

# INVESTIGATION OF SELECTED SITES ON SMITH LAKE

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## **1.0 INTRODUCTION**

### **1.1 Purpose**

The purpose of this study is to survey Forest Service (FS) lands within the range of influence of reservoir operations on Smith Lake. Our investigation mostly involved a 35 foot buffer from the edge of average, pool levels. Pool levels were near maximum during most of the study period. Exploration of areas outside this buffer took place when rare species habitats were observed. In practice, the buffer was extended from waters edge to the base of bluffs. Bluffs were searched for grottoes, crevice plants, seeps, etc., though most were well outside the range of direct influence by reservoir operations.

This investigation specifically sought:

1. limestone and sandstone glades;
2. coves, ravines, canyons, grottoes (rock houses);
3. exotic species, particularly those that are invasive;
4. PETS and other locally rare species, and their habitat;
5. primary human influences on natural communities; and
6. obvious disease or arthropod infestations.

In addition, a sketch of the vegetation (some sites are large with miles of shoreline) was created. A preliminary floristic list was compiled based upon field observations on each site. It is evident that some common taxa occurring on-site may not be on the list; however, an effort was made to identify and list all taxa observed on each site. Floristic lists for an individual site are incomplete; however, it is anticipated that the combination of floristic lists contains common taxa observed throughout the Smith Lake environs.

## 1.2 Methods

Our field studies were initiated in June 2003, and concluded in July 2003. Sites were identified and located using Bankhead National Forest (USDA 1985), and Lewis Smith Development maps (Alabama Power 2003). USGS topographic maps were also utilized to locate FS lands. In some cases, lands noted on Lewis Smith Development maps (Alabama Power 2003) as “public lands” were posted as FS lands while in other cases, sites were not posted as FS lands. In other places, lands noted on maps as FS lands were apparently privately owned. Great effort was made to locate FS postings and the traditional red blazes used to mark property boundaries.

Data forms were completed for each site comprising the following information:

- ❖ date(s) of study;
- ❖ quadrangle name;
- ❖ GPS coordinates;
- ❖ topographic map;
- ❖ disturbances;
- ❖ invasive species;
- ❖ physical description of site;
- ❖ images of site;
- ❖ vegetation;
- ❖ PETS;
- ❖ management considerations;
- ❖ listed plant survey form and image (if PETS are present); and
- ❖ a provisional list of common flora.

Trimble Geo-3 data loggers were used to determine GPS locations. Occasionally, we had to move away from bluffs to improve the geometry of satellites used to determine our location so accuracies may lack precision. Disturbances include man-made and natural influences. Nearly all species were determined on-site. Nomenclature reflects that in

Radford *et al.* (1968) and Spaulding *et al.* (2000). Digital images were made using a Sony camera equipped with a Zeiss variable focus lens.

Differing survey techniques were utilized depending upon topography. Transects were walked roughly parallel to the shoreline on some sites. On large sites and small ones with rough or very steep terrain, observations were made by making landings where practicable and using a boat to survey the site. Many sites have vertical rock faces along the shoreline that precluded exploration except where rock benches are exposed along the toe slopes.

## **2.0 PHYSICAL ATTRIBUTES**

### **2.1 Soils**

Arenaceous soils prevail within the project area. Parent material within the project is sandstone. Soils along gentle slopes comprise alluvium and colluvium. Soils are characteristically fine, sandy loams that are low in organic matter and fertility. A clay or silt horizon is present where soils are deeper. Most sites lack soil or contain a thin layer of unconsolidated sediments ranging from clays, silts and sand to pebbles, cobble, and boulders. Some sites comprise solid rock. Wooded areas generally have an organic layer mostly comprising materials such as leaves, twigs, wood, and other debris in myriad stages of decomposition. Other sites have open, thin soils or well-washed sands with little surface litter. Soils are mostly acidic.

### **2.2 Geology**

Geology of this region is sedimentary. Sandstones and conglomerates of the Pottsville Formation form most of the surface of the plateau. These are highly resistant to erosion and cap most ridges. Limestone or shale may underlie this resistant cap. Thus, limestone and shale are usually exposed along lower portions of stream valleys in this area. No limestone was observed on FS lands within the project area. Some thin beds of shale are exposed within some of the FS lands, but no large exposures were observed. Coal (carboniferous shale) is well-developed in this part of Alabama.

A significant portion of the land has been surface mined. Original topography is altered, and with discharge elimination devices (NPDES) of early mining operations virtually non-existent, sediment loading of many streams is heavy. Other water quality issues hark back to this activity.

### 2.3 Hydrology

All waters flowing into this area come from local precipitation (Cumberland Plateau) or from subsurface sources. Stream flow and pool levels are likewise dependent on this same precipitation. Smith Lake is the second largest body of water on the Cumberland Plateau of Alabama. Smith Lake is formed by Lewis Smith Dam that is situated on the Black Warrior River near the confluence of Sipsey Fork and Ryan Creek.

Primary streams contributing to Smith Lake include Ryan Creek, East Sipsey Fork, Dismal Creek, Clear Creek, Clifty Creek, Yellow Creek, and West Sipsey Fork. The channel emptying Smith Lake is Sipsey Fork. Below Smith Lake, the Sipsey Fork merges with the Mulberry Fork which flows into Bankhead Lake (an impoundment on the Black Warrior River).

Smith Lake is an impoundment created for the production of hydroelectric power, for recreation, as a water source, and serves in many ways as an important asset to the economy of all communities that border the facility. As a source of hydroelectric energy, a primary feature is a vastly fluctuating pool level resulting from plant operations, flood control measures, and from natural variation in precipitation. Winter pool levels are around 490 feet (elevation) while summer levels are about 510 feet. Flood levels are known to reach about 522 feet. Thus, pool amplitude fluctuates about 20 feet during years with average precipitation. The “draw down” action creates a variable boundary of vegetation with mostly non-vegetated land surrounding the water during low pool levels. These non-vegetated lands are flooded during other time periods so that the pool meets the edges of vegetation or even floods some low-lying communities. Due to marked differences in topography, non-vegetated flats may extend for many yards from vegetated slopes or water levels may merely move up and down very steep rock faces.

## **2.4 Physiography**

Smith Lake occupies a portion of the Appalachian Highlands. Generally, the Appalachian Plateau Province is a plateau region of the Appalachian chain that lies west of the Blue Ridge and the Ridge and Valley sections. Specifically, this area is referred to as the Cumberland Plateau which is similar to and perhaps not historically and geomorphologically different from the Allegheny Plateau which is a northern border to the Cumberland Plateau. The nearest physiographic border is the Gulf Coastal Plain which extends in a crescent through adjacent counties of Franklin, Marion, Fayette, and Tuscaloosa.

## **2.5 Topography**

This area is a plateau or a tableland. A primary feature is an undulating, “flattened” surface. Generally speaking, the plateau is gently tilted from northeast to southwest so it dips into the sediments of the coastal plain along the western and southern borders. Streams have carved knolls, slopes, ravines, canyons, and gulfs into the surface of the mass of rocks. Thus, bluffs have at their apex characteristically flattened shoulders with shallow soils backed by deeper soils of gently undulating lands. Slopes frequently have rock benches of resistant sandstones. Grottoes or rock houses are common features at the base of bluffs. These are overhangs of sandstone in varying sizes and represent erosion of the base of the bluff. Boulders and cobble abound near openings of the grottoes.

Grottoes are well known to plant enthusiasts due to the unique habitat provided in their darkened, wet recesses. Summer temperatures are moderated and cooler than ambient just outside the grottoes. Winter temperatures are likewise moderated by the rock masses, and seeps with water temperatures around 60° F (summer and winter).

## **3.0 BIOLOGICAL ATTRIBUTES**

### **3.1 Vegetation**

#### **3.1.1 Overview**

Vegetation of the Cumberland Plateau is generally Oak-hickory forest (Fagales-Juglandales). This forest type is part of the Eastern Deciduous Forest Biome, a name referring to the mixture of dominant canopy species that characteristically lose their leaves in the winter condition. The understory is highly variable ranging from a thick shrub/sapling stratum with a sparse herb layer to thinly populated shrub coverage with extensive herb cover.

#### **3.1.2 Tablelands**

Most relatively undisturbed communities comprise an oak-hickory forest. Common oaks are *Quercus alba* (white oak), *Q. coccinea* (scarlet oak), *Q. velutina* (black oak), *Q. montana* (rock chestnut oak), and *Q. shumardii* (Shumard's oak). Hickories may or may not predominate, however, commonly encountered taxa are *Carya glabra* (pignut hickory), *C. pallida* (sand hickory), and *C. tomentosa* (mockernut hickory). The most common shrub taxon is *Vaccinium pallidum* (low-bush blueberry). Herbs typically are present and highly variable with regard to diversity.

#### **3.1.3 Canyon Shoulders**

Shallow soils and bands of exposed sandstone pavement along the edge of bluffs (and benches) provide a relatively arid habitat for the region. These sandstone outcroppings support woody species which are frequently stunted. Shallow soils of these areas typically have *Pinus virginiana* (scrub pine) as a dominant species. *Nyssa sylvatica*

(black-gum) and *Diospyros virginiana* (persimmon) are of frequent occurrence. Ericads, such as *Kalmia latifolia* (mountain-laurel), *Oxydendrum arboreum* (sourwood), and *Vaccinium arboreum* (sparkleberry), abound in these habitats. Succulents, such as *Diamorpha cymosa* (elf-orpine), *Opuntia humifusa* (prickly-pear), and *Talinum mengesii* (fame flower), are of common occurrence.

### 3.1.4 Sandstone Bluffs

Vegetation of bluffs is usually sparse. However, irregularities such as ledges, crevices, benches, and grottoes offer important habitats. *Diervilla rivularis* (bush-honeysuckle) is an uncommon shrub that is sometimes very abundant in certain regions of the Cumberland Plateau. The species is rather uncommon in the areas within the study area. A crevice plant, *Asplenium montanum* (mountain spleenwort) is common within the study area. Plants of wet rock faces or moist, shaded grottoes include *Trichomanes petersii* (Peter's filmy fern) and *T. boschianum* (Bosch's filmy fern) are located in many grottoes within the study area.

### 3.1.5 Slopes

This generally rugged landscape is generally unsuited for agriculture so now supports some of the better developed plant communities. Most of the slopes within the study area are vegetated by hardwood communities; however, *Tsuga canadensis* (hemlock) is a common component. Dry sites have a preponderance of *Quercus montana* (rock chestnut oak), *Quercus velutina* (black oak), *Quercus alba* (white oak), *Carya tomentosa* (mockernut hickory), *Carya pallida* (sand hickory), *Liriodendron tulipifera* (tulip-poplar), *Tilia americana* (basswood), and *Acer rubrum* (red maple). Woody plants of the understory that are frequent include *Acer rubrum* (red maple), *Nyssa sylvatica* (black-gum), *Oxydendrum arboreum* (sourwood), *Prunus serotina* (black cherry), *Cornus florida* (dogwood), and *Diospyros virginiana* (persimmon). Herbs are variable, but commonly encountered are *Polystichum acrostichoides* (Christmas fern), *Stipa avenacea*

(needle grass), and *Chasmanthium sessilifolium* (spike grass). *Vitis rotundifolia* (muscadine) and *Toxicodendron radicans* (poison-ivy) are important lianas.

### 3.1.6 Riparian Zones and Mud Flats

In the draw-down areas of the lake and along the shorelines, *Cephalanthus occidentalis* (button-bush) and *Alnus serrulata* (alder) are the most common shrubs. Interestingly, *Diospyros virginiana* (persimmon) which is normally associated with well-drained upland sites is a frequent species in inundated areas. Herbs are infrequent; however, *Justicia americana* (water-willow) beds are characteristic of shallows.

Draw-down of the pool levels exposes expanses of unconsolidated bottom during winter and early spring. These areas are subject to flooding, yet remain exposed for long periods. Annual herb communities form in these open mud-flats with characteristic assemblages. Bringing pool levels up in late spring submerges these communities thus ending their active season. No field studies were performed during their growing season.

## 3.2 Proposed Endangered, and Threatened Species (PETS)

Table 1 presents PETS taxa, which were located within the project area. A summary for each PETS is provided below. Each taxon is accompanied by species name, author, family, and vernacular name(s).

**Table 1. Distribution of PETS within the study area.**

Species	Vernacular	# of Sites
<i>Asplenium pinnatifidum</i>	Lobed spleenwort	10
<i>Cuscuta harperi</i>	Harper's love-vine	1
<i>Diervilla rivularis</i>	Bush-honeysuckle	1
<i>Heuchera parviflora</i>	Alum-root	4
<i>Hexastylis shuttlesworthii</i>	Wild-ginger	3

<b>Species</b>	<b>Vernacular</b>	<b># of Sites</b>
<i>Hymenocallis caroliniana</i>	Spider-lily	3
<i>Philadelphus hirsutus</i>	Mock-orange	1
<i>Smilax smallii</i>	Small's cat-brier	2
<i>Stewartia ovata</i>	Mountain-camellia	1
<i>Talinum mengesii</i>	Fame-flower	1
<i>Trichomanes boschianum</i>	Bosch's filmy-fern	3
<i>Trichomanes petersii</i>	Peter's filmy-fern	3
<i>Waldsteinia fragarioides</i>	Barren strawberry	1

*Asplenium pinnatifidum* Nuttall, Aspleniaceae. Lobed spleenwort. This species dwells in rock crevices containing small pockets of soil. Although extremely rare in portions of the range, populations are of infrequent occurrence in the Cumberland Plateau of Alabama. In Alabama, populations vary from a few individual rosettes to hundreds. The species is found on acidic rocks within our plateau region.

*Cuscuta harperi* Small, Cuscutaceae. Harper's love vine, Harper's dodder. Harper's love vine is a twining, herbaceous parasite that is primarily located in well-lit openings around sandstone glades. The species usually is attached to forbs and grasses common to these habitats. Originally thought to be an endemic to Lookout Mountain, the species has been located around outcrops on Sand Mountain as well. The species is not abundant in any of the populations known to this author. The USDA lists this species as an invasive plant species.

*Diervilla rivularis* Gattinger, Caprifoliaceae. Bush-honeysuckle. Bush-honeysuckle is a low, arching shrub that inhabits deeper soils around sandstone outcrops. This shrub is found in sunlit and shaded environments.

Though widely dispersed, the species is a southern Appalachian endemic. In Alabama, the species is rare with populations seldom well-developed off the Cumberland Plateau. Populations on Lookout Mountain are extensive.

*Heuchera parviflora* Bartling, Saxifragaceae. Alumroot. This species of alumroot is widely distributed in several states within the deciduous forests of Eastern North America. This alumroot is common within the Cumberland Plateau of Alabama. Almost invariably, this taxon grows on dry, bluffs where it occurs in grottoes and shallow soils of rock races. Habitats are usually shaded, and on north-facing slopes or in ravines.

*Hexastylis shuttleworthii* (Britten and Baker *f.*) Small. Aristolochiaceae. Shuttleworth's wild-ginger. This wild-ginger is broadly endemic to eastern North America. Habitat is generally rocky, slopes above creeks and rivers. Sites are usually shaded north-facing or sheltered slopes, and in hardwood forests. This species is common in the Ridge and Valley of eastern Alabama and sporadic in the environs of Smith Lake.

*Hymenocallis caroliniana* L. Herbert, Liliaceae. Spider-lily. This species is wide-ranging in the central and southern United States. The habitat is usually low-lying silts and clays of floodplains, though the species is occasionally found in rocky soils. Habitat varies from densely shaded where the individuals seldom flower to sites with full sunlight where flowering is much more common. The species appears to tolerate disturbance but does not withstand competition from invasive taxa very well.

*Philadelphus hirsutus* Nuttall, Hydrangeaceae. Mock-orange. This mock-orange is wide-ranging in the southeastern United States. This species occurs in rocky, hardwood forests. In Alabama, the species is of sporadic occurrence but may form large populations in older growth

hardwoods. Though the species tolerates full sunlight, specimens appear more vigorous in filtered light.

*Smilax smallii* Morong, Smilacaceae. Small's cat-brier. Small's cat-brier ranges mostly in the southern United States. This liana may be creeping or high-climbing in moist ravines and along water courses. The species tolerates full-sunlight, but is much more common in filtered light to shaded forests. The species is of common occurrence in the Valley and Ridge and Cumberland Plateau of Alabama.

*Stewartia ovata* (Cavender) Weatherby, Theaceae. Mountain-camellia. Mountain-camellia is a small tree usually reaching the sub-canopy in hardwood forests. The species is located in the southeastern United States. In Alabama, populations are of rare occurrence locally; however, populations may comprise a large number of individuals. All populations observed are within mesic, hardwood forests.

*Talinum mengesii* W. Wolf, Portulacaceae. Fame-flower. This fame-flower is known from five states in the Appalachian chain. The species occurs on acidic, arenaceous, rock outcrops where it is better developed in glade communities. Rock types most commonly are granite and sandstone. A few individuals occur in shaded environments, but the most profuse populations are in full sunlight. This species is relatively rare in this area of Alabama.

*Trichomanes boschianum* Sturm, Hymenophyllaceae. Appalachian filmy fern, Appalachian bristle fern. Appalachian filmy fern is situated in darkened recesses of wet, sandstone grottoes. This species is restricted by its habitat. In Alabama, this fern is very rarely encountered. Most populations are in

this portion of Alabama. During periods of drought, populations suffer high mortality of fronds and are reportedly slow to recover. Fronds are generally appressed to the wet, rock faces. None of the populations observed during this study received direct sunlight.

*Trichomanes petersii* A. Gray, Hymenophyllaceae. Peters's filmy fern, bristle fern. Peters's filmy fern is a mat-forming fern that mostly lives on wet rock faces. Usually light is subdued, but some populations occur in direct sunlight. This species may be located around waterfalls or in seeps near exposed acidic rock faces. Though widely scattered in Alabama, this species is less common than the more celebrated Appalachian filmy fern (*T. boschianum*).

*Waldsteinia fragarioides* (Michaux) Trautvetter, Rosaceae. Barren straw-berry. Barren straw-berry is an herbaceous plant that grows in sandy, alluvial soils. Overall, the species is widely distributed but is listed as a conservation concern in many of the states in which it is known. In Alabama, the plant is rarely encountered. In our area, the species occurs in shaded hardwood forests where soils are sandy or sandy and rocky.

### **3.3 Non-native Species**

Table 2 summarizes the invasive species observed within the project area. Invasives are considered herein to be non-native (to the area) taxa that are found growing outside cultivation and that appear to supplant native species within their habitats. Non-natives may be considered:

1. waifs which are species that humans constantly re-introduce and not thought by authors to be sexually reproducing;

2. persistent from cultivation, a group of perennial species that are long-lived but remain where they were planted; or
3. naturalized, a condition whereby non-natives “behave” as native taxa by sexually reproducing in the area.

Of these possibilities, naturalized taxa are those which can become invasive since they have diaspores by which they can spread from a single site and move to new locations distant from the site of introduction.

**Table 2. Invasive plant species.**

Family	Genus/Species	Vernacular Name	Origin	Habitat
Amaranthaceae	<i>Alternanthera philoxeroides</i>	Alligator-weed	South America	Along toe of slope.
Caprifoliaceae	<i>Lonicera japonica</i>	Japanese honeysuckle	Asia	Disturbed areas along toe of slope and informal recreational sites.
Dioscoreaceae	<i>Dioscorea batatas</i>	Cinnamon vine	Asia	Disturbed area along the shoreline.
Fabaceae	<i>Albizia julibrissin</i>	Silk tree	Asia	Along toe of slope.
Fabaceae	<i>Lespedeza bicolor</i>	Bush-clover	Japan	Along shoreline within an area that has been cleared.
Fabaceae	<i>Lespedeza cuneata</i>	Sericea	Asia	Along shoreline and within informal recreational sites.
Fabaceae	<i>Pueraria lobata</i>	Kudzu	Asia	Along shoreline within an area that has been cleared.
Fabaceae	<i>Wisteria sinensis</i>	Chinese wisteria	Asia	Disturbed areas along toe of slope and informal recreational sites.
Liliaceae	<i>Hemerocallis fulva</i>	Daylily	Europe	Along a dirt road on a slope.
Oleaceae	<i>Ligustrum sinense</i>	Chinese privet	Asia	Low areas and within informal recreational sites.
Poaceae	<i>Microstegium vimineum</i>	Nepal grass	Asia	Informal recreational sites and disturbed areas.

Descriptions of invasive species are cited below with scientific name, author, family, and vernacular name.

*Albizia julibrissin* Durazzini, Fabaceae. Silk tree, mimosa. This tree is from Asia. The species performs best in moderate to full sunlight, though it persists in the shaded understory. This species is of common occurrence in the project area.

*Alternanthera philoxeroides* (Martius) Grisebach, Amaranthaceae. Alligator-weed. Alligator-weed is a perennial herb thought to have originated in South America. In the study area, this species grows in aquatic environments, usually in shallow waters of shorelines. This species is a pernicious invasive in ponds and lakes.

*Dioscorea batatas* Decaisne, Dioscoreaceae. Potato vine. This herbaceous vine is from Asia. Common localities are in disturbed areas, particularly around water courses. This species is most abundant in clearings or other sites where it receives adequate sunlight.

*Hemerocallis fulva* Linnaeus, Liliaceae. Day-lily. Day-lilies are perennial herbs. This species is thought to originate in Europe. In most environments, this species appears to persist from cultivation. The only site located for this taxon appeared to be around other cultivated species.

*Lespedeza bicolor* Turczaninow, Fabaceae. Bush-clover. This shrub is from Asia. Bush-clover has long been a favorite of wildlife biologists who use this in food plots.

*Lespedeza cuneata* (Dumont) G. Don, Fabaceae. Sericea. This perennial herb is from Asia. Sericea has long been grown from hay and as a ground cover to “improve” the soil by virtue of root

symbiosis that fix atmospheric nitrogen. This is a noxious weed that is commonly incurred in the study area and continues to be widely planted.

*Ligustrum sinense* Loureiro, Oleaceae. Privet. This Asian shrub has become one of the most invasive species in Alabama. In floodplains and mesic woodlands across the state, this species has formed dominant understory strata and has changed the structure of floodplain forests by supplanting native species.

*Lonicera japonica* Thunberg, Caprifoliaceae. Japanese honeysuckle. This liana originated in Asia. In the study area, the species grows in mesic woodlands, usually in areas with some disturbance, such as old home sites, open woodlands, and along shorelines. This is the most pernicious weed in the study area.

*Microstegium vimineum* (Trinius) A Camus. Poaceae. Nepal Grass. This annual (to weakly perennial) herb is from Asia. Nepal grass is a noxious species that has become invasive in woodlands as well as wetlands.

*Pueraria lobata* (Willdenow) Ohwi, Fabaceae. Kudzu. This Asian liana has long been planted to control erosion. Not much of this species occurs within the study area, though much exists immediately outside the study area.

*Wisteria sinensis* (Sims) Sweet, Fabaceae. Wisteria. This Asian liana is from China and was imported as for horticultural reasons. This species is wide-ranging and is often located in sites with no evidence that the species may have been planted. Around older

homesites, the species is a very aggressive species by forming a dense ground-cover and becoming high climbing in trees.

#### **4.0 SUMMARY OF RESULTS**

1. Two unusual plant communities were located on sandstone flat-rocks. Though not extensive, these outcrops contained taxa normally associated with more extensive glades known from other locations on the Cumberland Plateau.
2. Many coves, ravines, canyons and grottoes were located during our study. Most importantly, 13 sites contained grottoes, many of which are very extensive harboring several PETS taxa. A number of these grottoes exhibited signs of recent use.
3. Thirty-nine sites have invasive species dwelling therein.
4. Thirteen PETS and other locally rare species occur within the project area.

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