland and Floodplain Forests – (synonyms: bottomland hardwoods, river bottoms, seasonally flooded basins or flats, second bottom, levee forest, river terrace). Southern floodplain forests have undergone some of the most rapid reduction in size and changes in floral composition than nearly any other forest biome in the United States, and are therefore of critical conservation concern. Many have been and are continually converted to farmland and industrial parks, or are modified by urban expansion. Other bottomlands are managed for timber

production or as recreational areas in ways that reduce their viability as natural wetland habitats. Nonetheless, an understanding of the distribution, physical and biotic characteristics, and functional properties of these systems are crucial toward establishing appropriate criteria for their use and long-term preservation.

Floodplain forests are found wherever streams or rivers flood at least occasionally beyond their channels. In the southeastern United States these forests are broadly classified into three general categories, bottomland forests, floodplain forests, and deepwater alluvial swamps, each being defined by the frequency and timing of annual flooding. Floodplain ecosystems are highly variable in size, ranging from broad alluvial valleys several miles wide to more narrow strips of streambank vegetation. On CRNWR, these forest associations, three of which are currently recognized, occupy only a small portion of the Refuge landscape.

- ◆ *Fagus grandifolia* – *Quercus alba* / *Kalmia latifolia* – *Rhododendron canescens* – *Symplocos tinctoria* Forest
[Translated Name: Beech – White Oak / Mountain Laurel – Hoary Azalea – Horse Sugar Forest]
(Common Name: White Oak – Beech Small Stream Floodplain Forest)

Occurrences of this association are confined to the floodplains of small streams that empty into either side of the Cahaba River. The most accessible example occurs along Little Ugly Creek where it parallels River Trace Road, just south of County Road 24. Larger, higher quality examples occupy more remote sections of the Refuge, often well isolated and protected from general day-use visitation. Elevated at a height of no more than three feet above the streambed, this community is prone to sporadic flooding, likely of minimal duration associated with periods of heavy precipitation. Deep alluvial soils coupled with occasional flooding lends it self to accommodate a strikingly different flora in relation to the hardwood dominated associations of adjacent upland systems. Undoubtedly, the most pervasive trademark of the small floodplain assemblage is the prominence of beech (*Fagus grandifolia*) and white oak (*Quercus alba*). Although both species are well distinguished in the canopy, several hardwood species of similar height dimensions are also worth noting, in decreasing order of abundance, including tuliptree (*Liriodendron tulipifera*), sweetgum (*Liquidambar styraciflua*), red maple (*Acer rubrum*), pignut hickory (*Carya glabra*), and water oak (*Quercus nigra*). The understory contains not only smaller specimens of the foregoing canopy species, but also an assortment of low growing trees and shrubs such as Florida maple (*Acer barbatum*), American hornbeam (*Carpinus caroliniana*), horse sugar (*Symplocos tinctoria*), witch hazel (*Hamamelis virginiana*), hoary azalea (*Rhododendron canescens*), and an occasional common silverbell (*Halesia tetraptera* var. *tetraptera*) and mountain laurel (*Kalmia latifolia*). The herbaceous component is generally sparse and of moderate diversity, with the following serving as representative species: Christmas fern (*Polystichum acrostichoides*), giant cane (*Arundinaria gigantea* var. *gigantea*), longleaf spikegrass (*Chasmanthium sessiliflorum*), cuneate trillium (*Trillium cuneatum*), rue anemone (*Thalictrum thalictroides*), heartleaf ginger (*Hexastylis arifolia* var. *arifolia*), blue phlox (*Phlox divaricata*), bloodroot (*Sanguinaria canadensis*), partridgeberry (*Mitchella repens*), beechdrops (*Epifagus virginiana*), and blue-stem goldenrod (*Solidago caesia*). Llanas are frequent, often climbing into the tops of the tallest trees; characteristic species include muscadine grape (*Vitis rotundifolia*), Virginia creeper (*Parthenocissus quinquefolia*), and cross-vine (*Bignonia capreolata*). Examples of this vegetation type have also been documented from the Oakmulgee District of Talladega National Forest.

- ◆ *Liquidambar styraciflua* – *Quercus (laurifolia, nigra)* – (*Pinus taeda*) / *Arundinaria gigantea* var. *gigantea* / *Carex abscondita* Forest
 [Translated Name: Sweetgum – Oak (Laurel, Water) – (Loblolly Pine) / Giant Cane / Thicket Sedge Forest]
 (Common Name: Sweetgum – Water Oak – Laurel Oak / Giant Cane – Thicket Sedge Forest)

This forest occupies a triangular-shaped area of a somewhat poorly drained to moderately well-drained ridge and swale complex along the west side of the Cahaba River, proximal to the Refuge's southern boundary. Flooding is a well pronounced but temporary driving force typically occurring at least once annually, often in association with spring and autumn climatic events. Its provenance is generally recognized as an artifact of human intervention, a successional phase that soon commences after the land is abandoned and gradually conforms to, depending on the magnitude of anthropogenic and natural influences, an oak-dominated climax forest. Sweetgum (*Liquidambar styraciflua*) and loblolly pine (*Pinus taeda*) are primary canopy species, and have as their secondary components a various assortment of hardwoods, including water oak (*Quercus nigra*), red maple (*Acer rubrum*), sugarberry (*Celtis laevigata*), and American elm. With the exception of *Pinus taeda*, the understory contains not only the canopy species mentioned above, but a series of trees, shrubs, and vines indicative of similar conditions elsewhere in the region, such as American hornbeam (*Carpinus caroliniana*), Florida maple (*Acer barbatum*), box elder (*Acer negundo*), pawpaw (*Asimina triloba*), Chinese privet (*Ligustrum sinense*), poison ivy (*Toxicodendron radicans*), Virginia creeper (*Parthenocissus quinquefolia*), and Japanese honeysuckle (*Lonicera japonica*). Of the species highlighted *Ligustrum sinense* and *Lonicera japonica* are of particular concern to land stewards. These two species are currently recognized as some of the most invasive exotic plants known in the Southeast, and now encompass a significant proportion of the vegetation occupying the site. As such, given their evergreen foliage and subsequent dense shade, the herbaceous layer is now poorly represented, with some of the more characteristic taxa being giant cane (*Arundinaria gigantea* var. *gigantea*), cuneate trillium (*Trillium cuneatum*), wild garlic (*Allium canadense*), wood sedge (*Carex digitalis*), and blue violet (*Viola affinis*).

The Sterrett series appears to be the principal soil type associated with floodplains in the Refuge, characterized as a deep, somewhat poorly drained, slowly permeable series that formed in loamy fluvial sediments derived from sandstone and shale residuum. These soils are usually saturated with water during the winter season, typically flooding for brief periods from December through March.

- ◆ *Liquidambar styraciflua* – *Liriodendron tulipifera* / *Onoclea sensibilis* Forest
 [Translated Name: Sweetgum – Tuliptree / Sensitive Fern Forest]
 (Common Name: Sweetgum – Tuliptree Brownwater Floodplain Forest)

This association assumes a sporadic distribution throughout the southeastern United States, where it occupies somewhat poorly drained sites associated with brownwater rivers. Its occurrence on CRNWR is essentially confined to the bottomlands along the northern- and southern-most extremities of the Cahaba River, specifically the western side. The canopy is often characterized by a prominence of sweetgum (*Liquidambar styraciflua*), tuliptree (*Liriodendron tulipifera*), and water oak (*Quercus nigra*), with loblolly pine (*Pinus taeda*) and white oak (*Quercus alba*) occurring as secondary components, and are therefore of only minor importance. Sycamore (*Platanus occidentalis*) occasionally serves as a canopy species closest to the River's edge. The subcanopy, although well represented, is generally patchy, attaining its

greatest development in openings of the foregoing canopy species. With the exception of loblolly pine the subcanopy is also comprised of the above-mentioned taxa, in addition to the following: Florida maple (*Acer barbatum*), American hornbeam (*Carpinus caroliniana*), winged elm (*Ulmus alata*), black cherry (*Prunus serotina*), and pignut hickory (*Carya glabra*). A scenario that has all too often presented itself in bottomlands across the Southeast is the rapid incursion of Chinese privet (*Ligustrum sinense*), an exotic shrub now prevalent in portions of CRNWR. In light of its enterprising habit the species has established nearly monotypic stands, often to the preclusion of less ambitious shrubs and herbs. The ground cover, though generally sparse, is characterized by a suite of flora typical of bottomlands in the region, with the more notable species including the following: sensitive fern (*Onoclea sensibilis*), Christmas fern (*Polystichum acrostichoides*), longleaf spikegrass (*Chasmanthium sessiliflorum*), giant cane (*Arundinaria gigantea* var. *gigantea*), cuneate trillium (*Trillium cuneatum*), and wild garlic (*Allium canadense*).

D. Hydric Communities

- ◆ (*Salix* spp.) / *Andropogon gerardii* – *Panicum virgatum* – *Salvia azurea* Cahaba Riverwash Herbaceous Vegetation
[Translated Name: (Willow species) / Big Bluestem – Switchgrass – Blue Sage Cahaba Riverwash Herbaceous Vegetation]
(Common Name: Cahaba Riverwash Prairie)

Frequent scouring from the Cahaba River has developed and maintained this association as a boulder- and cobble-strewn substrate vegetated with a luxuriant growth of robust grasses and forbs accented by a scattering of low growing trees and shrubs. Soils are classified as rapidly drained Psammments and are generally restricted to the narrow interstices of tightly packed boulders, or to small crevices in bedrock exposures. Floristically, grasses, primarily big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), and switchgrass (*Panicum virgatum*), serve as the principal vegetation component, constituting nearly 40 % of the total cover. While represented by smaller numbers, the following herbs are as equally characteristic: Indian grass (*Sorghastrum nutans*), broomsedge (*Andropogon virginicus*), gama grass (*Tripsacum dactyloides*), two-flowered melic grass (*Melica mutica*), wild potato vine (*Ipomoea pandurata*), virgin's bower (*Clematis virginiana*), axil-flower (*Mecardonia acuminata*), blue sage (*Salvia azurea*), Elliott's fan-petal (*Sida elliotii*), butterfly-weed (*Asclepias tuberosa*), and poison ivy (*Toxicodendron radicans*). Though of lesser significance, woody species also serve to distinguish this association, most of which are stunted and contorted, bearing testimony to the ecological importance and abrasive force of flooding. Typical small trees and shrubs include river birch (*Betula nigra*), black willow (*Salix nigra*), Carolina willow (*Salix caroliniana*), green ash (*Fraxinus pennsylvanica*), maidenbush (*Leptopus phyllanthoides*), and buttonbush (*Cephalanthus occidentalis*). Pepper-vine (*Ampelopsis arborea*) and cross-vine (*Bignonia capreolata*) are common vines, often trailing along the ground surface.

Rare species present: maidenbush (*Leptopus phyllanthoides*) and Elliott's fan-petal (*Sida elliotii*).



Figure 5. (*Salix* spp.) / *Andropogon gerardii* – *Panicum virgatum* – *Salvia azurea* Cahaba Riverwash Herbaceous Vegetation

- ◆ *Hymenocallis coronaria* – *Justicia americana* Herbaceous Vegetation
[Translated Name: Cahaba Lily – Water-willow Herbaceous Vegetation]
(Common Name: Spiderlily – Water-willow Rocky Shoals)

Scattered intermittently along the Cahaba River (within the Refuge and beyond) is a series of rocky shoals characterized by a prominence of Cahaba lilies (*Hymenocallis coronaria*). While the lilies command the attention of most observers, the shallow rapids and the general littoral zone of the River furnish favorable habitat for several smaller species such as the following which grow partly immersed in the water, although some of them may be left stranded as the water recedes: water-willow (*Justicia americana*), soft rush (*Juncus effusus* var. *solutus*), lizard's-tail (*Saururus cernuus*), and sensitive fern (*Onoclea sensibilis*).

From a national perspective this association is recognized as one of the most vulnerable and endangered ecological systems in North America. Never very common, *H. coronaria* is known only from the rapids along the Fall Line, extending from central Alabama, through Georgia, to the vicinity of Columbia, South Carolina. Apart from water quality concerns, many occurrences are now forever submerged in the numerous reservoirs that have been constructed to serve the interests of humanity.

Rare species present: Cahaba lily (*Hymenocallis coronaria*).

◆ Roadsides

Roadsides are very similar floristically and structurally to successional fields, but typically support a greater plant diversity. In fact, roadsides are among the most interesting plant communities at CRNWR and adjacent areas, for they represent a conglomerate of floristic elements of diverse origins. Because roads are frequently associated with human habitation, both past and present, roadside plant communities often feature species that have escaped from or persist after cultivation. Examples at CRNWR include Chinese wisteria (*Wisteria sinensis*), Rose-of-Sharon (*Hibiscus syriacus*), and Formosa firethorn (*Pyracantha koidzumii*). The high disturbance associated with roadsides also provides suitable habitat for a diverse array of native and exotics weeds. New introductions are likely to be seen first along roads, which can provide far-reaching connections between seed source and suitable dispersal habitat. Examples of common native roadside flora include Canada goldenrod (*Solidago canadensis*), bitterweed (*Helenium amarum*), ragweed (*Ambrosia artemisiifolia*), and dog fennel (*Eupatorium capillaceum*). Exotics frequently encountered include tall fescue (*Festuca arundinacea*), Nepal grass (*Microstegium vimineum*), Chinese bush-clover (*Lespedeza cuneata*), and Brazilian vervain (*Verbena brasiliensis*). Whereas the species mentioned so far can be found along roads throughout the Refuge, roadside communities, to a degree, also reflect the plant communities that immediately surround them. Thus, roadsides associated with longleaf pine forests often feature such species as little bluestem (*Schizachyrium scoparium*), goat's-rue (*Tephrosia virginiana*), woodland sunflower (*Helianthus divaricatus*), and grass-leaf golden-aster (*Pityopsis graminifolia*).

2. Natural Community Diversity at Cahaba River National Wildlife Refuge

From a casual observation, the longleaf pine – shortleaf pine – (Virginia pine) / blackjack oak – (chestnut oak) / lowbush blueberry woodland is the most notable feature of the Refuge landscape, a representation of highly variable levels of maturity that have resulted from different land use practices.

The majority of the Cahaba River landscape is comprised of fire-maintained communities. Without fire, the pyrogenic associations that naturally occur on CRNWR will gradually transform into various hardwood-dominated associations to the detriment of both species and habitat diversity. Although the historic ratio of fire-maintained hardwoods (e. g., some oaks and hickories) to longleaf and shortleaf pines is poorly known, the restoration and maintenance of Cahaba River's fire-adapted communities depends on the application of prescribed fires that mimic natural fire frequencies and timing. The natural fire return interval in Alabama's longleaf pine-associated communities is variable, where contemporary research suggests fire frequency is highest along the Gulf Coast with a marked decrease on proceeding north. While fire frequency along Alabama's coast is approximately two to ten years, the natural burning regimen in the state's montane region has been, and continues to be, the subject of much debate.

There is little doubt that both lightning and indigenous peoples were responsible for burning many of the state's woodlands and forests prior to the arrival of European settlement. However, the relative importance of each in molding the plant and animal life is debated among ecologists and land managers. Many argue that plants evolved largely in response to lightning-ignited fires, and thus react differently to burning during the season that lightning fires are common (mid-May through August) than to burns in other times of the year. Supporting this theory is the strikingly prolific flowering response of wiregrass (*Aristida stricta*) along the Coastal Plain when it is

burned in late spring and summer, and the near absence of flowering when burning occurs other times of the year. This physiological response may be viewed as an adaptive strategy to produce seed only when the ground has been recently cleared of vegetation, increasing the chances of establishment. Detracting from this argument is the fact that while fire stimulates the flowering of some species, many do not appear to be strongly dependant on a particular season of fire for successful reproduction.

In addition to fire, mechanical removal and herbicide application are two other methods of midstory vegetation control that can be used. Neither is recommended for use in high quality community types, but are beneficial for some restoration purposes. Two reasons are often given for mechanical tree removal in restoration and maintenance of fire-maintained communities. The first is removal of hardwoods that have encroached due to long-term fire suppression. The second reason is partial thinning of the canopy to enhance the growth and reproduction of the herbaceous layer, or to create a more natural distribution of canopy trees. However, caution is advised when incorporating mechanical tree removal, as the technique can impart undesirable side effects in areas containing an intact native, herbaceous groundcover. The equipment used in mechanical tree removal churns and compacts the soil, damaging groundcover species necessary for carrying fire, and promoting the germination of undesirable species that compete for light and nutrients with more desirable species.

Herbicide application is generally not recommended as a management tool within high quality natural communities, unless it is the only feasible alternative for combating exotic species. Various chemicals are available to kill hardwood and exotic species that have encroached into fire-maintained areas because of fire suppression.

The relative effects of mechanical removal and herbicide on natural community restoration needs to be better understood. For example, it is unknown what impacts are imposed on plant-mycorrhiza relationships through herbicide application or how such chemicals affect water quality. Until the effects of mechanical tree removal and herbicides are better understood, these techniques should not be employed in high quality natural communities.

3. Invasive Exotic Species

Invasive exotic species have demonstrably caused irreparable damage to various natural communities throughout the Southeast. Chinese privet (*Ligustrum sinense*) (Figure 6), Japanese honeysuckle (*Lonicera japonica*), mimosa (*Albizia julibrissin*) (Figure 7), and Chinese bush-clover (*Lespedeza cuneata*) are four invasive plant species that have become well established in several locations on CRNWR. Major infestations of exotic plant species on the Refuge are illustrated in Figure 8. These species are capable of colonizing large areas throughout warmer regions of the world. Japanese honeysuckle was first introduced into the New World at Long Island, New York, to embellish the gardens of Colonial America. Since then, the popularity of this species as a garden plant has enabled it to quickly spread throughout much of the eastern United States, displacing desirable native vegetation. Also firmly established in bottomlands of the Refuge is Chinese privet, a species first introduced from China in 1852 having been promoted as a fast-growing, disease-free alternative to other ornamental species. Reportedly escaped from cultivation as early as the 1930s in Louisiana, this shrub has now become widely

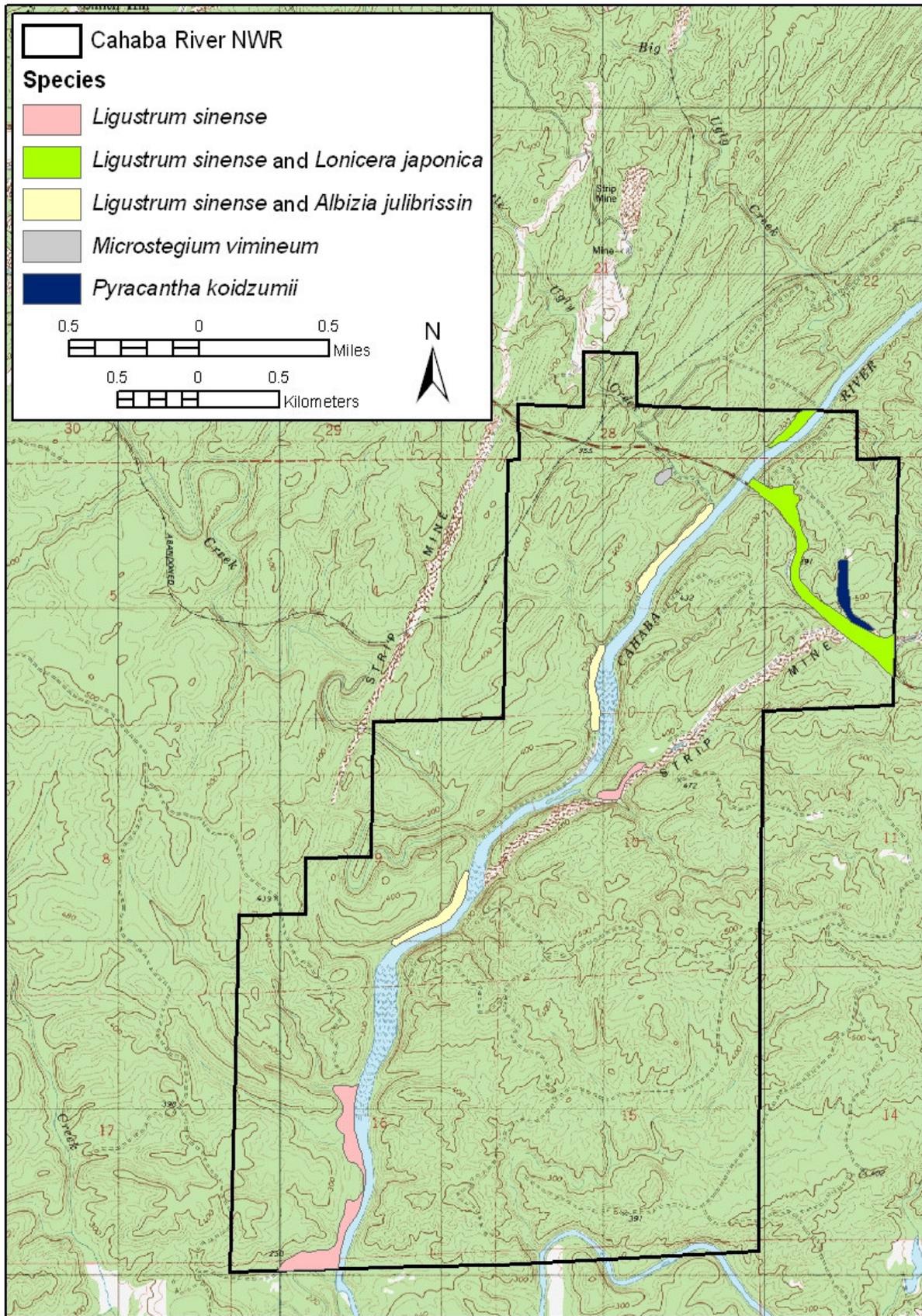


Figure 6. Major infestations of exotics on Cahaba River National Wildlife Refuge

naturalized in the Southeast, often monopolizing large areas. The widespread dispersal of the above-mentioned and other exotic species have been primarily attributed to highway maintenance and construction, horticultural purposes, and the enhancement of wildlife habitat. The illegal disposal of yard trash has also aided the spread of these and other invasive species. Invasive plant species documented on CRNWR during the course of this project appear in Table 2.

Table 2. Exotic plant species observed in Cahaba River National Wildlife Refuge

Scientific Name	Common Name	Degree of Severity*
<i>Albizia julibrissin</i>	mimosa	1
<i>Alternanthera philoxeroides</i>	alligator-weed	2
<i>Briza minor</i>	little quaking grass	3
<i>Colocasia esculenta</i>	wild taro	2
<i>Festuca arundinacea</i>	tall fescue	2
<i>Hemerocallis fulva</i>	orange day-lily	3
<i>Hibiscus syriacus</i>	Rose-of-Sharon	3
<i>Lespedeza bicolor</i>	Japanese bush-clover	2
<i>Lespedeza cuneata</i>	Chinese bush-clover	1
<i>Ligustrum sinense</i>	Chinese privet	1
<i>Lonicera japonica</i>	Japanese honeysuckle	1
<i>Lygodium japonicum</i>	Japanese climbing fern	2
<i>Microstegium vimineum</i>	Nepal grass	2
<i>Paspalum urvillei</i>	Vasey grass	2
<i>Paulownia tomentosa</i>	princess-tree	2
<i>Perilla frutescens</i>	beefsteak plant	3
<i>Poncirus trifoliata</i>	trifoliolate orange	2
<i>Prunella vulgaris</i>	selfheal	3
<i>Pyracantha koidzumii</i>	Formosa firethorn	2
<i>Senna occidentalis</i>	coffee senna	3

- * Category 1 = Species that have invaded and disrupted the natural processes in Cahaba River NWR.
- Category 2 = Species that have shown potential to invade and disrupt natural processes, but pose no immediate threats in Cahaba River NWR.
- Category 3 = Species that have shown no or minimal potential to invade and disrupt natural processes in Cahaba River NWR.

Monitoring and treatment of existing infestations, and preventing the encroachment of new populations should remain an important component of land management throughout the CRNWR. Education of land managers about problems associated with exotic pests coupled with the use of native species indigenous to the region for improving wildlife habitat may be beneficial in this effort. If non-native cultivars must be used, then invasive species should be avoided. Many invasive exotic species are sold in nurseries, despite their known destructive impacts on native vegetation. Element Stewardship Abstracts (ESA) have been prepared by The Nature Conservancy to provide guidance to land managers and homeowners regarding the control of specific exotic and weedy species. The Conservancy continuously prepares new publications and updates existing ESAs. It is recommended that the program's internet website

(<http://tncweeds.ucdavis.edu>) be accessed at least twice yearly to receive the latest revisions. Currently, the website has information on over 180 invasive weed species, as well as management plan templates, weed control methods, tool reviews, and other sources pertinent to invasive species control. Additional websites are also available that offer guidance and technical support on all aspects of exotic species, three of which are highlighted below.

Invasive and Exotic Species of North America (<http://www.invasive.org/seweeds.cfm>): A compilation of invasive species prepared by various federal agencies that offers a listing of invasive plants documented from each of the 13 southeastern states.

Southeast Exotic Pest Plant Council (<http://www.se.eppc.org>): A non-profit organization dedicated to promoting public awareness about the spread of exotic plants and to serve as an outlet for educational, advisory, and technical support on all aspects of exotic plants in the Southeast. The website also provides information on grant opportunities, publications, upcoming events, and links to other webpages devoted to invasive species.

National Invasive Species Council (<http://www.invasivespecies.gov>): A website that focuses on federal efforts concerning invasive species. The site offers information outlining the impacts of invasive species and the Federal government's response, as well as furnishes profiles of exotic species and links to agencies and organizations dealing with invasive species issues.

PART III: BOTANY

Introduction

A rich mosaic of habitats and natural communities characterize the landscape along the Cahaba River and across the greater Bibb County area. Collectively, the region's upland forests, forested bottomlands, dolomite glades, and river shoals form a broad spectrum of floral assemblages that, in turn, support an exceptional diversity of plant life.

The vegetation found in this area can be broadly defined into two categories: generalists (those species occurring across various habitats) and specialists (species having narrow ecological requirements and are restricted to particular habitats). The mixed pine – hardwood forests of the uplands, for example, contain a suite of species entirely restricted to the well-drained, rocky soils indicative of this natural community. Yet, another group of plant species inhabit only mesic soils that occur further downslope along the Cahaba River. Wetland associations on the other hand, such as river shoals and seepage areas, support floral assemblages that are unique to each of these widely varying environments. And within this complex of habitat extremes are generalists that typically occur throughout this diverse region. This array of plant life includes rare and/or declining species as well as those that are common and abundant in the region.

Following the arrival of Europeans and their descendants, broad scale alterations to the landscape in the vicinity of the Refuge have completely removed or seriously impeded the ecological processes that once maintained a complex of functional ecosystems. The matrix of upland forests has nearly disappeared from areas surrounding CRNWR to serve the interests of forestry and coal production. Today, only a few viable remnants remain.

Fortunately, localized extinctions and extirpations of species intimately associated with the regional landscape are avoidable and potentially reversible provided that lands are protected from large-scale development and ecological processes restored. The following discussion and

tables are intended to provide baseline knowledge of vascular plants that are currently found on the Refuge. Hopefully, this information will help direct and propel a holistic view of this diverse matrix that will ultimately lead to an active preservation and ecological restoration program at Cahaba River National Wildlife Refuge.

Methodology

Natural history information, occurrence records, and species accounts of vascular plants potentially associated with CRNWR were extracted from published literature, unpublished reports, anecdotal accounts, and museum collections. This list was prepared to facilitate survey efforts for species having the greatest likelihood of occurring on the Refuge. Survey for rare plants were generally conducted in conjunction with natural community surveys, being specifically arranged to coincide with the optimum season for identification. A vast majority of field work was conducted on foot, with some areas having been accessed by canoe. When an occurrence of a rare plant species was located, field data pertinent to population specifics (size, status, vulnerability), habitat conditions, and management needs were gathered and entered onto an Element Occurrence form. This information was then processed and computerized in ALNHP's Biological Conservation Database at Auburn University.

Botanical nomenclature is in accordance with Synthesis of the North American Flora (The Biota of North America Program 1999), with the Flora of North America (Flora of North America Editorial Committee 1993+) serving as an additional reference.

Results and Discussion

Currently, 22 populations of 12 rare plants, as recognized by the Alabama Natural Heritage Program as conservation concern, occur within the Refuge boundaries (Figure 7). A case study of each species is presented below, including brief management recommendations, which, if implemented, will help ensure the long-term viability of these species on the Refuge. Five plants formerly monitored by ALNHP as rare species are also noted. Two tables outlining the results of the botanical surveys follow this section.

1. *Corallorhiza wisteriana* (spring coralroot)

Orchidaceae (Orchid) Family. Saprophytic herb arising from a multibranched, jointed, yellowish rhizome. Stems yellow-brown to purple, up to 30 cm in height. Flowers are loosely arranged at the summit of the stem; lateral petals and sepals attain 2 mm in width and 7 mm in length, are green to yellow, suffused and mottled with various shades of purple, generally converging over the lip (lower petal); the lip is white, spotted with pink or purple. Fruit capsule is pendent, ovoid, to 6 mm across and 10 mm long. Flowering season (in Alabama): late February – early April.

In Alabama spring coralroot is one of the first woodland wildflowers to herald the arrival of spring. Throughout the southern portion of the state the species frequently produces flowers in late February, often well before the threat of cold weather subsides. While the species is capable of achieving a trivial amount of photosynthesis, the majority of its nourishment is obtained from decomposing organic material in the soil. As such, the plant produces no leaves. To further heighten the unusual characteristics of the species, the rhizomes are curiously clustered, branching roughly at 60° angles, and are peculiarly jointed, resembling vaguely sea-coral or even some type of crystal (Luer 1972).

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Figure 7. Locations of rare plant occurrences in Cahaba River National Wildlife Refuge

2. *Croton alabamensis* var. *alabamensis* (Alabama croton)

Euphorbiaceae (Spurge) Family. Diffusely-branched, medium-sized shrub to 3 m tall. Stems exhibit an irregular forking habit, generally branching at the base of old inflorescences; younger twigs are terete, covered with a dense layer of silver scales. Leaves alternate, elliptic to narrowly ovate, the lower surface covered with a dense coating of silver scales, upper surface yellowish-green, margins entire, the largest attaining 10 cm in length. Inflorescence is a terminal cluster comprised of male and female flowers, 5-parted, petals and sepals pale green, roughly 3-4 mm long. Flowering season: late February – early April.

Croton alabamensis var. *alabamensis* was first brought to the attention of botanists by Professor Eugene A. Smith, who found it in the summer of 1877 near Pratt's Ferry in Bibb County, Alabama. Since this initial discovery, the taxon was then discovered by Roland M. Harper along the south banks of the Black Warrior River near Tuscaloosa in 1905. Additional occurrences have since been found, but only in the vicinity of the original discoveries. In 1989 a similar appearing species was discovered at Fort Hood Military Reservation in Caryell County, Texas, on the eastern edge of the Edwards Plateau. Through a comparative analysis of the



Figure 8. *Croton alabamensis* var. *alabamensis* (Alabama Croton)

Alabama and Texas populations, it was determined that the species in Texas, although similar, was sufficiently distinct to merit a varietal status. The Texas variety *Croton alabamensis* var. *texensis* (Texabama croton) is separated from the Alabama variant by nearly a thousand kilometers, a remarkable disjunction considering that so few populations are known (Ginzburg 1992).

The preservation of Alabama croton is best accomplished by maintaining the integrity of the upland habitat which this species favors. Although intolerant of fire, the species is known to resprout after burning, as witnessed nearby on The Nature Conservancy's Bibb County Glades Preserve.

3. *Hymenocallis coronaria* (shoals spider lily, Cahaba lily)

Liliaceae (Lily) Family. Perennial; leaves linear, to 5 cm wide and 8 cm long, arising from an ovoid-shaped bulb. Flowers borne in terminal clusters, white, 6-parted, with perianth consisting of linear segments that are connected by, and extend beyond, a broadly cup-shaped corona. Flowering season: May – early June.

The shoals spider lily is an emergent aquatic species narrowly restricted to the major river systems associated with the Fall Line in Alabama, Georgia, and South Carolina. Due to its specific habitat requirements – rocky shoals, with an open canopy – the species is considered rare and imperiled throughout its range. *Hymenocallis coronaria* attains its greatest prominence

in Alabama, where no less than 40 occurrences are known, many of which inhabit the Cahaba and Little Cahaba Rivers.

Because of its preference for high gradient, clear flowing streams, the long-term viability of the species depends on the health of the stream itself. Unfortunately, refuge personnel will have only limited influence to minimize threats affecting water quality. Interpretive brochures, on-site exhibits (kiosks), and other sources of public outreach will inform visitors about the sensitivity surrounding the lilies and their habitat.

4. *Lathyrus venosus* (smooth veiny peavine)

Fabaceae (Pea) Family. Climbing perennial herb to 2 m long. Leaves compound, with 10-12 ovate to elliptic leaflets, 1.5-6.5 cm long. Flowers purplish, to 2 cm in length, closely clustered along a peduncle that arises from the leaf axis. Flowering season: late April – early June.

Lathyrus venosus is a broadly distributed species of eastern North America but is relatively rare in Alabama. A plant of forested slopes and stream banks, it often colonizes large areas that contain several hundred stems. Its presence at CRNWR, however, is restricted to the lower slopes along either side of the Cahaba River, occurring more abundantly on the east side of River.

Management for this species should focus on maintaining the integrity of the mesic hardwood forest where it occurs. Prescribed fire should be allowed to burn naturally from adjacent upland forests into the lower slopes and bottomlands, where it will extinguish itself. Exotic species, most notably *Ligustrum sinense*, are beginning to encroach upon portions of the populations and should be eradicated.



Figure 9. *Lathyrus venosus* (Smooth Veiny Peavine)

5. *Leptopus phyllanthoides* (maidenbush)

Euphorbiaceae (Spurge) Family. Leafy, low-growing shrub generally less than 1 m in height; leaf blades elliptic- to obovate-oblong mostly exceeding 1 cm in length. Flowers inconspicuous with male and female flowers borne on separate plants, 5-parted, petals shorter than the sepals, yellowish-green in color. Flowering season: late June – October.

Although relatively common and widespread in the mountainous regions of central Texas, western Arkansas, southern Missouri, and Oklahoma, the species assumes a sporadic and localized distribution in Alabama. Originally discovered in the state by the well-known author-naturalist Blanche Dean along the Locust Fork River in Blount County, in 1966, the presence of the species along the Cahaba and Little Cahaba Rivers in Bibb County would not be realized until 1992 when James Allison of the Georgia Natural Heritage Program and Timothy Stevens of Montgomery embarked on their monumental studies of the Bibb County Glades.

Two occurrences are currently known from the Refuge, both of which inhabit water-scoured areas along the Cahaba River. The preservation of *Leptopus phyllanthoides* at both sites will require minimal management efforts; however, vehicular damage to one site is apparent.

6. *Marshallia trinervia* (broadleaf Barbara's-buttons)

Asteraceae (Aster) Family. Leafy-stemmed perennial 3-7 dm in height. Leaves thin, broadly lanceolate to ovate, prominently 3-nerved, to 2 dm in length. Flowers pink, small, 5-parted, clustered in terminal heads 2-3 cm wide, borne on a peduncle 1-2 dm long. Flowering season: June – July.

A poorly-known and rare species, *Marshallia trinervia* is endemic to the southeastern United States, generally preferring moist rocky streambanks under partial shade. While attributed to calcareous clays in some botanical manuals, known sites in Alabama are underlain by primarily acidic substrates comprised of sandstone and granite.

The viability of this species is dependent on the maintenance of its streamside habitat. The greatest threat to occurrences on CRNWR is the pervasive influence of exotic species, namely *Ligustrum sinense*. Efforts to eliminate invasive taxa, specifically those proximal to rare plant occurrences, are recommended.

7. *Melanthium latifolium* (slender bunchflower)

Liliaceae (Lily) Family. Erect, leafy perennial to 1.6 m in height, arising from a thick, fleshy rootstock. Leaf blades narrowly oblanceolate, to 7 cm wide and 55 cm long. Flowers borne in a diffusely-branched inflorescence, 6-parted, greenish white to light yellow, becoming green with age, to 10 mm across. Flowering season: late June – July.

Known in Alabama from only three sites in Bibb County, these occurrences are disjunct by roughly 150 miles from their nearest known sites in the southern Appalachians of northwest Georgia. On CRNWR the species occurs in the northern-most section of the Refuge where it inhabits mesic, wooded slopes under a mixed canopy of *Fagus grandifolia*, *Quercus alba*, *Quercus falcata*, *Oxydendrum arboreum*, and *Kalmia latifolia*.

The preservation of *Melanthium latifolium* is best achieved by maintaining the cool, forested conditions that this species requires. Canopy removal will greatly jeopardize long-term viability by inducing soil desiccation and increased surface temperatures. Further, erosion may occur if the slopes remain unvegetated for an extended period of time.

8. *Phlox pulchra* (Wherry's phlox)

Polemoniaceae (Phlox) Family. Perennial herb 3-5 dm tall. Leaves opposite, equally distributed along stem, to 20 cm in length. Flowers pink, lavender, or rarely white, 2-2.5 cm long, clustered at the apex of the stem. Flowering season: mid May – June.

The mesic hardwood forest where this species occurs is not a fire-adapted community; it is assumed that *Phlox pulchra* is not fire-tolerant. However, extreme measures to exclude fire from these sites, such as entrenched fire lines, are not recommended and could potentially damage occurrences of this species. Fires in adjacent areas will naturally extinguish upon entering the relatively non-flammable ground litter of the hardwood forests and should not pose a direct threat. The best recommendation for long-term protection of this species is to maintain its habitat in an undisturbed condition.

9. *Sedum nevii* (Nevius' stonecrop)

Crassulaceae (Stonecrop) Family. Low rhizomatous perennial to 15 cm high. Leaves succulent, sessile, spreading, spirally arranged along stem, assuming two growth forms: those of fertile shoots are nearly terete, variously linear to narrowly oblanceolate and those of sterile shoots are broadly spatulate at the base of the plant, becoming linear and very leafy toward the tip. Flowers sessile, arranged on the upper side of a branched inflorescence; petals white, generally 5-parted (sometimes 4-parted), 5 mm in length. Flowering season: May – early June.

According to ALNHP records Nevius' stonecrop was originally reported from the Refuge in 1992 – from forested slopes along the east side of the River – but could not be relocated on behalf of this project. The species is highly sensitive to disturbance, usually succumbing to the slightest change in its environment. Preservation of the species will be best accomplished by maintaining the cool micro-habitat that it favors.



Figure 10. *Sedum nevii* (Nevius' Stonecrop)

10. *Sida elliotii* (Elliott's fan-petal)

Malvaceae (Mallow) Family. Many-branched, erect, perennial herb, 6-12 dm high. Leaves alternate, linear to narrowly oblong, to 8 mm wide and 6 cm long. Flowers bright yellow, 2-3 cm across, generally solitary in leaf axils. Flowering season: June – October.

Sida elliotii is widely distributed throughout the Southeast, preferring well-drained soils in open woodlands and fields. At CRNWR, the species inhabits the water scoured shoreline of the Cahaba River, in association with another rare plant, *Leptopus phyllanthoides*.

The long-term preservation of this species is dependent on maintaining the integrity of the riverside habitat where it occurs. Vehicles should be discouraged from entering this area to prevent soil and other types of disturbance.

11. *Stewartia malacodendron* (silky camellia)

Theaceae (Tea) Family. Shrub to 6 m in height. Leaves simple, alternate, elliptic, to 10 cm in length. Flowers few, borne in leaf axis, to 8 cm across; petals white; stamens numerous, purple. Flowering season: early May – early June.

Silky camellia is a rare species extending primarily along the Atlantic and Gulf Coastal Plains from southeastern Virginia south to northern Florida and west to southeast Texas. In Alabama, the species sporadically occurs throughout the southern two-thirds of the state favoring acidic soils of forested slopes. One occurrence is known from CRNWR, along an intermittent stream under a filtered canopy of mature hardwoods adjacent to the Refuge's northern boundary.

The forest association where silky camellia grows is not fire-adapted; therefore, prescribed burning is not recommended. The preservation of the canopy under which this species exists is essential for its long-term survival.

12. *Symphyotrichum georgianum* (Georgia aster)

Asteraceae (Aster) Family. Perennial; colonial habit, with a single stem (sometimes two) arising from a rhizome, to 15 dm in height. Leaves clasping, alternate, scabrous, lanceolate to oblanceolate, to 70 mm long and 30 mm wide. Flowers displayed in a widely diffuse inflorescence; purple with white center disk, to 5 cm across. Flowering season: early October – mid November.

Georgia aster is a showy species restricted to the Piedmont and Ridge and Valley physiographic provinces extending from Alabama northeastward into North Carolina. In Alabama the plant is represented by 35 occurrences in seven counties, primarily in the central portion of the state. The species was originally discovered by Alfred Cuthbert north of Augusta, Georgia, in 1898. The Augusta-born botanist sent a specimen to the New York Botanical Garden where the species was subsequently described as *Aster patens* var. *georgianus* by Edward Alexander in Small's "Manual of the Southeastern Flora" published in 1933 (Matthews 1993).



Figure 11. *Symphyotrichum georgianum* (Georgia Aster)

Since Alexander's original description, the species has undergone a series of taxonomic revisions as to the proper disposition within the Asteraceae complex. Many authorities now follow the most recently accepted determination, *Symphyotrichum georgianum*.

Given its preference for dry, open woodlands, maintenance of these habitats will be critical toward ensuring the viability of this species on the Refuge. Fire is the foremost driving force behind restoring and maintaining the conditions required by the species for growth and

reproduction. In the absence of fire, woody vegetation will soon invade and outcompete, and gradually eliminate, the plant. Georgia aster is particularly abundant along some roadsides where the disturbed soil mimics the effects of fire, and where increased light levels favor this species. With the widespread use of prescribed fire to open the canopy and expose the soil, this species should flourish.

Table 3. Statewide significance of rare plants in Cahaba River National Wildlife Refuge

Scientific Name	Common Name	Number of Element Occurrences (EOs) in Cahaba River NWR	Number of EOs in Alabama	% of state EOs in Cahaba River NWR	Number of protected EOs in Alabama
<i>Corallorhiza wisteriana</i>	spring coralroot	1	10	10	6
<i>Croton alabamensis</i> var. <i>alabamensis</i>	Alabama croton	2	47	4	14
<i>Hymenocallis coronaria</i>	shoals spider lily	5	41	12	7
<i>Lathyrus venosus</i>	smooth veiny peavine	2	5	40	5
<i>Leptopus phylanthoides</i>	maidenbush	2	21	10	10
<i>Marshallia trinervia</i>	broadleaf Barbara's-buttons	2	4	50	3
<i>Melanthium latifolium</i>	slender bunchflower	1	3	33	1
<i>Phlox pulchra</i>	Wherry's phlox	1	6	17	1
<i>Sedum nevii</i>	Nevius' stonecrop	1	34	3	5
<i>Sida elliotii</i>	Elliott's fan-petal	1	19	5	8
<i>Stewartia malacodendron</i>	silky camellia	1	11	9	1
<i>Symphyotrichum georgianum</i>	Georgia aster	3	35	9	5

Table 4. Plants formerly monitored by ALNHP as rare species that occur on Cahaba River NWR

Scientific Name	Common Name	Number of occurrences in Cahaba River NWR
<i>Gentiana saponaria</i>	soapwort gentian	1
<i>Gentiana villosa</i>	striped gentian	1
<i>Listera australis</i>	southern twayblade	1
<i>Monotropa hypopithys</i>	piresap	1
<i>Panax quinquefolius</i>	ginseng	2

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APPENDICES

APPENDIX 1: Element Occurrence Records of Rare Vascular Plants and Select Natural
Communities in Cahaba River National Wildlife Refuge

MAP INDEX: 371

Element Occurrence Record
CORALLORHIZA WISTERIANA

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APPENDIX 2: Completed Natural Community Field Forms
(included separately)

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