A FLORISTIC STUDY OF THE CANE CREEK WATERSHED OF THE JOCASSEE GORGES PROPERTY, OCONEE AND PICKENS COUNTIES, SOUTH CAROLINA

A Thesis

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Botany

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by

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ABSTRACT

The Cane Creek Watershed is one of the four existing watersheds included within the Jocassee Gorges Area. Cane Creek consists of approximately 7.6 miles of stream associated with the Keowee River System of the Savannah Drainage System.

A descriptive study of the vascular flora of the watershed initiated in 1998 documented four hundred and three plant species, two hundred and eighty-three genera, and one hundred and five families in the 4,400 acre study area. This investigation centered on plant presence, distribution, and noted the presence of endemic, disjunct, and endangered species. Endemic species found include the following: *Carex austrocaroliniana, Carex radfordii, Clethra acuminata, Houstonia serpyllifolia, Rhododendron minus, Shortia galacifolia,* and *Trillium discolor*. Disjunct species included *Asplenium monanthes*. Two species reaching into the South Carolina mountains, but commonly found in more northern latitudes, include *Saxifraga micranthidifolia* and *Xerophyllum asphodeloides.* Rare and endangered species within the study site include seven threatened species and nine species which have unresolved status. Of these sixteen species, eleven, two, and one are of concern in South Carolina, in the southeast, and in the nation, respectively. These species include: *Asplenium monanthes, Carex austrocaroliniana, Carex bromoides* ssp. *montana, Carex radfordii, Circaea lutetiana* ssp. *canadensis, Gaultheria procumbens, Galearis spectabilis, Hepatica nobilis* var. *acuta, Juglans cinera, Juncus gymnocarpus, Lygodium palmatum, Panax quinquefolius, Saxifraga micranthidifolia, Shortia*

galacifolia, Trillium discolor, and *Xerophyllum asphodeloides.* Two species previously listed within North Carolina but occurring within the Cane Creek watershed of South Carolina include *Carex bromoides* ssp. *montana* and *Arnoglossum muehlenbergii.* Twelve distinct plant communities were revealed during this study and are described in relation to distribution and composition.

DEDICATION

Dedicated to the memory of Timothy Blair Frye: April 11th, 1970- May 29th, 1997.

ACKNOWLEDGMENTS

I wish to extend my gratitude to many people for their help throughout the course of this study. I appreciate and acknowledge the assistance of Dr. Robert Ballard, my major advisor, the committee members Dr. John E. Fairey III, Dr. David Bradshaw, Dr. Thomas McInnis and Dr. L. L. Gaddy for their time, advice, and support. Dr. John E. Fairey III is expressly thanked for the contribution of extensive knowledge in the field and guidance. Extreme appreciation is extended to Mr. John F. Townsend, former Curator of the Clemson University Herbarium (CLEMS) for providing field technique instruction and a vast knowledge of plant taxonomy. Ms. Mary Bunch and the South Carolina Department of Natural Resources are also thanked for providing partial financial assistance used in travel and supplies. Appreciation is extended to Mr. Michael Waldrop and Mr. Joshua

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INTRODUCTION

The Cane Creek watershed is one of the four watersheds composing the South Carolina portion of the Jocassee Gorges Land Area. Cane Creek is seated between Laurel Fork to the north and Eastatoe Valley to the southeast and the watershed consists of approximately 4,400 acres. Cane Creek, which is part of the Keowee River System of the Savannah Drainage System, is 7.6 miles long, has an approximate elevation of 900-2200 meters, runs northeast to southwest, and ends at Lake Keowee.

Cane Creek watershed is part of the 43,500 acre Jocassee Gorge Land Area purchase that was acquired by the state of South Carolina in 1998. This purchase was obtained with the help of the South Carolina Department of Natural Resources from Duke Power Energy Corporation/ Crescent Resources.

Previous botanical exploration (Cooper, 1963, Eggers, 1965, Rodgers, 1965, Rodgers & Shake, 1965, Rodgers & Shiflet, 1970, Ware, 1973, Gaddy, 1998) conducted within the Jocassee Gorge Land Area to inventory the plant species and community types produced from three hundred to six hundred species; however, an extensive survey has not occurred in the Cane Creek watershed. Gaddy (1998) conducted a brief survey in the Cane Creek watershed and concluded that a thorough investigation was needed.

The purpose of this study was as follows: (1) to document the diversity of the vascular flora occurring within the watershed and (2) to describe the plant communities of the watershed.

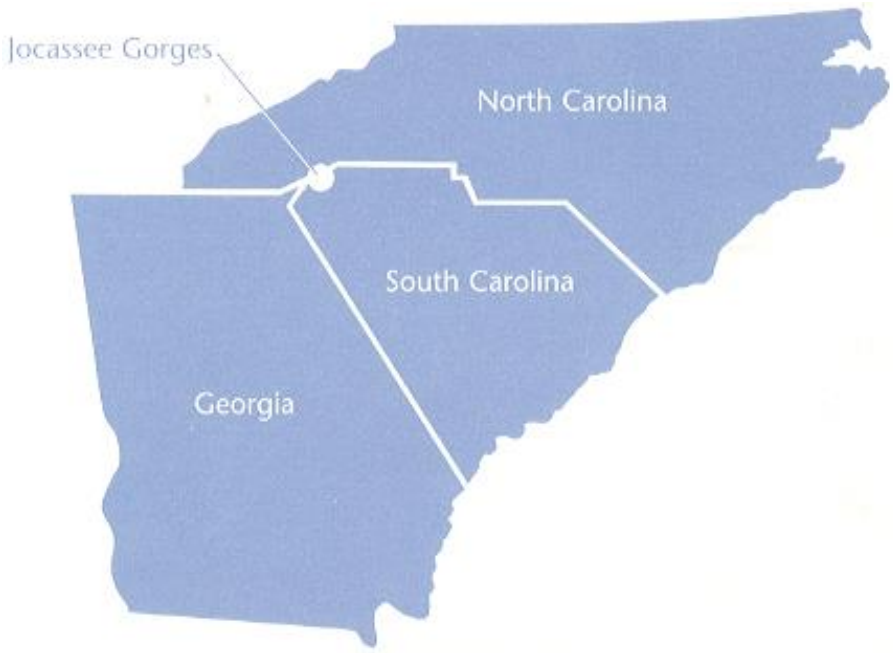


Figure 1. Location of Jocassee Gorges in Relation to North Carolina and Georgia.

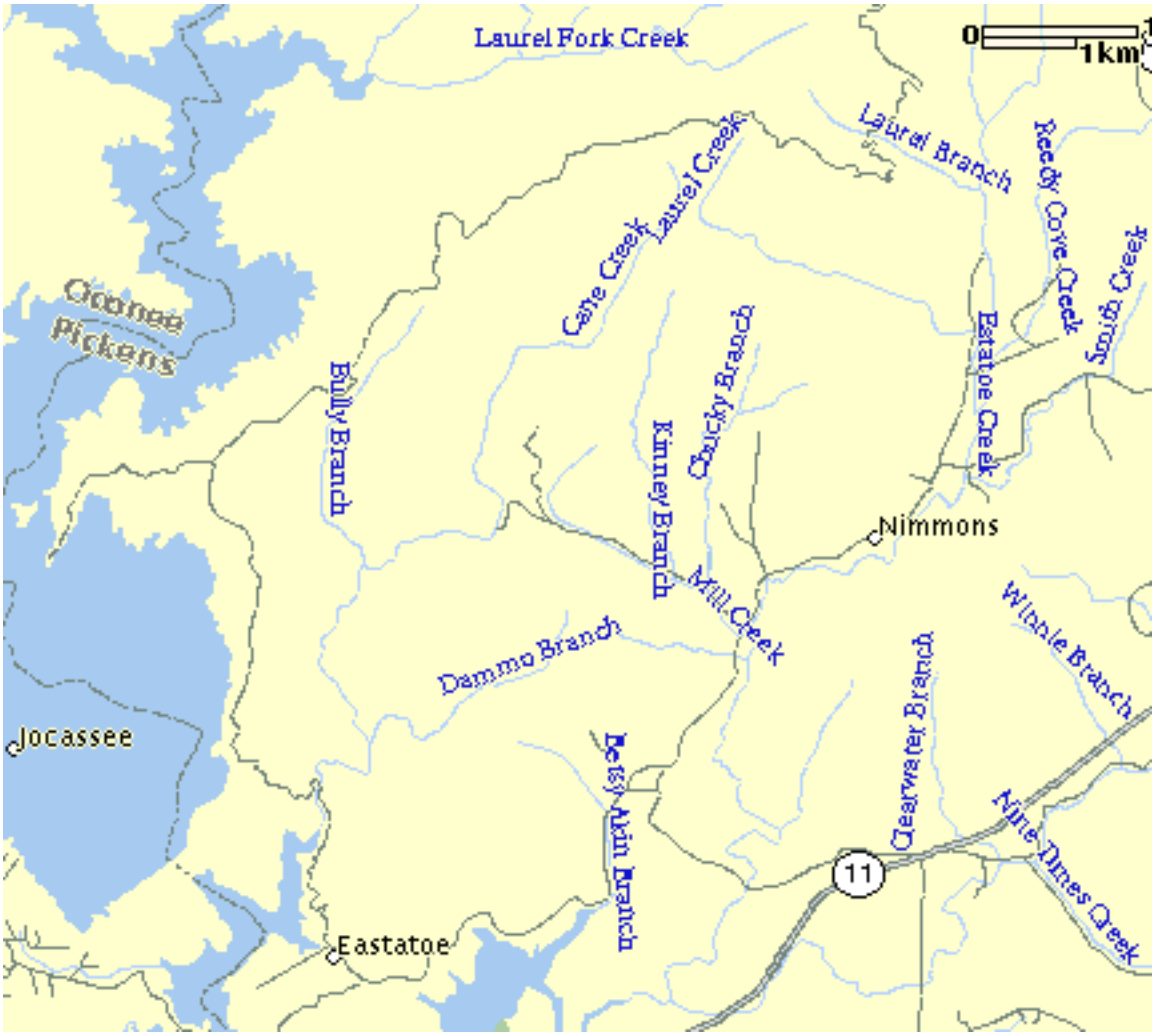


Figure 2. Location of Cane Creek in Relation to Lake Jocasee, Laurel Fork Creek, and Eastatoe. © 2000 MapQuest.com, Inc.; © GDT, Inc.

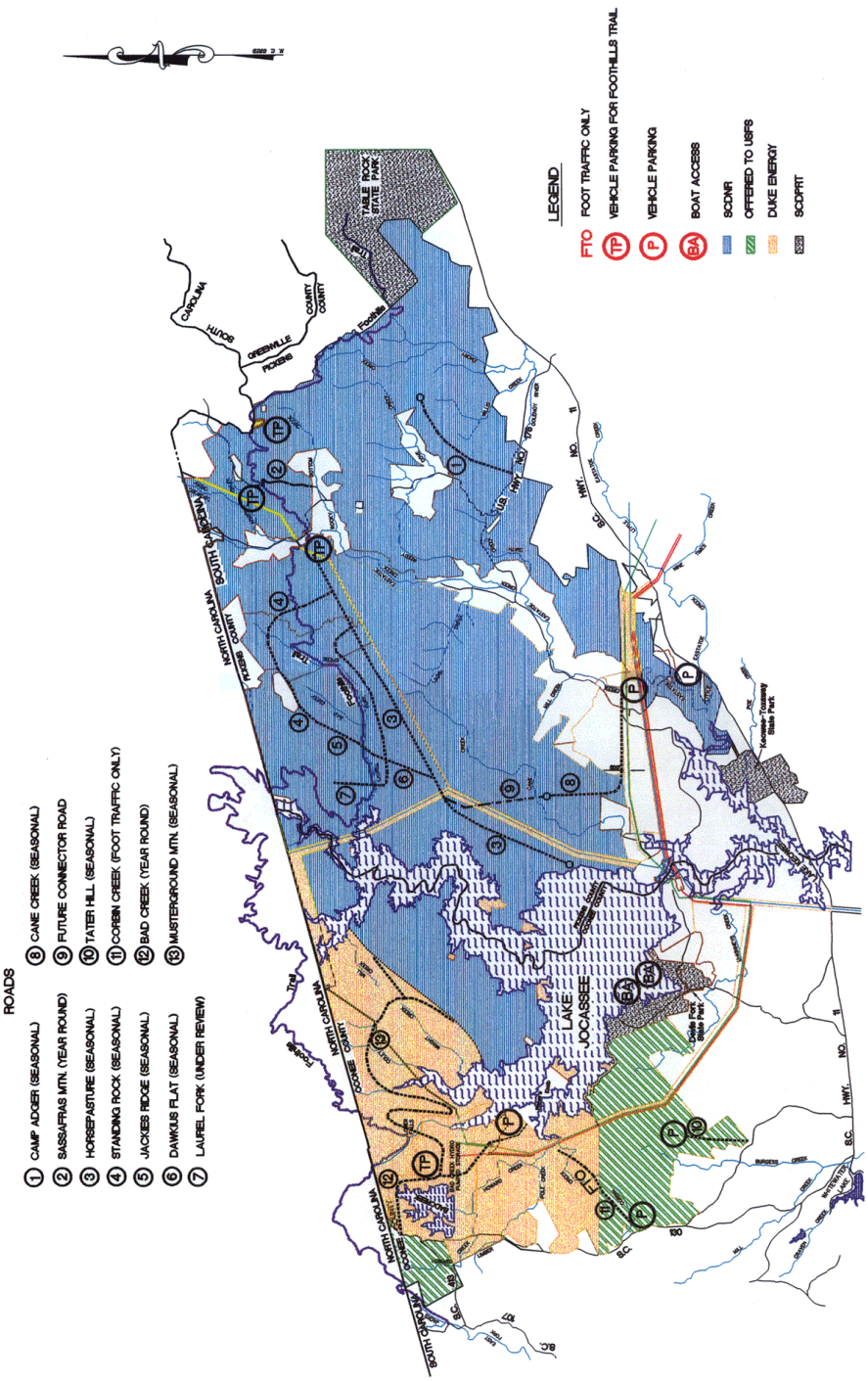


Figure 3. Approximate Boundaries of the Jocassee Land Area.

HISTORY AND BOTANICAL EXPLORATION

History and Land Use of the Area

In order to understand the history of the Cane Creek Watershed, we need to look at the history of the Jocassee Gorges Land Area as a whole, which dates back to 1539 when Hernando deSoto explored the area. Keowee Village or Keowee Town, the capital of the Lower Cherokee Indians, was located south of the present Lake Jocassee Dam. Keowee Village was located on the Oconee side of the Keowee River close to where the Crowe Creek and the Keowee River run together. Present local names were derived from the Cherokee language. Names such as “Jocassee”, “Keowee”, “Toxaway”, “Eastatoee”, and “Oconee” reflect the Native American history of the area (Blue, 1997). Jocassee was home to the Cherokee Indian Nation; it now lies 300 feet beneath the surface of Lake Jocassee, where the Toxaway River and Whitewater River join, located one-half mile north of Jocassee Dam. Jocassee gets its name from the legend of a Cherokee maiden. An Oconee tribe, known as the "Brown Vipers," lived on the west side of the Whitewater River governed by Chief Attakulla. A rival tribe lived on the east side of the river called the Eastatoees and were known as the "Green Birds,” a name perhaps derived from the Carolina parakeet (*Conuropsis carolinensis* L.), which became extinct in 1904. As the legend of the area tells, a young warrior called Nagoochee living among the Green Birds was not opposed to entering Brown Viper hunting grounds. While hunting in Brown

Viper territory currently known as Musterground today, Nagoochee fell and broke his leg. Nagoochee thought he would surely be stranded and die in the wilderness, but was rescued by Jocassee, Chief Attakulla's daughter. Jocassee took Nagoochee back to her father's lodge and tended his broken leg. The two fell in love and both remained with the Oconee tribe. In a later fight between the tribes, Cheochee, Jocassee's brother, killed Nagoochee. Cheochee returned with Nagoochee's head strapped to his belt. Jocassee saying nothing, set adrift on the water in a canoe. Likely stricken with grief, Jocassee stepped from the canoe into the water. As the story tells, Jocassee "did not sink but walked across the water to meet the ghost of Nagoochee" (Rankin, Sandifer, & Conrad, 1998). Jocassee refers to the "Place of the Lost One."

By the late 1700s, trading routes and relations among the Cherokees and Europeans were well established (Hembree and Jackson, 1995). Keowee Village was a primary stop along the trade route that connected Cherokee towns and villages with eastern Tennessee, western North Carolina, and northwestern South Carolina all the way to the Atlantic Ocean. In 1732, deerskins numbering 200,000 secured from trading with the Cherokees Indians were brought to Charleston. Cherokee Indians traded for European firearms, ammunition, tools, and clothing. Sir Alexander Cummings came from England to Keowee Village in 1730 in order to form a friendship treaty with the Cherokees. In the mid 1700s, tensions were mounting between the Cherokees and European settlers. The colony of South Carolina enacted a trade embargo on the Cherokees in 1751. Following this action, Governor James Glen initiated the

construction of Fort Prince George across the river from Keowee Village in 1753 (McKown, 1988). European and Cherokee relations were growing at odds and led to the Cherokee War of 1759-1760. General Andrew Pickens initiated a gathering of Indian chiefs along the banks of the Keowee River on 28 November 1785, a treaty was signed that gave all of the "Jocassee Gorges" land area, with the exception of northern Oconee County, to the United States. However, fifty years passed before the Oconee Mountains of the Jocassee Gorges were ceded to the United States. Even though this treaty was signed by a small group of Indians it granted the United States all the Indian Territory east of the Mississippi.

In 1788, the French botanist Andre Michaux observed and noted the unique natural resources of the Jocassee area. He described a rare wildflower with pink-white blossoms where the Toxaway and Whitewater rivers joined presently under Lake Jocassee. This rare wildflower, Oconee Bell (*Shortia galacifolia* Torrey & Gray), is native to only a few counties in the Blue Ridge Mountains. Many European settlers were moving into the region in the late 1700's while the land was still under Cherokee control, settling in the Horsepasture, Laurel Fork, Big and Little Canebrakes, Musterground, and other portions on the Jocassee Gorges property as early as the 1780s. The new Indian boundary was finally delineated around 1797. Scottish and Irish settlers from Virginia and Pennsylvania came by way of the Eastatoee Valley (Wyche and Kilgo, 1996). Others settlers from Charleston also came to the Horsepasture area (Turner and Sherrill, 1997). Land grants date back to 1791 in the Jocassee region. More and more people began

moving into the mountain region and valleys. Traveling along the well-established network of Cherokee trails and trade routes, early settlers built farms and homes into the rugged and remote land of the gorges. Their life was difficult and is best described by C.T. Wyche and J. Kilgo (1996) in *The Blue Wall* as "they survived by growing corn and making liquor, raising hogs and cutting timber, bearing and rearing children. Tough and independent, they married among themselves forming strong ties of blood kinship. They built schools and churches, opened stores, and ran gristmills." Few schools existed in the early days in the Jocassee Gorges area. The Laurel Fork School on Laurel Fork Creek and the Horsepasture School were the earliest (Simmons, 1983). The Horsepasture School (1923-1940) was constructed on top of the ridge between Toxaway River and Laurel Fork Creek. A schoolhouse once existed near Cane Creek along with many thriving communities in the Jocassee Gorges. In 1916, the Toxaway Dam in North Carolina failed and flooding down the Toxaway River removed much of the fertile topsoil and deposited rocks and boulders on family farms. After the flood, living off the land was difficult for the homesteaders.

The name "Horsepasture" has remained in the Jocassee region since the Civil War. Local residents would herd their livestock into a broad valley where the Toxaway River and the Laurel Fork Creek fork in order to keep them hidden from General Sherman's armies. The inhabitants of the Jocassee valley referred to this area as the "Horsepasture" and renamed the Green River to its present name of the Horsepasture River. In the 1920's, horses and cattle were delivered to the Horsepasture from the West

by rail car. This was to circumvent poor grazing conditions in the west. Many Jocassee residents worked for the federal government conducting head counts of cattle.

The arrival of the railroad brought the textile industry to the upstate and around the turn of the 20th century, many Jocassee residents moved from their isolated homes and farms to find work in the local town mills. Their land was most often sold, abandoned, or auctioned for back taxes. Those staying in the Jocassee region remained around Jocassee Valley relying on moonshining and the timber industry to make a living. The timber industry began to grow as a result of the industrial boom in the region (Bloomer 1997), southern forests were cut to provide lumber for factories and houses to shelter workers. Lots of timber could be found in the mountains and foothills of Pickens and Oconee counties for these construction demands. A major factor contributing to the emerging timber industry in South Carolina was the lack of timber resources available in northeast forests. The South, due to its virgin forests, became a prime candidate for new sources of timber. Corporate lumber companies began purchasing large tracts of Jocassee land. These areas became the source of timber to supply both local and national timber demand. These timber company purchases were the beginning of the land acquisitions that led to what is now referred to as the Jocassee Gorges. Many timber companies were involved. For example, Saluda River Lumber Co., Montvale Lumber Company, Southern Lumber Company, and Carolina Timber Company were once owners of the Horsepasture property. Appalachian Forest Corporation, Poinsett Lumber Company, and Crescent Resources, Inc. are some of the more recent Jocassee Land Area

owners. Logging roads were built into the Eastatoee Creek area by the Appalachian Forest Corporation to remove timber from Jocassee to the sawmills in Pickens, S.C. The railroads were constructed along the easiest grades and slopes into the cove forests of the Jocassee property. Yellow poplar and oak timber grew abundantly in the cove forests along the rugged hills and were of primary interest in the lumber industry. Horses were the prime means used to skid the logs downhill to the rails constructed next to river and streambeds. Once the logs were loaded, they were sent to Pickens, S.C., to be sawed into lumber. Railroad iron remnants of the old railroad system still remain in many places along the rivers and streambeds of the Jocassee property. Poinsett Lumber Company, a subsidiary of Singer Sewing Machine Company, purchased the land in 1939. The decision was made to no longer use the railroad system. Instead, Poinsett built roads into the Jocassee region and hauled the logs out on trucks to a Pickens mill. For 24 years, hardwood lumber from rich cove forests of the Jocassee area was used to build sewing machine cabinets. Using best management practices, Poinsett Lumber Company had completed one rotation and began to harvest the timber a second time by the end of its ownership. In 1963, Duke Power Company (DPC), a Duke Energy Company (DEC), formed Carolina Land and Timber Company. Carolina Land and Timber Company purchased 83,400 acres in the Horsepasture area from Singer Corporation and private landowners that same year. DPC announced its intensions for the construction of the Keowee Toxaway Project on 2 January 1965, and began the project in 1967. This construction formed Lake Keowee (18,400 acres) and Lake Jocassee (7,500 acres).

Carolina Land and Timber Company became Crescent Land and Timber Company in 1969 and is currently Crescent Resources, Inc. (CRI), a Duke Energy Company. Crescent's intent was to use the Jocassee Land Area for the commercial timber industry. Under Crescent Resources management plan, social and environmental concerns of the Jocassee region began for the first time. CRI continued to harvest Jocassee forests to meet timber demands for approximately 35 years. CRI has also continued to plant trees to meet future forest product needs. In December 1964, the South Carolina Wildlife Resources Commission in the South Carolina Department of Natural Resources (SCDNR), Duke Power Company, and CRI established a formal agreement to include the lands of Jocassee Gorges in the SCDNR's Game Management Area Program (WMA Program). Hunting and fishing within the Jocassee property had always been allowed in the past; however, this agreement established formal public access. Wildlife management programs were taken to new heights after 1964. In 1965, a SCDNR wildlife biologist was assigned to the Jocassee region. The first management programs consisted of deer and wild turkey stockings. Over a four-year period, seventy-five deer from South Carolina's coastal plain counties were stocked in the Horsepasture. A total of four turkey hens were released in 1965, with additional wild turkey stockings completed in the 1970s. Fish management efforts in Jocassee Gorges streams date back to the 1930s when the managed trout stocking from the Cleveland State Trout Hatchery, Table Rock State Hatchery, and Walhalla National Fish Hatchery occurred (S.C. Game & Fish Department and S.C. Wildlife Resources Department, 1935-1962). Stream monitoring efforts began

in 1965 after a SCDNR fishery biologist was hired for the Jocassee Gorges. The Jocassee Gorges has long been revered for its biodiversity of plant and animal life. Biologists have continually documented the occurrence of rare, threatened, and endangered elements in this region.

Recent Botanical Exploration

The floras of the Jocassee Land Area (JLA) have been randomly sampled throughout the years; however, no extensive collections or studies of the flora have been undertaken. Due to the creation of Lake Jocassee, under the Duke Power hydroelectric pump-storage project in 1973, large expanses of the flora in the area no longer exist. This flooding, in conjunction with logging and settlements, has impacted the JLA immensely. Prior to World War II, A.J. Sharp and L.E. Anderson were investigating mosses around Highlands, N.C. Until the 1980's, the only published botanical inventory of the Jocassee Area flora was that of the Eastatoe River (Rodgers and Shiflet, 1970). Although there have been numerous surveys in the JLA by public government and private agencies, little inventory data have been published. In 1998, L.L. Gaddy conducted a preliminary investigation of the "Jocassee Tract". This brief investigation yielded a total of fifty-two reportings of rare, threatened, or endangered species. Approximately twenty-nine of the fifty-two new records reported occurred within the quadrangles encompassing the Cane Creek watershed and established that an in-depth survey of the flora warranted.
Using information from vascular plant species lists, similarities can be drawn between the biodiversity of the Cane Creek watershed and surrounding gorge studies. When

comparing the Cane Creek watershed to studies occurring from the Chauga, Chattooga, Horsepasture, Thompson, and Tullulah River Gorge, species common to all areas include: *Liriodendron tulipifera, Magnolia fraseri, Asimina triloba, Sassafras albidum, Sanguinaria canadensis, Hamamelis virginiana, Platanus occidentalis, Ilex opaca, Acer rubrum, Salix nigra, Parthenocissus quinquefolia, Passiflora lutea, Aralia racemosa, A. spinosa, Lysimachia quadrifolia, Lycopus virginicus, Nyssa sylvatica, Clethra acuminata, Symplocos tinctoria, Halesia carolina, Ipomoea pandurata,* and *Solanum carolinense.* Rare species common to Cane Creek and surrounding gorge areas include: *Xerophyllum asphodeloides, Juncus gymnocarpus, Lygodium palmatum,* and *Smilax biltmoreana* (Noel, 1998).

CLIMATE, GEOMORPHOLOGY AND HYDROLOGY

Climate

The climate of the Cane Creek watershed of the JLA is typical of the Blue Ridge escarpment of the Southern Appalachian Mountains. Extreme highs or lows are uncharacteristic, helping this region maintain temperate conditions and evenly distributed precipitation throughout the year. Climatological data are available from two surrounding weather stations. The first weather station, Pickens 5 SE (Pickens County), is located at 34°53'N/ 82°37'W at 351.1 m in elevation. The second station, the Salem 5 NNE station (Oconee County), is located at 34°57'N/ 82°57'W at an elevation of 329.8 m. Temperature and precipitation data averages are available from these stations from 1948 to the present.

The warmest period of the year in the Cane Creek watershed occurs during June through August with an average maximum temperature of 88.0°F at the Salem station and 87.0°F at the Pickens station. Reliable climatological data are unavailable from the Jocassee station for this study. The coldest period in the Cane Creek watershed occurs during December through February with an average minimum temperature of 28.0°F at the Salem station and 33.1°F at the Pickens station. Climatological normals, between 1961-1990, show that the Salem station recorded an annual maximum temperature of 71.9°F and an annual minimum temperature of 44.5°F. Data for this same period of time show that the Pickens station recorded an annual maximum temperature of 71.4°F and an annual minimum temperature of 49.7°F. The highest recorded temperature for the Salem

station reached 106°F in August of 1954, with a lowest temperature of -5°F in January of 1985. The highest recorded temperature for the Pickens station reached 105°F in July of 1952 with a lowest temperature of -6°F in January of 1985. The average mean temperature for the Salem station and for the Pickens station is 58.2°F and 60.6°F, respectively.

The JLA is one of the wettest areas in eastern North America, creating warm microclimates within the gorges (Billings & Anderson, 1966). Precipitation within the gorges usually occurs from low-pressure systems rising north from the Gulf of Mexico that culminate in thunderstorms throughout the summer months. According to Cooper and Harden (1970), the high elevation gorges of the JLA may have up to twice the amount of mean annual precipitation than surrounding gorge areas. The average precipitation recorded per year for the Salem station is 67.43 inches with a high mean of 5.53 inches per month occurring from May to August. The average precipitation recorded per year for the Pickens station is 56.56 inches with a high mean of 4.66 inches occurring from May to August. The highest recorded monthly precipitation for the Salem station is 15.32 inches in May of 1976 and 11.65 inches in December of 1961 for the Pickens station. The wettest year on record for the Salem station is 1964 with 82.26 inches and 1964 for the Pickens station with 78.46 inches. According to data records, the Salem station has recorded average annual snow accumulation to 3.5 inches while the Pickens station averages up to 4.5 inches per year. Both stations received the largest snowfall in 1971 with a reported 18.0 inches in accumulation.

Figure 4. Average Monthly Temperatures (1961-2000)

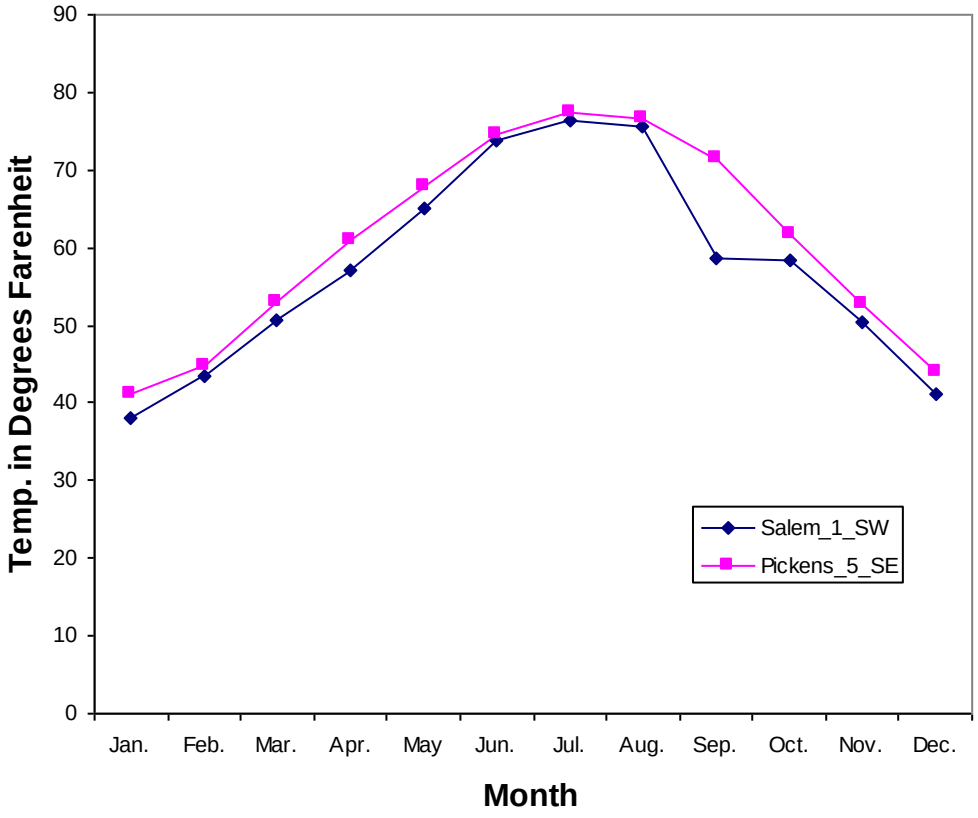


Figure 6. Avg. Monthly Precipitation (1961-2000)

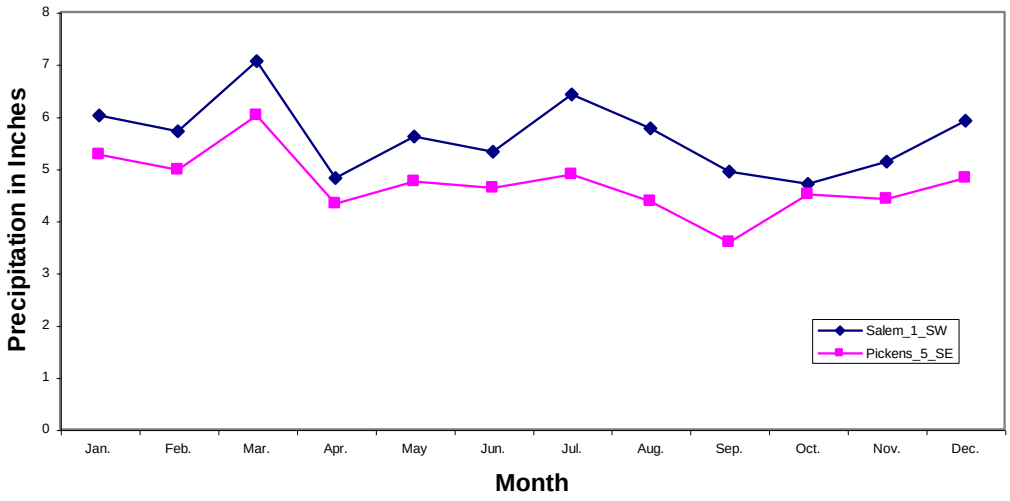
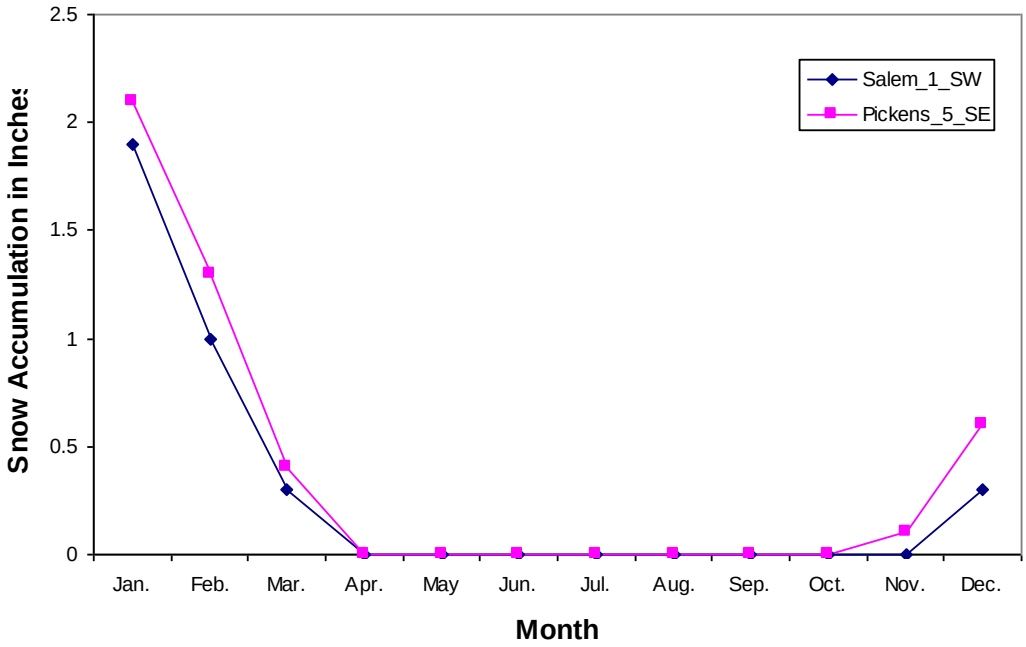


Figure 7. Average Monthly Snow Accumulation (1961-2000)



Geology and Soils

The Jocassee Gorges erode the following two tectonic provinces in South Carolina: (1) the Blue Ridge and (2) the Inner Piedmont (including the Chauga belt, Walhalla nappe, and Six Mile nappe). A regional northeast striking structure, known as the Brevard fault zone, separates the two tectonic provinces and runs 300 km along the eastern edge of the Appalachian Mountains from Alabama to Virginia. The Blue Ridge-Inner Piedmont uprising resulted from at least three continent-to-continent collisions. Parent rock material of the Jocassee Gorges formed from metamorphosed marine and volcanic rock, becoming commonly known today as schist and gneiss. Both schist and gneiss are part of the southern Appalachian metamorphic core. Evidence of the area's 1.1 billion years of geologic history can be seen in these rock formations. These events formed a durable rock known as “Toxaway gneiss” like granite but metamorphosized to produce its characteristic black and white bands dating back to the pre-Cambrian age approximately 1.3 billion years ago. Tectonic activity can be detected by the northeast to southeast marking direction.

The soils of Jocassee Gorges are variable with the most dominant soil type being the Ashe-Saluda-Stony land association. The Ashe-Saluda-Stony association is characteristic of the Cane Creek watershed. The Ashe-Saluda-Stony association is dominant on all of the Pickens County portion of the property with the exception of the Lake Jocassee drainage and the mountain ridge areas. Characteristically, this association

is described as excessively to well-drained, strongly sloping to very steep soils that have a loamy sub-soil and are moderately deep or shallow to weathered rock on mountains. Approximately 31 percent, 30 percent, and 18 percent of the association are made up of Ashe soils, Saluda soils, and Stony land. Within the Jocassee and Cane Creek areas, this association has an average slope of about 60 percent. Soils formed predominately from granite-weathered material with a high content of gneiss and quartz. Residing on the Pickens County side, the Cane Creek watershed has to its upper and lower extremities the Lake Jocassee drainage and the high peaks and ridge areas. The Lake Jocassee Drainage and high mountain ridge areas are characterized by the Edneyville-Porters-Hayesville association. Soils in this association are best described as being well-drained, strongly sloping to very steep soils, having a loamy sub-soil, and being moderately deep or deep to weathered rock on mountains. Respectively, 33 percent, 23 percent and 12 percent of the association are composed of Edneyville, Porters, and Hayesville soils. Edneyville, Porters, and Hayesville soils formed from granite and gneiss weathered in a cool climate characterized by abundant rainfall.

Location, Physiography and Hydrology

The Cane Creek watershed is one of the four major watersheds composing the JLA associated with the Keowee River System of the Savannah Drainage System. Situated in the Blue Ridge province, the Jocassee Gorges are flanked by steep northeast rising mountain ridges intermixed with lowland valleys. South Carolina's portion of the Blue Ridge escarpment, reaching 90 miles long and 25 to 30 miles wide, stretches into

Oconee County and extends eastward into Greenville County. The Blue Ridge escarpment's southeast flank is separated from the Piedmont region by the Chattooga Ridge. The JLA is positioned between the mountain Highlands Plateau and the rolling hills of the South Carolina's piedmont, predominately located in Pickens County and the northwestern reaches of Oconee County, S.C. The Jocassee Tract itself is an expanse of the Blue Ridge Front extending from Sassafras Mountain to the lower Cane Creek and Eastatoe Creek in the southwest and to Bearcamp Creek plus Musterground Mountain in the northwest. This portion of the Blue Ridge escarpment has a south facing orientation where the rivers collectively form a bowl-shaped indentation approximately fifteen miles wide and 2,000 feet deep. The 43,500-acre Jocassee Tract has to its west the Sumter, Chattahoochee, and Nantahala National forests. Located to the eastern border, in South Carolina, are the Mountain Bridge Wilderness Area, Table Rock, Caesar's Head, and Jones Gap State Park.

The study area comprises approximately 4,400 acres of the total land tract. The Cane Creek watershed displays topography typical to that of the Blue Ridge escarpment. It ranges from high mountain peaks and bluffs dissected by fast flowing water to creek bottoms and coves along Cane Creek itself. Valleys, bogs, waterfalls, and seeps lie intermixed between the high and low elevations. The mountain peaks of the Cane Creek watershed range from1800 to 2200 feet in elevation with an overall drop to 900 feet in the creek bottoms.

The main drainages in the Jocassee Gorges property are Eastatoee Creek to the east, Cane Creek in the center, and the Toxaway River (now Lake Jocassee) to the west. These systems flow generally to the south and southwest and drain into the Savannah River Basin. On the eastern boundary is the Oolenoy River, which flows to the south and then to the east, into the Saluda River Basin. In the Cane Creek region, the annual precipitation averages about 62 inches. As a result of this high precipitation, stream flow is relatively high, with an average flow of 3.3 cubic feet per second per square mile (Johnson et. al. 1968). The steep terrain produces stream gradients as high as 250 feet per mile in some areas (Bloxham, 1979). Surface fractures in the igneous and metamorphic rock provide channels for runoff. Consequently, stream channels often become angular and drainage patterns rectangular (Acker and Hatcher, 1970). The steep terrain and semi-permeable soils in the area cause rainfall to rapidly run off into stream channels. As a result, streams show rapidly fluctuating flows dependent on rainfall but have well sustained base flows because of substantial ground water discharge (SC Water Resources Commission, 1983). Maximum summer stream temperatures are generally less than 75°F. Minimum winter stream temperatures can approach 35°F. Stream substrate varies considerably and appears most related to past disturbances in the watersheds and stream gradient.

METHODS

The study was initiated with collecting trips starting in March of 1998 and continuing into June of 2000. Voucher specimens collected were pressed, mounted, and identified and housed in the Clemson University Herbarium (CLEMS). Duplicate copies of the voucher specimens were collected for the University of South Carolina Herbarium (USC). Threatened or endangered species comprising small populations were not collected.

The first step of the survey was analysis and reconnaissance of the area to obtain familiarity of land distribution and to determine particular habitats. Rodger's (1969) observations of the Horsepasture Gorge lead to six zone situations that are relative to specific communities. These six zones include the following: (1) River Margin, (2) Floodplain, (3) Coves and Seepage Slopes, (4) Slopes of Lower Elevation, (5) Slopes of Higher Elevation and (6) Dry Peaks and Ridges. These zone/community situations were used as a preliminary guide to distinguish habitats and introduce the community types of the Cane Creek watershed. The specimens were identified as to location within the Cane Creek watershed including approximate direction and relation to Cane Creek. Infrared aerial photographs (United States Forest Service) were employed to determine habitat and land distribution. These photographs, in conjunction with United States Geological Survey maps, aided in subjective selection of representative areas of vegetation in relation to slope and disturbance.

Due to the expanse of the acreage included within the watershed, no quadrant sampling was conducted. Collections were made by rapid- sampling method, through field observation, and relationship to Cane Creek. Community types were based on field observation of associated species, soil type, dynamics, plant species of concern that are present, and location. Classification of community types follows that of Nelson (1986) and Schafale & Weakley (1990).

COMMUNITY DESCRIPTIONS

Contributing factors including heterogeneous topography, succession, and historical human impact to the gorge area have created a subtle merging of plant communities within the JLA. This merging of communities presents a problem when trying to distinguish any particular one from another. For the purpose of this study, distinction of plant communities was primarily based on field reconnaissance work in order to establish distribution within the Cane Creek watershed. Due to the vast acreage of the Cane Creek watershed in and of itself, no quantitative selection sampling was performed. Distribution patterns of communities were delineated and described as follows in accordance with Nelson (1986) and Schafale & Weakley (1990). After adequate field reconnaissance and mapping, twelve plant community types were distinguished. These communities include: Cove Forest (Rich, Basic and Acidic), Mesic-Mixed Hardwood Forest, Canadian Hemlock Forest, Piedmont-Low Mountain Alluvial Forest, Pine-Oak Heath, Rhododendron Thicket, Piedmont-Mountain Semi-permanent Impoundment, High Elevation Seeps, Spray Cliff, Southern Appalachian Bog, Exposed Rock Surfaces, and the Submerged Aquatics. The larger forest-type communities occur as large land expanses normally grading from one to another within the watershed tract. Communities including river margins, seeps, cliffs, bogs, impoundments, and thickets may occur somewhat smaller, scattered or irregular within the watershed tract.

Cove Forest

The cove forests of the Cane Creek watershed vary depending on richness and relative pH of the soil. The Cane Creek watershed has within it Rich Cove forest, Acidic Cove forest, and Basic Cove forest. Each cove forest type is based upon elevation, soil type, vegetation, and other important dynamic features.

The Rich Cove forest is a terrestrial community type often synonymous with Cove Transition forest and Mixed Mesophytic forest found frequently in mountain regions and the piedmont. Rich Cove forests primarily occupy sites characterized as low sheltered slopes, rich broad flats next to streams, low to moderate elevation, mesic ravines, and are not restricted to northern exposures. This type of forest has generally rich circumneutral soil that may be rocky but relatively deep. Mapped soil series for the Rich Cove forest includes: Ashe, Porters, and Tusquitee. The Rich Cove forest is recognized as a stable climax community generally with uneven aged trees, some possibly several centuries old. Tree reproduction occurs in canopy gaps continuously produced by natural occurrences and possible, but unlikely, fire. Logging promotes shade intolerant trees, proliferation of shrubs, and reduction in herb layer. Early disturbance is indicated by the predominance of *Tsuga* and *Liriodendron.* Within the Blue Ridge escarpment, the Rich Cove forest is known to occur in low elevation areas plus foothills and in high-rainfall gorges with southern orientation.

A dense canopy composed of diverse combinations of mesophytic trees characterizes Rich Cove forest communities. The Rich Cove forests of the Cane Creek watershed have canopies predominated by *Liriodendron tulipifera, Tilia americana* var.

heterophylla,Betula lenta, Fagus grandifolia, and *Tsuga canadensis.* To a lesser extent, the canopy includes *Aesculus* sp., *Magnolia acuminata, Fraxinus americana,* and *Halesia carolina.* Rich Cove forest under story is open consisting of *Cornus florida, Carpinus carolina, Magnolia fraseri,* and *Asimina triloba.* The shrub layer is, in most cases, open to quite dense including species such as *Hydrangea arborescens, Calycanthus floridus, Cornus alternifolia,* and *Rhododendron maximum.* The herbaceous layer of Rich Cove forests is rich and diverse with many spectacular spring ephemerals. Such species include *Cimicifuga racemosa, Impatiens capensis, Laportea canadensis, Adiantum pedatum, Polystichium acrostichoides, Hepatica acutiloba, Viola canadensis, Stellaria pubera, Tiarella cordifolia, Actaea pachypoda, Podophyllum peltatum, Arisaema triphyllum,* and *Carex* spp.

Plant species of concern present within the Rich Cove forest are *Carex austrocaroliniana, Circaea lutetiana* ssp. *canadensis, Shortia galacifolia, Calystegia catesbiana, Juglans cinera, Panax quinquefolius,* and *Trillium discolor.* Even though Rich Cove forests are characterized by dominance of diverse mesophytic trees and a rich herb layer, this community type may be difficult to separate from Basic and Acidic Cove forests. Differences between Rich Cove and Basic Cove forests are centered primarily on the composition of the herbaceous layer rather than on canopy tree species. The Acidic Cove forest is distinguished from the Rich Cove forest by the presence of mesic convex slopes. Rich Cove forests are found adjacent to oak communities defined by the

increasing predominance of oak species over mesophytic trees. In most cases, Rich Cove forests grade upward to Chestnut Oak or Canadian Hemlock communities.

The Cane Creek watershed has within it variations of the Rich Cove forest community. One such variation is the Basic Cove forest community. The terrestrial Basic Cove forest community type is predominately upland on slopes overlying basic or once again circumneutral soil where there is significant weathering of parent material. This forest community is located primarily in the piedmont. The Basic Cove forest consists of a dense canopy composed of diverse hardwood tree species and a lush herbaceous layer, especially in mesic sites of the upper piedmont. These two aspects of the Basic Cove forest are highly developed on north-facing and sheltered slopes. Availability of water is an important factor in the overall appearance and richness of this community. The presence of the Basic Cove forest on drier slopes indicates a less dense canopy layer and less diverse herbaceous layer than if it were more optimally oriented on a moist bottom slope.

The dense hardwood canopy of the Basic Cove forest is characterized by the presence of such species as *Quercus alba, Q. velutina, Carya glabra, Aesculus* sp., *Liriodendron tulipifera*, *Fagus grandifolia,* and *Acer rubrum.* In extreme drier regions of Cane Creek watershed, this community has a predominance of *Quercus alba* and other oak species adapted for drier habitats. The Basic Cove forest sub canopy consists primarily of *Nyssa sylvatica* and *Cornus florida*. The shrub layer is sparse to dense and contains species such as *Euonymous americana, Symplocos tinctoria, Viburnum* spp.

Vaccinium spp., and *Rhododendron* spp. The lush herbaceous layer contains many species including *Stellaria pubera, Podophyllum peltatum, Anemone* spp., *Trillium cuneatum, T. catesbaei, Sanguinaria canadensis, Cynoglossum virginianum, Iris cristata, Luzula* spp., and *Juncus* spp.

Potential plant species of concern within the Basic Cove forests of the Cane Creek watershed are primarily *Orchis spectabilis* and *Panax quinquefolius.* The Basic Cove forest most likely grades into various upland forest types such as the Rich Cove forest; however, these two community forest types are hard to distinguish from one another. The most distinguishing aspect of the Basic Cove forests, when trying to separate it from Rich Cove forests, is availability of groundwater. The Basic Cove forest flora is achieved when groundwater is in abundance.

Cane Creek watershed also contains a variation of the Rich Cove forest known as the Acidic Cove forest. This terrestrial forest community type ranges from sites with sheltered low to moderate elevation or narrow rocky gorges with occasional flooding and steep ravines to low ridges. The Acidic Cove forest persists mainly in mountainous regions and the upper foothills. This forest community is classified primarily on soil composition and pH. The Acidic Cove forest maintains rocky acidic soil with mapped soil series including the Ashe and Tusquitee. The Acidic Cove forest, like other cove forest communities, is categorized as a stable climax forest with a typical regime of natural disturbance maintaining gaps for continual growth. The Acidic Cove forest may, in fact, result from disturbance in a Rich Cove forest community that will resume through

succession to its previous state. The rocky acidic soil of the Acidic Cove forest most likely serves as a deterrent to prevent or slow down the invasion of typical mesophytic tree species. The dominant presence of *Liriodendron,* a shade tolerant species, in the Acidic Cove forest community may indicate that a large-scale disturbance has occurred within the area. However, Buckner and McCrackin (1978) have made a strong case indicating that predominance of *Liriodendron* is due to the species' ability to regenerate in old growth forest where gaps have occurred.

The canopy of the Acidic Cove forest is still considerably dense but the composition has fewer number of mesophytic tree species. Canopy constituents are *Liriodendron tulipifera, Betula lenta, Tsuga canadensis, Acer rubrum,* and *Quercus rubra.* Species of the Rich Cove forest such as *Tilia americana* var. *heterophylla, Magnolia acuminata,* and *Asimina triloba* are rare or not present. The under story of the Acidic Cove forest is open and includes species such as *Magnolia fraseri, Halesia carolina,* and various canopy species. The shrub layer of the Acidic Cove forest is, in general, much different than that of the Rich Cove forest. The Acidic Cove forest moves toward a dense richly developed thicket containing *Rhododendron maximum* and *Leucothoe fontanesiana.* Due to the highly developed shrub layer, the herbaceous layer of this forest community type is less rich. The herbaceous layer is composed of acidic tolerant species such as *Galax aphylla, Polystichium acrostichoides, Mitchella repens, Epigaea repens, Thelypteris noveboracensis, Arisaema triphyllum, Medeola virginiana, Maianthemum racemosum,* and *Carex* spp. Herbaceous species of the Rich Cove forest

also occur in the Acidic Cove forest; however, these species will be less abundant due to the acidic nature of the soil.

Plant species of concern in the Acidic Cove forest of the Cane Creek watershed include *Smilax biltmoreana, Lygodium palmatum, Panax quinquefolius,* and *Shortia galacifolia.* The Acidic Cove forest most often grades into the Hemlock forest, Rich Cove forest, or upland to the Chestnut Oak forest community. Acidic Cove forest may move to a Rich Cove forest, through succession, making the distinction between the two highly difficult. Distinctions may be ascertained based on the acidic substrate, fewer canopy species, richly developed ericaceous shrub layer, and acidic tolerant herbaceous layer. Acidic Cove forests occur, in the Cane Creek watershed, lower on steep slopes in approximation to streams or alluvial flats than do Rich Cove forests.

Mesic-Mixed Hardwood Forest

The Mesic-Mixed Hardwood forest is a second terrestrial type forest community within the Cane Creek watershed. It is synonymous with the Piedmont Cove forest and the Beech Ravine. The Cane Creek watershed maintains the piedmont subtype of this community ranging down into lower parts of the Blue Ridge Mountains (Schafale and Weakley, 1990). The Mesic-Mixed Hardwood forest occupies sites including low-forested slopes, steep north-facing slopes, and ravines or well-drained stream bottoms in close relation to acidic rock. The Mesic-Mixed Hardwood forest type is determined more on soil type rather than exposure. The soil of this community is well drained and somewhat acidic with soil series including that of Cecil, Georgeville, Pacolet, Tatum,

Wedowee, Talapoosa and Louisberg. Mesic-Mixed Hardwood forests are stable communities. This forest community has a typical uneven aged tree population interspersed with some relatively old tree species. It is difficult to discern one particular dominant tree species in this community. Regeneration occurs in canopy gaps maintained by natural disturbances allowing less shade tolerant tree species to remain in the community. However, variation among this community depends locally on position of slope and content of soil.

The canopy of the Mesic-Mixed Hardwood forest is dominated by mesophytic tree species including *Fagus grandifolia, Liriodendron tulipifera, Acer rubrum, Quercus rubra, Q. alba, Q. velutina, Liquidambar styraciflua, Oxydendrum arboreum, Tilia americana* var. *heterophylla, Carpinus caroliniana,* and *Hamamelis virginiana.* Though there is generally no dominate tree species in the canopy of this community, there may be a high concentration of *Fagus grandifolia, Quercus rubra,* and *Liriodendron tulipifera.* Sites with a western orientation within the piedmont tend to have increasing numbers of *Tsuga canadensis* present with *Rhododendron* ssp. at the shrub layer. Under story species consists of *Acer rubrum, Nyssa sylvatica, Cornus florida, Ilex opaca,* and *Ostrya virginiana.* The shrub layer of the Mesic-Mixed Hardwood forest community is not extensive. The species included at this level are *Vaccinium stamineum, Euonymus americana, Symplocos tinctoria, Calycanthus floridus, Rhododendron nudiflorum,* and, in some cases, *Kalmia latifolia.* The herbaceous layer, in contrast to the shrub layer, is dense and diverse. Many spring ephemerals are present at this level in high abundance

except in areas of dense shade. Species common to the herbaceous layer of the Mesic-Mixed Hardwood forest include *Polystichium acrostichiodes, Viola* ssp., *Dichanthelium* ssp., *Galium circaezans, Desmodium nudiflorum, Chamaelirium luteum, Epifagus virginiana, Tiarella cordifolia, Stellaria pubera, Podophyllum peltatum, Botrychium virginianum, Goodyera pubescens, Chrysogonum virginianum, Hieracium venosum, Spigelia marilandica, Mitchella repens, Sanguinaria canadensis,* and *Iris cristata.* This community type has considerable diversity of species at all levels; however, species of concern are much more rare. Plant species of concern for the Mesic- Mixed Hardwood forest within the Cane Creek watershed are *Actaea pachypoda* and *Panax quinquefolius.* The Mesic-Mixed Hardwood forest can be indicated primarily on species present in the herbaceous layer and continues upland to community types such as the Oak-Hickory forest and Basic Mesic forest. It, however, grades downward into Piedmont-Low Mountain Alluvial forest or Piedmont Bottomland forest. The Mesic-Mixed Hardwood forest can be distinguished from these two separate forest types based on the absence of bottomland tree species and presence of flood intolerant tree species.

Canadian Hemlock Forest

Cane Creek watershed contains a third terrestrial forest community type recognized as the Canadian Hemlock forest. This forest community occurs in areas that are less mesic than the Cove or Mesic-Mixed Hardwood forest. These sites include terrain with open valley flats, steep slopes, north-facing high elevation flats, sheltered low ridges, narrow ravines, and sometimes flats adjacent to streams within mountain

ranges and north facing river bluffs of the Blue Ridge Mountains. Due to the abundance of *Tsuga canadensis,* the soil of the Canadian Hemlock forest is acidic with an abundance of rocky substrate and with upland soils series including Ashe, Edneyville, and Porters. The Canadian Hemlock forest is a stable natural climax forest most usually with uneven aged tree species.

The canopy layer of the Canadian Hemlock forest community is predominated by the tree species *Tsuga canadensis* with a minor mixing of *Pinus strobus* plus various other Cove forest tree species. The under story of the Canadian Hemlock forest produces a lush thicket. If the under story thicket is dense and relatively closed, the thicket will be primarily comprised of *Rhododendron maximum* singularly or in conjunction with *Kalmia latifolia* and *Leucothoe fontanesiana.* However, if the under-story thicket is a bit more open it will include these species and low shrubs such as *Euonymus americana, Hamamelis virginiana, Pyrularia pubera,* and *Vaccinium stamineum.* With the dominant presence of *Tsuga canadensis* and a rich ericaceous layer, other species have trouble establishing and, in most cases, are suppressed, allowing the boundary of the Canadian Hemlock forest to become highly distinguishable. The herbaceous layer of this community is sparse and less dense than that seen in the other forest communities mentioned. The richness of the herbaceous layer depends highly on whether the under story thicket is closed or open. Species included within the herbaceous layer of the Canadian Hemlock forest include *Mitchella repens, Viola blanda, V. rotundifolia, Cimicfuga racemosa, Medeola virginiana, Polystichium acrostichiodes, Symphyotrichum*

cordifolium, Thelypteris noveboracensis, Dennstaedtia puntilobula, Tiarella cordifolia and *Thalictrum clavatum.*

The predominance of *Tsuga canadensis* and a thicket-like under story of ericaceous shrubs limits the occurrence of rare species in the Canadian Hemlock forest community of the Cane Creek watershed. A couple of noteworthy species include *Shortia galacifolia* and *Trillium discolor*. The Canadian Hemlock forest grades upslope to drier communities such as the Chestnut Oak forest and the Cove forest. At exceedingly high elevations, it will merge into the Acidic Cove forest communities. Down slope, the Canadian Hemlock forest is differentiated by occurring in well-drained, non-flooded locations and can be distinguished from other lowland forest communities by an abundance of *Tsuga canadensis* and the absence of species such as *Platanus occidentalis* and *Carpinus caroliniana*.

Piedmont- Low Mountain Alluvial Forest

The Piedmont-Low Mountain Alluvial forest community is synonymous with the term floodplain. This forest community type occupies an area adjacent to or in approximation with the river and stream floodplains. These locations contain landforms and vegetation that have been formed by rivers within the Piedmont and low mountain elevations, but may be hard to distinguish due to size. This community ranges throughout the Piedmont and lower valleys of the Blue Ridge escarpment and includes the Cane Creek watershed. This community type is also referred to as palustrine, indicating seasonal or intermittent flooding. The soil of the Piedmont-Low Mountain

Alluvial forest is ever changing due to introduced flood-carried sediment. Soil series are Chewacla (Fluvaquentic Dystrochrept) or the Congaree (Typic Udifluvent). Considering that the Piedmont-Low Mountain Alluvial forest community involves the maintenance of floodplains, the nutrient input into this community doubles as a significant natural disturbance. Parts of the terrain of this community can be dramatically shifted due to flooding and erosion, though less likely to occur than in higher elevation Mountain Alluvial forests. This community may also be affected by beaver activity that produces impoundments. Due to these imposing factors, the Piedmont-Low Mountain Alluvial forest of the Cane Creek watershed has considerable variation. Flooding, alluvial material deposition, and relative fertility depending on upland soil composition cause such variation. Soils of this community may become rich in magnesium and iron when mafic rock substrate is upland within the vicinity.

The Piedmont Low-Mountain Alluvial forest is characterized as a forest with an open to possibly dense under story grading to the shrub layer including variation of the herbaceous layer. The canopy of this community contains a mixture of bottomland and mesophytic tree species. Canopy species include *Liquidambar styraciflua, Liriodendron tulipifera, Juglans nigra, Fraxinus pennsylvanica, Acer rubrum,* and *Halesia carolina.* Locations within this community exposed to cultivation or clearcutting are dominant in *Liriodendron tuliperifera* and *Liquidambar styraciflua.* Under story tree species consist of *Acer rubrum, Asimina triloba, Ilex opaca,* and *Carpinus caroliniana.* Shrub species include *Euonymus americana* and *Aesculus sylvatica* with an intermixing of vines such as

Toxicodendron radicans, Parthenocissus quinquefolia, Bignonia capreolata, Vitis ssp., and *Smilax* ssp. Though sometimes sparse, the herbaceous layer of the Piedmont Low-Mountain Alluvial forest can be rich and diverse. Species include *Stellaria pubera, Solidago caesia, Dichanthelium dichotomum, Polystichium acrostichoides, Botrychium virginianum, Boehmeria cylindrica, Impatiens capensis, Cryptotaenia canadensis, Viola* ssp., *Arisaema triphyllum,* and *Polypodium virginianum.* Common invasives include *Lonicera japonica* and *Microstegium vimineum.*

The Piedmont Low-Mountain Alluvial forest often has a number of well-known plant species of concern; however, most of these species do not occur within the Cane Creek watershed. Frequent extreme flooding, difficulty in establishment, or competition by invasive plant species may explain their absence. The Piedmont Low-Mountain Alluvial forest grades into mesic to dry-mesic or dry upland forests possibly crossing over into cliff communities bordering various river or streambed landforms. This community type is separated from mesic forests by placement within the floodplain and the inclusion of certain characteristic species. The Piedmont Low-Mountain Alluvial forest is also segregated from larger floodplain communities by landforms creating specific vegetation and ecosystem composition. Ecological pressures increase greatly within the Piedmont Low-Mountain Alluvial forest community, due to variable size and flooding regime of this community, as opposed to larger floodplain communities with less variability.

Pine- Oak Heath

The Pine-Oak Heath community moves away from the mature forests of the previous community types. This community undergoes continual regeneration through natural disturbances, including fire, keeping it from reaching an extensive mature forest. *Castanea dentata* was once a primary component of this community. With its disappearance, the canopy of this community became more open and heath dominated. The Pine-Oak Heath community was formerly referred to as Pine leads (Cooper, 1963). This community ranges from the upper piedmont zone into mountainous regions. The Pine-Oak Heath community occupies sites on high ridge tops and is distinguished by open canopies with stunted pine and oaks, low elevation peaks, and steep southern slopes. The Pine-Oak Heath community usually borders high and low elevation granite domes or summits. The soil of this community is extremely acidic and thin with tons of rocky quartzite substrate. Soil series for the Pine-Oak Heath community include Porters and Cleveland. Conditions for this community are highly xeric due to shallow soil and swift drainage. This community maintains a relatively open canopy layer; therefore, periodic fire is a necessity for the continuation of dormant seedbeds of shade intolerant species present. Due to the elevation zone for this community and its xeric conditions, a primary source of fire may be by dry lightning.

The open canopy layer of the Pine-Oak Heath community is composed of a combination of pine and oak species with other interspersed species. These other less dominant species maintain a sub canopy rather than differentiated into the under story.

The dominant pine and oak species found in the open canopy include *Pinus virginiana, P. pungens, P. rigida, Quercus prinus, Q. coccinea,* and *Q. velutina.* The presence of so many dominant pine and oak species creates a heterogeneous community; however, the pine species occur at different elevations. In high elevation Pine-Oak Heaths, *Pinus pungens* is dominant followed by *P. rigida* at intermediate elevations and *P. virginiana* at the lowest elevations within the community. At exceedingly low elevations, *Pinus echinata* may become more abundant. Oak species dominate in areas of little exposure. The sub canopy layer of the Pine-Oak Heath is characterized by species such as *Castanea dentata* occurring as stump sprouts, *Castanea pumila, Sassafras albidum, Nyssa sylvatica, Acer rubrum, Tsuga canadensis,* and *Oxydendrum arboreum.* Species included in the dense normally ericaceous shrub layer consist commonly of *Kalmia latifolia, Rhododendron maximum, R. minus, Gaylussacia ursine, G. dumosa, Vaccinium stamineum, V. arboreum,* and *Leucothoe recurva.* Species bridged between the shrub and herbaceous layers are *Smilax glauca* and *S. rotundifolia.* The herbaceous layer of the Pine-Oak Heath community is more depauperate than the communities previously discussed. Species common to this strata level include *Epigaea repens, Chimaphila maculata, Galax aphylla, Coreopsis major, Pteridium aquilium, Tephrosia virginiana, Uvularia puberula, Gaultheria procumbens,* and *Xerophyllum asphodeloides.*

The Pine-Oak Heath communities of the Cane Creek watershed contain several rare species. These species include *Xerophyllum asphodeloides, Fothergilla major, Gaultheria procumbens, Smilax biltmoreana* and *Amorpha glabra.* The Pine-Oak Heath

grades upward to communities such as the Chestnut Oak forest or Hemlock forests where xeric conditions are not as severe and less light exposure is present. At higher elevations, this community grades towards the Granite Dome and other high-elevation forest communities. The Pine-Oak Heath community is distinguished from most hardwood forests by structure and composition including the open canopy of pines and xerophytic oaks.

Rhododendron Thicket

The Rhododendron Thicket community is a terrestrial type synonymous with streamside thicket. This community type occupies sites that are characterized by dense, shrub-dominated areas adjacent or near to streams. The Rhododendron Thicket normally ranges from mountainous areas to the upper piedmont. Rhododendron Thicket communities may endure extremes due to flooding during the rainy seasons. The Rhododendron Thicket community is dense with little sunlight reaching the forest floor. This, in conjunction with size and dynamics of the associated stream, causes leaf litter and detritus material to build up without being continually broken down.

The vegetation of the Rhododendron Thicket is dense and abundant; however, as a whole it contains few individual species and is dominated by *Rhododendron maximum.* Though *R. maximum* is the predominate species of this community, there are several other ericaceous species that are inter-mixed throughout. Such shrub species include *Leucothoe fontanesiana* and *Kalmia latifolia.* The herbaceous level of the Rhododendron Thicket community is usually meager if not non-existent. The shrub layer of this

community creates a dense canopy that allows little penetration of sunlight to the forest floor. In addition too little sunlight, the ericaceous species leach alleopathic compounds into the soil and inhibit seed germination of herbaceous species.

Dominance of the ericaceous shrub layer limits the presence of plant species of concern within this community. However, *Trillium persistens* occurs within this community in ecotonal transitions that have adequate sunlight. Since the Rhododendron Thicket community occurs adjacent to or in near proximity to streams, this community has very little downward sloping to other community types. It may, however, grade towards land formations such as shoals and stream sandbars. The Rhododendron Thicket does grade upwards to other types of communities. Such upland community types include the Chestnut Oak forest, the Canadian Hemlock forest, the Cove forest, and the Spray Cliff.

Piedmont-Mountain Semi-permanent Impoundment

The Piedmont-Mountain Semi-permanent Impoundment is the second aquatic community type of the Cane Creek watershed. This unique community type occurs in proximity to Bully Branch. This community type is characterized as palustrine with permanent flooding towards the center with a gradual transition to surrounding hydrology patterns. This community occupies sites known commonly as beaver ponds or other older, undisturbed man-made constructions. These communities are maintained in low gradient locations within the floodplains and valleys. The Piedmont-Mountain Semi-permanent Impoundment ranges from mountainous regions throughout the piedmont,

being more common to the piedmont. The soils of this community type are difficult to classify because the original existing soil has undergone modification from being covered with sediment. The original soil content is difficult to establish and the new influx of sediment is ever changing. Dynamically, this community undergoes a high level of disturbance at random intervals. With proximal location to the floodplain and low valleys, this community is subject to occasional flooding plus nutrient and sediment renewal. Beavers are often responsible for the change in water level and land formation. Beaver activity can temporarily drain a water source, increase water levels through damming, take out tree populations or drastically change the lay of the land. Eventually, if this community is left dormant and absent of beaver activity, it will maintain high water levels, have a clay type sediment floor, and become invaded by tree species. This community is extremely variable and factors contributing to such variation include depth of water, geographic location, disturbance record, and age of existing impoundment.

The flora consists primarily of species present before formation of the impoundment, rapidly colonizing species, and a combination of wetland shrub species. Age of the impoundment within this community type also plays a role in dynamics and type of vegetation growing at the present time. Early stage impoundments are apt to have a higher amount of debris remaining from the pre-impoundment stage. There is generally no canopy layer within this community; however, certain flood-tolerant tree species such as *Acer rubrum* may become established. Within the Bully Branch impoundment of the Cane Creek watershed, wetland shrubs include *Alnus serrulata* and *Salix* sp. The

herbaceous layer varies to a large degree within an impoundment due to water levels. Characteristic species within the impoundments of the Cane Creek watershed include *Juncus* spp., *Carex* spp., and *Ludwigia* spp. If the impoundment creates deep ponds, several aquatic plant species may become established. This, however, has not occurred within the Bully Branch impoundment of the Cane Creek watershed.

At the upper regions of the impoundment or at its borders, the Piedmont-Mountain Semi-permanent Impoundment community grades to streams or to floodplain areas. Within the mountain regions of the Blue Ridge escarpment, this community is highly associated with the Appalachian Bog community. This community type is distinguished from surrounding floodplain areas based on water level dynamics. The surrounding floodplains are characterized by seasonal flooding and drainage, whereas, the semi-permanent impoundment experiences permanent to semi-permanent standing water. Man-made ponds can be included within this community type if they adhere to maintaining characteristics of remaining within the floodplain, have a relative size to that of natural occurring beaver ponds, have a considerable length of establishment history, and have had little modification other than flooding. Most man-made impoundments do not meet such restrictions.

High Elevation Seep

The High Elevation Seep is a third aquatic type community within the Cane Creek watershed. This palustrine community type occurs commonly throughout the mountains and piedmont regions and is a relatively stable community; however, it is subject to

temporal changes. High Elevation Seep communities vary in size, but are characterized by permanent water with interspersed seasonal dry periods. High elevation seeps occur on sites with upper elevation, sloping orientation to maintain continual seepage, and wet areas in relation to granite rock of acidic cliff regions. This community occurs in areas experiencing fracturing or foliation of metamorphic rock that creates soils that are primarily rocky, gravelly or mucky. No soil series is presently described for this community type. Variation of this community is contributed to rock composition, topographic position, soil formation, elemental extremes, degree of sunlight, and seepage. Eventhough seasonally there may not be an abundance of water moving through this aquatic community system, the ground soil is saturated to capacity. The High Elevation Seep community also may display a degree of patchiness. This is the result of separation of seeps by large rock outcrops or a terrestrial forest community such as the Granite Dome community. Such patchiness and intermittent disturbances make the High Elevation Seep community difficult to access.

Due to seasonal changes and water fluctuations, the High Elevation Seep community may experience temporary species dominance over a period of time. The land formation of this community prevents the establishment of a canopy layer. There are, however, several woody species that exists on the boundaries of this community, e.g., *Rhododendron maximum, Kalmia latifolia,* and *Acer rubrum.* These species normally do not reach the size that they characteristically would in mature forest communities. The flora of the High Elevation Seep community is notably known for its

diversity of bryophytes, ferns, and herbaceous species. This community type is characterized by an open to dense matte of wetland herbs. Species of the herbaceous layer include *Saxifraga micranthidifolia, Oenothera* sp., *Chelone* sp., *Rudbeckia* spp., *Houstonia serpyllifolia, Juncus* spp., *Carex* spp., *Impatiens capensis, Thalictrum clavatum,* and *T. dioicum.*

Plant species of special concern within the High Elevation Seep community include *Juncus gymnocarpus* and *Saxifraga micranthidifolia.* The High Elevation Seep community grades upland towards high elevation terrestrial communities. The High Elevation Seep community is distinguished from other high elevation communities by the degree of wetness and lack of canopy tree species. High Elevation Seeps grade down slope or at the same elevation to communities including the Acidic Cliff, Granite Dome, Spray Cliff, or the Southern Appalachian Bog. The High Elevation Seep and the Southern Appalachian Bog most commonly grade into one another but still maintain individual sites. The High Elevation Seep is distinguished from the Southern Appalachian Bog by occurring at higher elevations or on ridge tops. It is also distinguished from low elevation seeps by the dominance of herbaceous species.

Spray Cliff

The Spray Cliff community is the fourth aquatic system located within the Cane Creek watershed. This palustrine community type ranges consistently throughout the mountains and is rare in the upper piedmont. The Spray Cliff community reaches its height in the Southern Blue Ridge escarpment. This community is unusually stable,

occupying sites that are vertical to gently sloping with rock faces at the edge or base of waterfalls. The soils of the Spray Cliff community are not series classified but can be distinguished as depressions or mats of mineral rich organic matter in conjunction with bare rock. The Spray Cliff community depends invariably upon abundance of water. This community is continually saturated by water spray and may or may not have seepage water. Humidity within this community is relatively high, maintaining a constant source of moisture. Temperatures are balanced by water source, parent rock material, and sheltering from sun and wind. Drastic temperature changes may be caused by freezing or drought; however, such disturbances are rare. In conjunction with these disturbances, species content may be affected by other natural occurrences including floods and rock falls. Spray Cliff communities are strongly affected by the size and rate of flow of adjoining streams; however, most Spray Cliff communities are protected by slope orientation. What is uniquely striking about this community type is the resemblance to tropical regions. The atmosphere of this community is maintained by the effect of a constant water supply, high humidity, and a moderate climate. This community contains distinct endemic species and various disjunct pteridophyte populations.

The Spray Cliff community is composed of shrubs, herbs, and bryophytes that are resistant or can withstand the effects of continual water flow, high wind factors, and possible flooding. Vascular plants have difficultly withstanding these conditions and may be restricted to waterfall walls where they can colonize in areas where soil has built

up in holes and crevices. It is possible for tree species such as *Tsuga canadensis* to establish in the edge zone of the Spray Cliff community; however, this tree species may or may not reach considerable heights. Shrub species include *Rhododendron maximum* and *Kalmia latifolia.* The herbaceous layer is the most diverse and includes *Asplenium monanthes, Polypodium virginianum, Adiantum pedatum, Saxifraga micranthidifolia, Impatiens capensis, Houstonia serpyllifolia, Thalictrum* spp., and *Galax aphylla.*

The Spray Cliff community of the Cane Creek watershed houses the following species of concern: *Asplenium monanthes, Juncus gymnocarpus,* and *Saxifraga micranthidifolia. Asplenium monanthes* is unique in that while its normal range is tropical, disjunct populations occur in the Southern Blue Ridge escarpment /Southern Appalachian Mountains. The most distinguishing factor of the Spray Cliff community is that of water abundance. The constant water input and associated humidity in the Spray Cliff community, distinguishes this community from other similar communities such as the High Elevation Seep or Acidic Cliff. Moving away from the water source, the Spray Cliff community gradually grades into several other community types, i.e., various terrestrial mature forests, the Rhododendron Thicket, or the Shoal and Stream Bar. Down slope, this community gradually is expressed by a stream or full flowing river.

Southern Appalachian Bog

The Southern Appalachian Bog is the fifth aquatic community type in the Cane Creek watershed. Within the Jocassee Gorge Land Area, the Southern Appalachian Bog is specifically designated as the southern subtype. This palustrine community type is

generally saturated with moisture from seepage but may experience dry periods. The range of this community is intermittent throughout the mountains south of the Asheville Basin. It occupies sites that are flat or slightly sloping in valley lowlands that are not subject to flooding. Soils of the Southern Appalachian Bog are moist and mucky with high levels of organics and minerals. The soils are acidic and mapped as Toxaway, Wehadkee, or Hatboro series. The Southern Appalachian Bog community is unique in that, at the present, it is not fully understood. Factors involved in creating such communities are still open for speculation; however, grazing has likely played an important role. The Southern Appalachian Bog communities located within the Cane Creek watershed are under constant pressure from colonization attempts by shrub and tree species. This activity may eventually close the bog aquatic system and eliminate several herbaceous species. The Southern Appalachian Bog community tends to move towards mature forest communities; however, the rate at which this process happens can be quite slow. If rapid succession does occur in this community, then the natural disturbance regime that previously kept the community open has been interrupted. Alternatively, another idea for bog aquatic systems maintenance might involve herbaceous species establishment as a limiting factor on the invasion of shrub and tree species. The Southern Appalachian Bog varies in water abundance, elevation, nutrient levels, and organic accumulation. These factors influence the vegetation within this community; however, it is common to see more diversity in open systems verses shrub-

dominated systems. This community type is rare within the Southern Appalachian region and, in most cases; those that are present are relatively inaccessible.

The vegetation of the Southern Appalachian Bog-southern subtype varies considerably depending on whether it is an open or closed system or where it exist between these two possible transitions. Tree species may be present scattered within the community or pervade at the edges. Tree species include *Acer rubrum, Pinus strobus, P. rigida,* and *Tsuga canadensis.* Abundance of shrub species including *Alnus serrulata, Salix* sp., *Rhododendron maximum,* and *Kalmia latifolia* varies in this community. Shrub species included within the bog communities of the Cane Creek watershed. The herbaceous layer of the Southern Appalachian Bog is considerably diverse within the Cane Creek watershed with characteristic species including *Carex leptalea, Carex bromoides* ssp. *montana, Osmunda cinnamomea,* and *O. regalis* var. *spectabilis.*

Rare or plant species of concern pervade the Southern Appalachian Bog- southern subtype communities in the Cane Creek watershed and include *Juncus gymnocarpus* and *Lygodium palmatum.* This community type often is associated with the Swamp Forest-Bog Complex; however, abundance of water is key in making the distinction. The Swamp Forest-Bog Complex resides close to streams or rivers whereas the Southern Appalachian Bog exists further away from water sources. Upslope, the Southern Appalachian Bog system grades toward community types such as Montane Alluvial Forests and Acidic Cove Forests. The Southern Appalachian bog community may also

conjunct with High Elevation Seep communities; however, this is rare due to considerable elevation differences.

Exposed Rock Surfaces

A rare community found in the Cane Creek watershed is the Exposed Rock Surface community. It occurs along the margins of the river and scattered throughout high seeps. The Exposed Rock Surface community is uncommon with a relative degree of instability. The exposed rock common to Cane Creek consists of the granite-like "toxaway gneiss" causing the surface pH to be acidic under weathered conditions. Though not included within this survey, bryophytes and lichens rapidly colonize the rock surfaces of this community to become the dominant species for many sites.

This community is rare and intermittent along the creek system due largely to variability of water flow. Plant species present show tremendous diversity depending upon orientation and water flow. In areas where the Exposed Rock Surface community exists at high elevations, this community begins to share species common to the Seepage Slope community. Plant species of drier, high-elevation Exposed Rock Surface communities include *Pinus virginianum* and *Vaccinium arboreum.* Exposed Rock Surface communities situated on mesic sites have species that include *Asplenium monanthes, Heuchera villosa,* and *Saxifraga micranthidifolia*. There are Exposed Rock Surface sites that vary in moisture between xeric and mesic conditions. Characteristic plant species under such conditions include *Polypodium virginianum* and *P. polypodioides.*

Submerged Aquatics

The Submerged Aquatics system is very different than all other communities previously described. This system within the Cane Creek watershed consists primarily of a single species, *Podostemum ceratophyllum*. This aquatic plant species is maintained entirely within a stream or riverbed, lending to its common name of riverweed. *Podostemum ceratophyllum* establishes on rock formations, most commonly found in rushing "whitewater" and spray areas. Within the Cane Creek watershed, commonly associated species including *Potamogeton* spp. and *Sparganium americanum* are not found with *P. ceratophyllum* populations. The rapid to fast moving streams in Cane Creek watershed are probably the limiting factor.

SUMMARY

The inventory produced from the Cane Creek watershed of the Jocassee Land Area has lived up to its expectation for flora diversity with its 403 species of vascular plants representing 105 families. Of these species, sixteen are listed as state-level, regional, or national concern. These species include: *Asplenium monanthes, Carex austrocaroliniana, Carex bromoides* ssp. *montana, Carex radfordii, Circaea lutetiana* ssp. *canadensis, Gaultheria procumbens, Galearis spectabilis, Hepatica nobilis* var. *acuta, Juglans cinera, Juncus gymnocarpus, Lygodium palmatum, Panax quinquefolius, Saxifraga micranthidifolia, Shortia galacifolia, Trillium discolor,* and *Xerophyllum asphodeloides.* The largest family within the inventory is the Poaceae with forty-two species from thirty-two genera, followed by the Asteraceae with forty species from twenty-seven genera. The Cyperaceae, with twenty-five species, twenty-one of which are Carex species, is the third largest family. The floral richness of the Cane Creek watershed is similar to floras to that of the Horsepasture Gorge (Rodger's, 1969) and the Toxaway River Gorge (Cooper, 1963).

The high degree of floral diversity found in the Cane Creek watershed is attributed to both its location in the Southern Appalachian Mountains and its orientation in the Blue Ridge escarpment. Midsummer and midwinter temperatures average 71.2°F and 47.1°F, respectively. Average annual precipitation accumulation for the watershed is 61.99 inches with an average snowfall of 4.0 inches. Endemic species found include the

following: *Carex austrocaroliniana, Carex radfordii, Clethra acuminata, Houstonia serpyllifolia, Rhododendron minus, Shortia galacifolia,* and *Trillium discolor*. Disjunct species include *Asplenium monanthes.* Two more northern latitude species, *Saxifraga micranthidifolia* and *Xerophyllum asphodeloides*, occur at higher elevation within the watershed. Introduced species include the following: *Eragrostis pilosa, Dactylis glomerata, Lolium pretense, Lolium perenne* ssp. *multiflorum, Tristicum aestivum, Hordeum pusillum, Avena sativa, Eleusine indica, Echinochloa crus-galli, Digitaria sanguinalis, Microstegium vimineum, Lespedeza bicolor, Pueraria montana* var. *lobata, Daucus corota, Ligustrum sinense, Prunella vulgaris, Paulownia tomentosa, Verbascum thapsus,* and *Lonicera japonica*.

The inventory of the Cane Creek watershed of the Jocassee Land Area is an open-ended project. Due to the expanse and size of the watershed, new floristic records may continually become known. The combination of climate, geology, location and hydrology produces within this watershed the characteristic yet individualistic mode of the Southern Appalachians. Ten dominant and two major vegetation community types were distinguished for the watershed. The major communities include the following: (1) Rich Cove Forest, (2) Mesic-Mixed Hardwood Forest, (3) Canadian Hemlock Forest, (4) Piedmont-Low Mountain Alluvial Forest, (5) Pine-Oak Heath, (6) Rhododendron Thicket, (7) Piedmont-Mountain Semi-permanent Impoundment, (8) High Elevation Seep, (9) Spray Cliff and (10) Southern Appalachian Bog. Minor communities found intermittently within the watershed include: (1) Exposed Rock Surfaces and (2)

Submerged Aquatics. Community relationships and species comparison may be of further interest as the remaining watersheds of the JLA are fully inventoried.

APPENDICES

APPENDIX A

Soil Series Descriptions

Table I. USDA-Natural Resource Conservation Service Soil Series and Distinguishing Features.

Soil Type	Distinguishing Characteristics
Ashe- coarse-loamy	series consists of moderately deep, somewhat excessively drained soils on gently sloping to very steep, narrow ridges and side slopes of the southern Appalachian Mountains. They form in residuum that is affected by soil creep in the upper part, and weathered from felsic, intermediate, or mafic igneous and high-grade metamorphic rock such as granite, granite gneiss, granodiorite, hornblende gneiss, schist, amphibolite, high-grade metagraywacke, and mica gneiss. Solum thickness from 14 to 40 inches. Depth to hard bedrock from 20-40 inches. Reaction extremely acidic to moderate.
Cecil- fine-kaolinitic	series consists of very deep, well-drained moderately permeable soils on ridges and side slopes of the Piedmont uplands. They are deep to saprolite and very deep to bedrock. They formed in residuum weathered from felsic, igneous and high-grade metamorphic rocks of the Piedmont uplands. Solum thickness from 40-60 inches. Depth to bedrock from 6.5-10 feet. Reaction strongly acidic to moderate.
Chewacla- fine-loamy	series consists of very deep, moderately permeable, somewhat poorly drained soils on flood plains. They formed in recent alluvium washed largely from soils formed in residuum from schist, gneiss, granite, phyllite, and other metamorphic and igneous rocks. Solum thickness from 15-70 inches. Depth to bedrock from 5-10 feet. Reaction strongly acid to slightly.

Cleveland- loamy	series consists of shallow, somewhat excessively drained, moderately rapidly permeable soils that may be affected by soil creep. They formed in material weathered from felsic mafic, igneous and high-grade metamorphic rocks such as granite, hornblende gneiss, mica gneiss, and schist. Solum thickness and depth to bedrock from 10-20 inches. Reaction strongly acidic to moderate.
Congaree- fine-loamy	series consists of deep, to moderately well drained, moderately permeable loamy soils that formed in fluvial sediments. Depth to bedrock more than 10 feet. Reaction strongly acidic to neutral.
Edneyville- coarse-loamy	series consists of very deep, well-drained soils on gently sloping to very steep ridges and side slopes of the Southern and Central Appalachian Mountains. They formed in residuum that is affected by soil creep in the upper part, and from weathered felsic to mafic crystalline rocks such as granite, mica gneiss, hornblende gneiss, and amphibolite. Solum thickness from 20-55 inches. Depth to bedrock more than 60 inches. Reaction strongly to moderately acidic.
Georgeville-fine-kaolinitic	series consists of very deep, well-drained, moderately permeable soils that formed in material mostly weathered from fine-grained metavolcanic rocks of the Carolina Slate Belt. Thickness of clayey part from 24-48 inches. Depth to lithic contact more than 60 inches. Reaction strongly acidic to neutral.
Hayesville-fine-kaolinitic	series consists of very deep, well-drained soils on gently sloping too very steep ridges and side slopes of the Southern Appalachian Mountains. They commonly formed in residuum weathered from igneous and high-grade metamorphic rocks such as granite, granodiorite, mica gneiss, and schist; but in some places formed from thickly bedded metagraywacke and metasandstone. Solum thickness from 30-60 inches. Depth to bedrock greater than 60 inches. Reaction extremely acidic.

Hatboro- fine-loamy	series are very deep to poorly drained. They formed in regolith of alluvium from metamorphic and crystalline rock. They are on flood plains, and slopes ranging from 0-3 percent. Permeability is moderate. Solum thickness from 40-60 inches. Depth to bedrock 5-10 feet. Reaction strongly acidic to neutral.
Louisburg- coarse-loamy	series consists of very deep, well-drained, rapidly permeable soils that formed in material weathered from felsic igneous and metamorphic rock, primarily granite and granite gneiss. Soils are on summits and side slopes of the Piedmont upland. Solum thickness from 20-40 inches. Depth of bedrock more than 5 feet. Reaction strongly to moderately acidic.
Pacolet- fine-kaolinitic	series consists of very deep, well-drained, moderately permeable soils that formed in material weathered mostly from acid crystalline rocks of the Piedmont uplands. Depth to lithic contact is 60 inches. Reaction strongly to slightly acidic.
Saluda- loamy	series consists of shallow, well-drained, moderately permeable soils that formed in weathered granite, gneiss, or schist. Solum thickness from 10-20 inches. Depth to bedrock is greater than 40 inches. Reaction strongly to slightly acidic.
Tatum- fine	series is deep, well drained to moderate permeability with slow to very fast surface run-off. Residuum from sericite schist, phyllite, or other fine-grained metamorphic rocks. Solum thickness from 30 to 60 inches. Depth to bedrock from 40 to 60 inches. Reaction strongly acidic.
Toxaway- fine-loamy	series consists of very deep, poorly and very poorly drained soils that formed in loamy alluvial deposits on nearly level flood plains of mountain valleys. Solum thickness ranges from 24-50 inches. Depth to bedrock is more than 10 feet. Reaction strongly acidic to slightly.

Tusquitee- fine-loamy	series consists of very deep, well-drained soils on gently sloping to very steep benches, foot slopes, toe slopes, and fans in coves in the Southern Appalachian Mountains. These soils formed in colluvium derived from materials weathered from igneous and metamorphic crystalline rocks such as granite, mica gneiss, hornblende gneiss, and schist. Solum thickness from 40-60 inches. Depth to bedrock more than 60 inches. Reaction strongly to moderately acidic.
Wedowee- fine-kaolinitic	series consists of very deep, well-drained, moderately permeable soils that formed in residuum from weathered crystalline rock of the Piedmont Plateau. These soils are on narrow ridges and on side slopes of uplands. Depth to hard rock more than 60 inches. Reaction from extremely acidic to strongly acidic.
Wehadkee- fine-loamy	series consists of very deep, poorly drained and very poorly drained soils on the flood plains along streams that drain from the mountains and piedmont. They are formed in loamy sediments. Solum thickness from 20-60 inches. Reaction from strongly acidic to neutral.

APPENDIX B

Vascular Flora Summary

Table II. Summary of the Vascular Flora of the Cane Creek Watershed.

			Angiosperms		
	Ferns	Gymnosperms	Monocotyledons	Dicotyledons	Total
Families	12	2	12	79	105
Genera	19	3	60	201	283
Species	22	8	99	274	403
Subspecies	1	0	2	2	5
Varieties	1	0	8	8	17

APPENDIX C

List of Vascular Plant Species

Four hundred and three species of vascular plants, representing two hundred and eighty-three genera of one hundred and five families were identified from the study area of the Cane Creek Watershed of the Jocassee Gorges Land Area.

A set of voucher specimens is housed in the Clemson University Herbarium, Campbell Museum of Natural History.

Phylogenetic arrangement of plant families and species follows that of Radford et al. (1968) and binomial nomenclature follows that of Kartez (1994a & 1994b) unless otherwise noted.

Frequency, habitat and community designation were determined on the basis of field observation made at the time of collection. The following terms were used to describe frequency: common, uncommon, locally abundant, and rare. A collection number(s) follows each habitat description. Status in South Carolina follows that of Radford et al. (1968), Kartez (1994) and S.C. Heritage Trust Endangered, Threatened, or Special Concern Plants List (2000) and is indicated for selected species. **I** denotes introduced species within the vascular plant list. Coding for S.C. Heritage Trust Plant list includes GRANK, SRANK and status rank as follows:

GRANK/SRANK- the Nature Conservancy rating of degree of endangerment:

- **G2**- Imperiled globally because of rarity or factor(s) making it vulnerable.
- **G3**- Either very rare throughout its range or found locally in a restricted range, or having factors making it vulnerable.
- **G4**- Apparently secure globally, though it may be rare in parts of its range.
- **G5**- Demonstrably secure globally, though it may be rare in parts of its range.

S1- Critically imperiled statewide because of extreme rarity or because of some factor(s)making it especially vulnerable to extirpation.
S2- Imperiled statewide because of rarity or factor(s) making it vulnerable.
S3- Rare or uncommon in state.
S4-Apparently secure in the state.

STATUS- legal status:
NC- Of Concern, National (unofficial- plants only)
RC- Of Concern, Regional (unofficial- plants only)
SC- Of Concern, State

Pteridophyta

LYCOPODIACEAE

Hyperzia lucidula (Michaux) Trevisan, SHINING CLUBMOSS.
In mesophytic hardwood forests and alluvial terrace forests. Locally abundant. June- July. No. W-281.

Lycopodium digitatum Dill Ex A. Braun, RUNNING-PINE.
In disturbed Pine-Oak forests and roadsides swales. Common. July- Sept. No. W-435.

SELAGINELLIACEAE

Selaginella apoda (L.) Spring, MEADOW SPIKEMOSS.
On moist rocks and embankments of streams and along the river. Common. June-Oct. No. W-368.

OPHIGLOSSACEAE

Botrychium virginianum (L.) Swartz, RATTLESNAKE FERN.
In shaded, Oak-dominated forests. Common. April- June. No. W-216.

Botrychium biternatum (Sav.) Underwood, SOUTHERN GRAPEFERN.
Alluvial forests. Locally common. Aug.-Oct. No. W-420.

OSMUNDACEAE

Osmunda cinnamomea L., CINNAMON FERN.
Along river margins and moist patches adjacent to streams. Common. March-May. No. W-520.

Osmunda regalis var. *spectabilis* (Willd.) Gray, ROYAL FERN.
Along river margins, near seepage areas and in moist patches adjacent to streams. Uncommon. March-June. No. W-550.

LYGODIACEAE

Lygodium palmatum (Bernh.) Swartz, AMEREICAN CLIMBING FERN.
Local on disturbed roadside swales. Uncommon. **G4/S1S2/SC**. July- Sept. No. W-293.

PTERIDACEAE

Adiantum pedatum L., MAIDENHAIR FERN.
Mesic forests. Common. June- Aug. No. W-212.

DENNSTAEDTIACEAE

Dennstaedtia punctilobula (Michaux) Moore, HAY-SCENTED FERN.
Mesic forests. Common. No. W-297.

Pteridium aquilinum (L.) Kuhn, BRACKEN FERN.
Usually in open disturbed areas, can be in closed forest but rare. Common. July-Sept. No. W-474.

DRYOPTERIDACEAE

Athyrium filix-femina ssp. *asplenoides* (Michaux) Hulten, SOUTHERN LADY FERN.
Alluvial terrace forests and mixed mesic forests. Common. May- Sept. No. W-320.

Deparia acrostichoides (Sw.) M. Kato, SILVERY-SPLEENWORT.
Rich loamy woods and forested seepage slopes. Locally common. July- Sept. No. W-327.

Polystichum acrostichoides (Michaux) Schott, CHRISTMAS FERN.
Mesic forests. Common. No. W-220.

Onoclea sensibilis L., SENSITIVE FERN.
Seepage slopes, ditches, and marshes. Uncommon. No. W-341.

THELYPTERIDACEAE

Phegopteris hexagonoptera (Michaux) Fee, BROAD BEECH-FERN.
Mesic Oak dominated forests and shaded hardwood cove forests. Common. April-Aug. No. W-215.

Thelypteris noveboracensis (L.) Nieuwland, NEW YORK FERN.
Mesic and alluvial forests. Shaded cove forests. Common. May- Aug. No. W-262.

BLECHNACEAE

Woodwardia areolata (L.) Moore, NETTED CHAIN FERN.
Acidic swamps, bogs, and wet pinelands. Common. June-Sept. No. W-478.

ASPLENIACEAE

Asplenium platyneuron (L.) B.S.P., EBONY SPLEENWORT.
Mesic and alluvial forests. Sandy pinelands, road banks, and rocky woods. Common. April-Oct. No. W-469.

Asplenium monanthes L., SINGLE SORUS SPLEENWORT.
Shaded granite outcrops. Rare. **G4/S1/RC**. April-Oct. No. W-444. JFT- 1667.

POLYPODIACEAE

Polypodium virginianum L., ROCK POLYPODY.
Epiphyte usually on exposed gneissic rock cliff ledges and less commonly on tree bark. Common. June- Oct. No. W-223.

Pleopeltis polypodioides (L.) Andrews & Windham, RESURRECTION FERN.
Epiphyte on the bark of larger trees and less commonly on gneissic rock outcrops. Common. June- Oct. No. W-431.

Spermatophyta- Gymnosperme

PINACEAE

Pinus strobus L., WHITE PINE.
Steep river gorge slopes and on the upper slopes of mesic coves. Common. April- shed pollen, Aug.- Sept.-shed seeds. No. W-392.

Pius taeda L., LOBLOLLY PINE.
Low woods and old fields. Common. Shed seeds- Oct.-Nov. No. W-390

Pinus rigida Miller, PITCH PINE.
Pine and Oak-dominated forests nearing dry ridge tops. Locally abundant. May-shed pollen. Sept.-Oct.-shed seeds. No. W- 537.

Pinus pungens Lambert, TABLE MOUNTAIN PINE.
Pine and Oak-dominated forests on high dry ridge tops. Usually in poor soil Locally abundant. May-shed pollen. Sept.-Nov.-shed seeds. No. W-546.

Pinus echinata P.Miller, SHORT-LEAF PINE.
Old fields and upland woods. Common. March-April-shed pollen. Sept.-Oct.-shed seeds. No. W- 507.

Pinus virginiana Miller, SCRUB PINE, VIRGINIA PINE.
Disturbed upland areas and less commonly on xeric, vertical cliffs, crevices of large boulders and in thin soils around large rock outcrops. Common. March-May- shed pollen, Sept.- Nov. -shed seeds. No. W-397.

Tsuga canadensis (L.) Carr., CANADA HEMLOCK, EASTERN HEMLOCK.
Mesic cove forests, east- and north-facing gorge slopes and alluvial forests along the river margin down to about 900 feet in elevation. Common. March- April-shed pollen, Sept.-Nov.-shed seeds. No. W-388.

CUPRESSACEAE

Juniperus virginiana L., EASTERN RED CEDAR.
Dry soils usually in conjunction with old woods or rock outcrops. Uncommon. Jan.-Late March-shed pollen. Oct.-Nov.-shed seeds. No. W-579.

Spermatophyta- Angiospermea

TYPHACEAE

Typha latifolia L., BROAD-LEAF CAT-TAIL.
Shallow water lakes, ditches, seepages, and riverbanks. Rare. May-July.
No. W-381.

POACEAE

Arundinaria gigantea (Walter) Muhlenberg, GIANT CANE.
Component of the under story of open alluvial forests, Oak-Pine forests and in disturbed Oak-dominated forests. Common. April-July. No. W-355.

Tridens flavus (L.) A.S. Hitchc., TALL REDTOP.
Open disturbed areas. Common. July-Oct. No. W- 580.

Chasmanthium sessiliflorum (Poiret) Yates, LONG-LEAF WOOD-OATS.
Alluvial forests and open disturbed areas. Common. Aug.-Oct. No. W- 536.

Chasmanthium latifolium (Michx) Yates, RIVER OATS.
River margins and alluvial forests. Common. June-Oct. No. W- 538.

Eragrostis pilosa (L.) Beauv., LOVE GRASS.
Open disturbed areas, fields, and roadsides. Common. **I.** July-Oct. No. W- 312.

Dactylis glomerata L., ORCHARD GRASS.
Open disturbed areas, fields, and roadsides. Common. **I**. May-Oct. No. W-509.

Bromus commutatus Scharad., BROME GRASS.
Waste places, roadsides, and fields. Common. May-June. No. W- 506.

Bromus japonicus Thunberg Ex Murr, JAPANESE BROME GRASS.
Fields, waste places, and roadsides. Common. May- June. No. W-314.

Poa cuspidata Nuttal, EARLY BLUE GRASS.
Alluvial forests, meadow and seepage areas, and river/stream margins. Common. March-April. No. W-462. JFT-1666.

Melica mutica Walter, TWO-FLOWER MELIC GRASS.
Dry pine and oak-dominated forests and road banks. Common. April-May. No.W-256.

Glyceria striata (Lam) A.S. Hitch., FOWL MANNA GRASS.
Bogs, meadows, and river margins. Common. April-June. No. W- 574.

Lolium pratense (Huds.) S.J., Darbyshire, MEADOW RYE GRASS.
Roadsides, fields, and open disturbed areas. Common. **I**. May-July. No. W- 259.

Lolium perenne ssp. *multiflorum* (Lam) Husnot., RYE GRASS.
Open disturbed areas, fields, and roadsides. Common. **I**. April-July. No. W- 304.

Triticum aestivum L., WHEAT.
Cultivated. Locally common. I. May-June. No. W-475.

Hordeum pusillum Nuttall, BARLEY.
Cultivated. Uncommon. I. April-June. No. W-303.

Danthonia sericea Nuttall, SILKY WILD OAT GRASS.
Dry oak and pine-dominated forests, roadsides, and open disturbed areas. Common. April-June. No. W- 528.

Danthonia compressa Austin ex Peck, FLATTENED WILD OAT GRASS.
Xeric Pine-Oak, Oak-dominated forests and open roadsides. Common. June-Aug. No. W-310.

Avena sativa L., OATS.
Cultivated, escape to waste places. Common. I. May-June. No. W- 515.

Agrostis perennans (Walt.) Tuckerman, BENT GRASS.
River margins, marshes, and roadsides. Common. Aug.-Oct. No. W-558.

Cinna arundinacea L., SWEET WOOD-REED.
Low woods and ditches. Common. June-Aug. No. W-386.

Brachyelytrum erectum (Schreb. Ex Spreng.) Beauvois, BEARDED SHORTHUSK.
Rich woods. Common. June- Aug. No. W- 366.

Eleusine indica (L.) Gaertn., INDIAN GOOSE GRASS.
Open disturbed areas, roadsides, and fields. Common. **I**. June-Oct. No. W- 486.

Gymnopogon ambiguus (Michx.) B.S.P., BEARDED SKELETON GRASS.
Dry woods, fields, and open disturbed areas. Locally common. Aug.-Oct. No. W- 571.

Leersia oryzoides (L.) Sw., CUT GRASS.
Marshes, ditches, and river margins. Common. Aug.-Oct. No. W- 479.

Echinochloa crus-galli (L.) Beauv., LARGE BARNYARD GRASS.
Open disturbed areas. Locally common. **I**. July-Oct. No. W- 572.

Piptochaetium avenaceum (L.)Parodi, BLACK-SEED SPEAR GRASS.
Open xeric Pine-Oak forests and roadsides. Common. April-June. No. W-233.

Paspalum notatum var. *saurae* Parodi, BAHIA GRASS.
Roadsides and disturbed areas. Locally abundant. June-Oct. No. W-568.

Digitaria sanguinalis (L.) Scop., CRAB GRASS.
Open disturbed areas. Common. **I**. July-Oct. No. W- 482.

Urochola ramosa (L.)Nguyen, DIXIE LIVERSEED GRASS.
Open disturbed areas, low fields, and woods. Common. July- Oct. No. W-566.

Dichanthelium laxiflorum (Lamarck)Gould, OPEN-FLOWER ROSETTE GRASS.
Open woods,roadsides and disturbed areas. Common. April-June. No.W-487.

Dichanthelium dichotomum var. *dichotomum* (L.) Gould, CYPRESS ROSETTE GRASS.
Low pinelands, savannahs, ditches, alluvial forests and dry oak forests. Locally abundant. Oct.-Nov. No. W-530.

Dichanthelium dichotomum var. *ramulosum* (L.) Gould, FALL PANIC GRASS.
Alluvial forests. Locally abundant. April- Oct. No. W-542.

Dichanthelium sphaerocarpon var. *isophyllum* (Scribn.) Gould & C.A. Clark, PANIC GRASS.
Alluvial forests, low woodlands and ditches. Common. June-Aug. No. W-565.

Dichanthelium commutatum var. *commutatum* (Schultes) Gould, VARIABLE ROSETTE GRASS.
Low woodlands, bogs and savannahs. Locally common. March-Oct.
No W-315.

Dichanthelium commutatum (Schultes) Gould, VARIABLE ROSETTE GRASS.
Low woodlands, bogs and moist depressions along streams and rivers. Locally common. March-Oct. No. W-305.

Dichanthelium boscii (Pioret) Gould & C.A. Clark, BOSC'S ROSETTE GRASS.
Open alluvial terrace vegetation. Common. April- July. No. W-234.

Microstegium vimineum (Trinius) A. Camus, NEPALESE BROWNTOP.
Marshes, ditches, seepage areas and low woods. Common. **I**. Sept.-Oct.
No. W-578.

Saccharum alopecuroidum (L.) Nuttall, PLUME GRASS.
Woodland borders, disturbed open areas, and meadows. Common. Oct.
No. W-257.

Schizachyrium scoparium var. *scoparium* Michaux, LITTLE BLUE STEM.
Open disturbed areas. Common. Aug.-Oct. No. W- 531.

Andropogon virginicus L., BROOM SEDGE.
Open disturbed areas, savannahs, or bogs. Common. Sept.-Oct. No. W- 322.

Sorghastrum nutans (L.) Nash, YELLOW INDIAN GRASS.
Dry woods, roadsides, fields, and alluvial forests. Common. Sept.-Oct.
No W-387

Tripsacum dactyloides L., GAMMA GRASS.
Open alluvial forests roadsides, and meadows. Locally common. May-Nov.
No. W-319.

CYPERACEAE

Cyperus croceus Vahl, BALDWIN"S FLAT SEDGE.
In sandy woods, fields, roadsides and waste places. Common. July-Oct.
No. W-379.

Carex rosea Schkuhr ex Willd, ROSY SEDGE.
Chiefly wooded areas. Common. May-June. No.W-275.

Carex vulpinoidea Michaux, COMMON FOX SEDGE.
River margins, seeps, and low woods. Common. May-June. No.W-332.

Carex bromoides ssp. *montana* Naczi., BROME-LIKE SEDGE.
Low woods along river margins. Uncommon. May-July. No. W-459. JFT-1662.

Carex leptalea Wahlenberg, BRISTLY-STALK SEDGE.
Bog, seepage areas and river margins. Locally abundant. May-June. No. W-328.

Carex umbellata Schkuhr ex Willd, PARASOL SEDGE.
Mostly mountainous rocky ledges and dry wooded areas. Uncommon. May-
June. No. W-529.

Carex nigromarginata Schweinitz, BLACK-EDGE SEDGE.
Dry woods. Common. March-May. No. W-274.

Carex pensylvanica Lamark, PENNSYLVANIA SEDGE.
On steep open Oak-dominates forests. Common. April- June. No. W-244.

Carex albicans var.*albicans* Willd. ex Spreng., WHITE-TINGE SEDGE.
Open Oak-dominated forests. Common. April- May. No. W-205.

Carex austrocaroliniana Bailey, TARHEEL SEDGE.
Rich mesic forests. Locally common. **G4/SC**. April-May. No. W-497. JFT-1661.

Carex digitalis Willd., SLENDER WOODLAND SEDGE.
Seepage slopes and stream margins. Also in rich woods. Locally common. April-June. No. W-552.

Carex aff. *abscondita* MacKenzie, THICKET SEDGE.
Rich low woods. Uncommon. April-June. No. W-329.

Carex striatula Michaux, LINED SEDGE.
Rich low woodlands and mesic forests. Common. May-June. No. W-556.

Carex styloflexa Buckley, BENT SEDGE.
Bogs, low woodlands, shaded streams and river margins. Common. May-June. No. W-390.

Carex radfordii Gaddy, RADFORD'S SEDGE.
Uncommon. No. W-200.

Carex cerbriflora Wiegand, COASTAL-PLAIN SEDGE.
Rich bottomland woods. Uncommon. April- June. No. W-247. JFT-1663.

Carex laxiflora var. *serrulata* F.J. Herm.
Rich bottomland woods. Locally common. May-June. No. W-321.

Carex debilis Michaux, WHITE-EDGE SEDGE.
Bogs, meadows, and alluvial woods. Common. May-Aug. No. W-253.

Carex debilis var. *pubera* Gray.
Low woodlands and river margins. Common. May-June. No W-488.

Carex virescens Muhl. Ex Willd, RIBBED SEDGE.
Rich woods. Uncommon. May-June. No. W-268.

Carex swanii (Fern.) MacKenzie, SWAN'S SEDGE.
Rich woods and meadows. Uncommon. May-June. No. W-277.

Carex mitchelliana M.A. Curtis, MITCHELL'S SEDGE.
Low woods, meadows, and ravines. Uncommon. May-June. No. W-271.

Carex lurida Wahlenberg, SALLOW SEDGE.
Bog areas and meadows. Common. June-Sept. No. W-254.

ARACEAE

Arisaema triphyllum (L.) Schott, JACK-IN-THE-PULPIT, INDIAN TURNIP.
Mesic, alluvial forests, and moist depressions associated with seepage slopes. Common. March- April. No. W-316.

COMMELINACEAE

Commelina communis L., ASIATIC DAYFLOWER.
Alluvial forests and river margins. Common. **I**. May-Oct. No. W- 569.

Tradescantia subaspera Ker.-Gawl., ZIGZAG SPIDERWORT.
Open disturbed alluvial forests. Common. June- July. No. W-317.

JUNCACEAE

Juncus effusus L., COMMON RUSH.
River margins, edges of swamps and pastures, and low pastures. Common. June-Sept. No. W- 490.

Juncus gymnocarpus Coville, NAKED-FRUITED RUSH, PENNSYLVANIA RUSH.
Swampy and bog areas. Locally common. **G4/SC**. July- Sept. No. W-450.

Luzula acuminata Rafinesque, HAIRY WOOD RUSH.
Mesic upland forests and along seepage slopes beneath Oak-dominated tree species. Common. June- Aug. No. W-246.

Luzula echinata (Small) Herman, HEDGEHOG WOOD RUSH.
Moist woods and bluffs, occasionally in disturbed areas. Common. March- Aug. No. W-260.

SMILACEAE

Smilax biltmoreana (Small) JBS Norton ex Pennell, BILTMORE'S CARRION FLOWER.
Mesic forests and rich cove forests. April-May. Uncommon. No. W-298.

Smilax rotundifolia L, HORSEBRIER.
Deciduous woods and moist heavy thickets. Common. Late April- May. Common. No. W-555.

Smilax glauca Walter, GREEN BRIER, SAWBRIER.
Open disturbed areas. Common. Late April- Early June. No. W-464.

LILIACEAE

Trillium discolor Wray ex Hooker, PALE YELLOW WAKEROBIN.
Abundant in alluvial forests. Locally abundant. **G3/SC**. Late March- Early May. No. W-203.

Trillium vaseyi Harbison, SWEET WAKEROBIN.
Alluvial forests and mesic forests. Locally abundant. April- Early June. No. W-204. JFT-1664.

Trillium catesbaei Elliot, BASHFUL WAKEROBIN.
Alluvial forests and rich deciduous forests. Common. Late March-Early June. No. W-250.

Medeola virginiana L., INDIAN CUCMBER ROOT.
Alluvial forests and cove forests. Locally abundant. Mid April- Mid June. No. W-206.

Maianthemum racemosum (L.) Link, FEATHERY FALSE SOLOMON'S-SEAL.
Alluvial forests. Common. Mid April- Early June. No. W-219.

Polygonatum biflorum (Walter) Elliot, KING SOLOMON'S-SEAL.
Moist depressions associated with seepage areas and river margins. Common. Late April- June. No. W-222.

Xerophyllum asphodeloides (L.) Nuttall, EASTERN TURKEY BEARD.
Dry slopes of open pine forests. Uncommon. **G4/S1/SC**. May- June. No. W-287.

Chamaelirium luteum (L.) Gray, FAIREY-WAND,DEVIL'S-BIT.
Dry, Oak-dominated forests, mesic alluvial forests and mesic cove forests. Common. Late March- May. No. W-242.

Lilium superbum L., TURK'S-CAP LILY.
Moist cove forests but are known to high semi-moist ridges. Uncommon. July-Aug. No. W-533.

Uvularia puberula Michaux, MOUNTAIN BELLWORT.
Mesic wooded areas and pocosin borders. Common. Late March-Early May. No. W-517.

Hypoxis hirsuta (L.) Coville, EASTERN YELLOW STAR GRASS.
Along open roadsides, and on gravel along the river margins. Common. March-June. No. W-226.

DIOSCOREACEAE

Dioscorea oppositifolia L., CINNAMON VINE, CHINESE YAM.
Alluvial forests and disturbed areas. Common. June- Aug. No. W-540.

Dioscorea villosa L., WILD YAM.
Pine-Oak forests and alluvial forests. Common. April-June. No. W-394.

IRIDACEAE

Sisyrinchium fuscatum Bicknell, BLUE-EYED GRASS.
Abundant in open alluvial forests. Locally abundant. Late April- June. No. W-330.

Sisyrinchium mucronatum Michaux, NEEDLE-TIP BLUE-EYED GRASS.
Circumneutral soil of meadows, and roadside habitats. Locally abundant. April-June. No. W-516.

Iris cristata Aiton, CRESTED DWARF IRIS.
Rich mesic, Oak-dominated forests and wooded slopes. Common. April- May. No. W-463.

ORICHIDACEAE

Cypripedium acaule Aiton, PINK LADY'S-SLIPPER, PINK MOCCASIN FLOWER.
Oak-dominated forests and alluvial forests. Uncommon. April- July. No. W-280.

Platanthera clavellata (Michaux) Luer, SMALL GREEN WOOD ORCHID.
Usually in bogs or swamps in thick wooded area. Common. June-Sept.
No. W-377.

Galearis spectabilis (L.)Raf., SHOWY ORCHID.
Mesic cove forests and mesic alluvial forests. Uncommon. **G5/SC**. April- July.
No. W-428.

Goodyera pubescens (Willd.) R. Brown Ex Ait. F., DOWNY RATTLESNAKE-PLANTAIN.
In shade of mesic alluvial and cove forests. Common. June- Aug. No. W-335.

Tipularia discolor (Pursh) Nutt., CRANEFLY ORCHID.
Oak-dominated and alluvial forests. Common. July-Sept. No. W-442.

Aplectrum hyemale (Muhl. ex Willd.) Torrey, ADAM-AND-EVE ORCHID.
Heavy wet soil of floodplains, low rich wood, and steep dry slopes. Common.
May- June. No. W-326.

AGAVACEAE

Yucca filamentosa L., BEAR GRASS, ADAM'S NEEDLE.
Open, dry, alluvial forests and cove forests. Locally abundant. Late April- Early June. No. W-276.

SALICACEAE

Salix nigra Marshall, BLACK WILLOW.
River margins and stream banks. Locally abundant. March- April. No. W-473.

JUGLANDACEAE

Juglans nigra L., BLACK WALNUT.
Rich and disturbed woods. Locally abundant. April. No. W-494.

Juglans cinerea L., BUTTERNUT, WHITE WALNUT.
In alluvial forests, declining in most areas. Uncommon. **G4/SC**. April- May.
No. W-261.

Carya pallida (Ashe) Engl. & Graebn., SAND HICKORY.
Dry rocky or sandy woods. Common. April-May. No. W-562.

Carya alba (L.) Nutt, Ex Ell., MOCKERNUT HICKORY.
Oak and pine dominated forests, usually quite dry. Common. April-May. No. W-544.

Carya glabra(Miller) Sweet, PIGNUT HICKORY.
Oak- pine dominated forests; dry to moist woods. Common. April- May. No. W-466.

BETULACEAE

Alnus serrulata (Aiton) Willd., TAG ALDER, BROOKSIDE ALDER.
Along river margins and open, moist, roadside depressions. Common. Feb.- March. No. W-291.

Corylus americana Walt., AMERICAN HAZELNUT.
Alluvial forests. Common. Feb.- March. No. W-339.

Betula lenta L., SWEET BIRCH, CHERRY BIRCH.
In cove forests and mesic, alluvial forests generally above 304 meters in elevation. Common. March- April. No. W-263.

Betula nigra L., RIVER BIRCH.
Low woods. Common. March-April. No. W-391

Carpinus caroliniana Walter, AMERICAN HORNBEAM, IRONWOOD.
Along river margins and alluvial forests. Common. March- April. No. W-269.

FAGACEAE

Fagus grandifolia Ehrhart, AMERICAN BEECH.
In mesic, Oak-dominated forests and mixed mesophytic forests. Common. March- April. No. W-265.

Castanea dentata (Marshall) Borkhausen, AMERICAN CHESNUT.
Abundant as stump sprouts in mesic, Oak-dominated, alluvial and Pine-Oak forests. Locally abundant. June- July. No. W-228.

Castanea pumila (L.) Miller, ALLEGHANY CHINKAPIN.
Alluvial and Oak-dominated forests. Locally common. July. No. W-483.

Quercus alba L., NORTHERN WHITE OAK.
Oak-dominated and mesic forests. Common. April. No. W-501.

Quercus stellata Wangenh., POST OAK.
Dry poor or rich soils. Common. April. No. W-403.

Quercus prinus L., CHESTNUT OAK.
Pine and Oak-dominated forests. Also rocky ridges. Common. April.
No. W-498.

Quercus rubra L., NORTHERN RED OAK.
Rich hardwood forests. Common. April. No. W-500.

Quercus rubra var. *ambigua* (Gray) Fern., NORTHERN RED OAK.
In mesic, alluvial and mixed mesophytic forests. Common. May. No. W-361.

Quercus velutina Lamarck, BLACK OAK.
Pine-Oak-dominated forests and on dry well drained soil. Common. April.
No. W-523.

Quercus coccinea Muenchh., SCARLET OAK.
Pine and Oak-dominated forests usually in poor soil. Common. April.
No. W-526.

Quercus falcata Michaux, SOUTHERN RED OAK.
Oak-dominated forests. Common. April. No. W-499.

ULMACEAE

Ulmus rubra Muhlenberg, SLIPPERY ELM.
In mesic Oak-dominated and alluvial forests. Uncommon. Feb. -March.
No. W-273.

Ulmus alata Michaux, WINGED ELM.
On upland soils along streams and rivers. Common. Feb.-March. No. W-400.

Celtis laevigata Willd., SUGAR BERRY.
Alluvial woods. Common. April- May. No. W-392.

MORACEAE

Morus rubra L., RED MULBERRY.
Alluvial forests and lower slopes. Uncommon. April-May. No. W-495.

URTICACEAE

Laportea canadensis (L.) Weddell, CANADIAN WOOD-NETTLE.
Rich woods, seepage areas and on moist slopes of cove forests. Common. Late June-Aug. No. W-365.

Boehmeria cylindrica (L.) Swartz, SMALL-SPIKE FALSE NETTLE.
Along shaded river margins and on ledges associated with seepage areas. Common. July- Aug. No. W-416.

Pilea pumila (L.) Gray, CANADIAN CLEARWEED.
Alluvial woods, mostly shady habitats, marshes. Common. Aug.-Sept. No.W-417.

SANTALACEAE

Pyrularia pubera Michaux, BUFFALO NUT.
In mesic, Oak-dominated, alluvial and mixed mesophytic forests. Common. April- May. No. W-227.

ARISTOLOCHIACEAE

Hexastylis heterophylla (Ashe) Small, VARIABLE –LEAF HEARTLEAF.
In alluvial, mesic Oak-Pine and mixed mesophytic forests. Common. April-June. No. W-427. JFT-1668.

POLYGONACEAE

Rumex acetosella L., COMMON SHEEP SORREL, SOUR GRASS.
Roadsides and disturbed open areas. Common. May-July. No. W-511.

Polygonum virginianum L., JUMPSEED.
Alluvial woods and rich coves. Common. July-Oct. No. W- 535.

Polygonum pensylvanicum L., PINKWEED.
Alluvial fields and disturbed areas. Common. July-Frost. No. W-389.

Polygonum setaceum Baldwin, BOG SMARTWEED.
Open disturbed areas. Common. July- Frost. No. W-429.

Polygonum sagittatum L., ARROW-LEAF TEARTHUMB.
Sandy alluvium along the river margin. Common. May-Frost. No. W-470.

PHYTOLACCACEAE

Phytolacca americana L., AMERICAN POKEWEED.
Wasteland, pastures, disturbed habitats. Common. May- Frost. No. W-430.

CARYOPHYLLACEAE

Stellaria pubera Michaux, GIANT CHICKWEED.
Abundant on open alluvial forests. Locally abundant. April- June. No. W-243.

Cerastium semidecandrum L., FIVE-STAMEN MOUSE-EAR CHICKWEED.
Waste places. Locally abundant. April- June. No. W-376.

RANUNCULACEAE

Xanthorhiza simplicissima Marshall, SHRUB YELLOW ROOT.
Along seepage areas, streams, and river margins. Common. April- May.
No. W- 214.

Actaea pachypoda Elliot, DOLL'S EYE, WHITE BANEBERRY.
In mesic, Oak-dominated forests and along river margins. Common. April- May.
No. W-267.

Actaea racemosa var. *racemosa* L., BLACK COHOSH.
Rich woods and alluvial slopes. Common. May- July. No. W-347.

Clematis viorna L., LEATHER FLOWER.
Rich woods. Common. No. W-448.

Clematis virginiana L., VIRGIN'S BOWER.
Low woods and stream banks. Common. July- Sept. No. W-422.

Thalictrum thalictroides (L.) Eames & Boivin, WINDFLOWER.
Rich Oak-dominated forests. Common. March- May. No. W- 446.

Thalictrum clavatum DC., MOUNTAIN MEADOW RUE.
On seepage slopes. Common. May- July. No. W-202.

Thalictrum dioicum L., EARLY MEADOW RUE.
Rich woods and seepage slopes. Common. March- April. No. W-245.

Ranunculus recurvatus Pioret., BUTTERCUP, BLISTERWORT.
In open alluvial forests especially along disturbed foot trails and along stream margins. Common. April- June. No. W-358. JFT-1656.

Hepatica nobilis var. *acuta* (Pursh) Steyermark, LIVERLEAF.
Abundant on seepage slopes. Locally abundant. **G5/SC**. March- April. No. W-414.

Anemone quinquefolia L., NIGHTCAPS.
Rich woods. Common. March- May. No. W-388.

BERBERIDACEAE

Podophyllum peltatum L., MAY-APPLE, MANDRAKE.
In mesic, Oak-dominated cove and alluvial forests. Common. March- April. No. W-211.

MAGNOLIACEAE

Liriodendron tulipifera L., YELLOW POPLAR, TULIP TREE.
In mesic alluvial, Oak-dominated and mesic cover forests. In recently disturbed areas. Common. April- June. No. W-258.

Magnolia fraseri Walter, UMBRELLA TREE, FRASER'S MAGNOLIA.
In dry Pine- Oak, Oak-dominated and mesic cove forests. Common. April- May. No. W-240.

Magnolia acuminata L., CUCUMBER TREE.
Rich woods, pine-Oak-dominated areas and cove forests. Common. April-May. No. W-505.

ANNONACEAE

Asimina parviflora (Michaux) Dunal, DWARF PAWPAW.
Dry and alluvial forests. Common. April- May. No. W-484.

Asimina triloba (L.) Dunal, COMMON PAWPAW.
On open alluvial, mesic, Oak-dominated and mixed mesophytic forests. Common. March- May. No. W-318.

CALYCANTHACEAE

Calycanthus floridus var. *glaucus* (Willd.) Torr. & Gray, SWEET SHRUB, SPICEBUSH.
In mesic alluvial forests and in open river margins. Common. March- June. No. W-266.

PAPVARACEAE

Sanguinaria canadensis L., BLOODROOT.
Mixed deciduous forests and on wooded slopes. Common. March- April.
No. W-438.

LAURACEAE

Sassafras albidum (Nuttall) Nees, SASSAFRAS.
In open Pine-Oak, Oak-dominated and alluvial forests. Common. March- April.
No. W-236.

Lindera benzoin (L.) Blume, NORTHERN SPICEBUSH.
Stream margins and alluvial woods. Common. March-April. No. W-389.

BRASSICACEAE

Cardamine diphylla (Michaux) Wood, CRINKLE ROOT.
Wooded slopes and ravines. Uncommon. April- May. No. W-208.

PODOSTEMACEAE

Podostemum ceratophyllum Michaux, HORN-LEAF RIVERWEED.
On submerged rocks in swiftly flowing areas of the river. Common. May- July.
No. W-217.

SAXIFRAGACEAE

Heuchera villosa Michaux, HAIRY ALUMROOT.
On seepage slopes and steep rock ledges. Uncommon. June- Sept. No. W-364.

Tiarella cordifolia L., HEART-LEAF FOAMFLOWER.
In mesic, Oak-dominated, cove and alluvial forests. Common. April- June.
No. W-213.

Saxifraga micranthidifolia (Haw.) Steudel, LETTUCE-LEAF SAXIFRAGE.
Moist rocks and seepage slopes. Locally common. **G5/SC**. May- June.
No. W-248. JFT-1657.

HYDRANGEACEAE

Decumaria barbara L., CLIMBING HYDRANGEA.
Vine in mesic, Oak-dominated, alluvial and mixed mesophytic forests. Common.
May- June. No. W-324.

Philadelphus inodorus L., SCENTLESS MOCK ORANGE.
In rich dry woods. Common. April-May. No. W-241.

Hydrangea arborescens L., COMMON HYDRANGEA.
In Oak-dominated and mesic forests. Common. May- July. No. W-340.

GROSSULARIACEAE

Itea virginica L., VIRGINIA WILLOW, VIRGINIA SWEETSPIRE.
Along open river margins. Common. May- June. No. W-285.

HAMMAMELIDACEAE

Liquidambar styraciflua L., SWEET GUM.
Rich alluvial and mesic forests. Common. April-Oct. No. W-465.

Hamamelis virginiana L., AMERICAN WITCH-HAZEL.
In mesic, Oak-dominated cove and mixed mesophytic cover forests. Common. Oct.- Dec. No. W-225.

PLATANACEAE

Platanus occidentalis L., AMERICAN SYCAMORE.
River margins and low woods. Common. April-May. No. W-232.

ROSACEAE

Fragaria virginiana Duchesne, VIRGINIA STRAWBERRY.
Alluvial forests. Common. March-June. No. W-564.

Potentilla canadensis L., FIVE FINGERS,DWARF CINQUEFOIL.
Along dry open roadsides and on xeric rock outcrops along the river. Common. March- May. No. W-224.

Rubus argutus Link, SAW-TOOTH BLACKBERRY.
Along open roadsides and disturbed areas. Common. April- May. No. W-249.

Rubus flagellaris Willd., WHIPLASH DEWBERRY.
Open disturbed areas and clearings. Common. April-May. No.W-521.

Geum canadense Jacq., WHITE AVENS.
Alluvial woods and swamp forests. Uncommon. May-Frost. No. W-570.

Agrimonia pubescens Wallroth, COCKLEBUR, SOFT GROVEBURR.
In mixed or deciduous woods, usually found on slight slope. Common. July-Early Sept. No. W-545.

Porteranthus trifoliatus (L.) Britt., INDIAN PHYSIC, BOWMAN'S ROOT.
In disturbed Oak-dominated forests and along moist roadsides. Common. April-May. No. W-286.

Crataegus punctata Jacquin, DOTTED HAWTHORN.
River banks and rocky wooded areas. Common. May- Early June. No. W-493.

Amelanchier arborea (Michaux) Fernald, SOUTHERN APPALACHIAN SERVICEBERRY, JUNEBERRY.
In dry forests, on steep cliffs and in shallow soils near rock outcrops along the river. Common. March- Early May. No.W-292.

Prunus serotina Ehrh., BLACK CHERRY.
Woodlands and pastures. Common. May-Oct. No. W-395.

FABACEAE

Mimosa microphylla Dry, SENSITIVE BRIER,LITTLE-LEAF MIMOSA.
In open alluvial forests and along open roadsides. Common. June- Sept. No. W-350.

Cercis canadensis L., REDBUD, JUDAS TREE.
In Oak-dominated and alluvial forests. Common. March- May. No. W-270.

Chamaecrista fasiculata (Michaux) Greene, PARTRIDGE PEA.
In disturbed field areas and open roadsides. Common. June- Sept. No. W-398.

Amorpha glabra Desf. Ex Poir., MOUNTAIN INDIGO-BUSH.
Open disturbed areas, hardwood slopes, and alluvial forests. Locally common. May- July. No.W- 534.

Amorpha fruticosa L., FALSE INDIGO BUSH.
Stream and river banks. Open woods. Common. April-June. No. W-492.

Stylosanthes biflora (L.) Britton, Sterns, Poggenburg, SIDE-BEAK PENCIL FLOWER.
Long dry open roadsides. Common. June- Aug. No. W-349.

Desmodium nudiflorum (L.) DC., BEGGAR'S LICE, BEGGAR'S TICKS.
In Oak-dominated forests. Common. July- Aug. No. W-357.

Kummerowia striata (Thunberg)Schindl., JAPANESE CLOVER.
Fields, roadsides, waste and disturbed areas. Common. **I**. July- Sept. No. W-385.

Lespedeza bicolor Turczaninow, BICOLOR LESPEDEZA.
Along open roadsides. Common. **I**. June- Sept. No. W-387.

Lespedeza cuneata (Dum.- Cours,) G.Don, SERICEA.
Fields, roadsides, and waste places. Common. July- Sept. No. W-561.

Robinia pseudoacacia L., BLACK LOCUST.
Wooded thickets and roadsides. Uncommon. April-June. No.W-468.

Robinia hispida L., BRISTLY LOCUST.
Open woods, slopes and sand hills. Common. May-June. No. W-496.

Tephrosia virginiana (L.) Peres., GOAT'S RUE
Dry, open pine-dominated forests, roadsides, and clearings. Common. May-June. No. W-582.

Tephrosia spicata (Walter) Torrey and Gray, SPIKED HOARY PEA.
In open dry alluvial forests. Common. June- Aug. No. W-351.

Vicia caroliniana Walter,CAROLINA VETCH.
Open disturbed areas and wooded borders. Common. April-June. No. W-557.

Apios americana Medicus, POTATO BEAN, GROUNDNUT.
In sandy alluvium along river and roadsides. Common. June- July. No. W-407.

Centrosema virginianum (L.) Bentham, SPURRED BUTTERFLY PEA.
In open alluvial forests. Common. June- Aug. No. W-401.

Pueraria montana var. *lobata* (Willd.) Maesen & S. Almeida, KUDZU.
Roadsides, woods and fields. Common. **I**. July-Oct. No. W-454.

Amphicarpaea bracteata (L.) Fernald, AMERICAN HOG PEANUT.
Alluvial forests, thickets, and river margins. Common. July- Sept. No. W-346.

OXALIDACEAE

Oxalis dillenii Jacquin, SHAMROCK, SLENDER YELLOW WOOD-SORREL.
Shallow soils, usually associated with rock outcrops. In open disturbed areas. Common. March-Oct. No. W-383.

GERANIACEAE

Geranium maculatum L., WILD GERANIUM, SPOTTED CRANE'S BILL.
Oak-dominated forests and open disturbed areas. Common. April-June.
No. W-502.

Geranium carolinianum L., CAROLINA CRANE'S BILL.
Disturbed habitats and roadsides. Sometimes associated with rock outcrops.
Common. March-June. No. W-457.

POLYGALACEAE

Polygala polygama Walter, SOUTHERN BITTER MILKWORT.
In open alluvial forests and along dry roadsides. Common. May- July.
No. W-294.

EUPHORBIACEAE

Euphorbia corollata L., FLOWERING SPURGE.
Alluvial forests, river margins, and open disturbed areas. Common. May-Sept.
No. W-396.

ANACARDIACEAE

Toxicodendron radicans (L.) Kuntze, EASTERN POISON IVY.
All types of forests and disturbed areas. Common. Late April-May. No. W-458.

Rhus copallinum L., WINGED SUMAC.
Open disturbed areas or woodland thickets. Common. Aug.-Oct. No. W-393.

Rhus glabra L., SMOOTH SUMAC.
Open disturbed areas, meadows, and woodland borders. Common. Late May-July. No. W-575.

AQUIFOLIACEAE

Ilex opaca Aiton, AMERICAN HOLLY.
Alluvial oak-dominated and mesic cove forests. Common. April-June.
No. W-576.

CELASTACEAE

Euonymus americana L., AMERICAN STRAWBERRY-BUSH.
In open alluvial forests. Common. May- June. No.W-264.

ACERACEAE

Acer rubrum L., RED MAPLE.
In disturbed, alluvial, Oak-dominated, and mesophytic forests. Common. Jan.- March. No. W-409.

HIPPOCASTANACEAE

Aesculus sylvatica Bartram, PAINTED BUCKEYE.
Oak-dominated cove forests and alluvial forests. Common. April-Mid May. No. W-456.

BALSAMINACEAE

Impatiens capensis Meerburgh, SPOTTED TOUCH-ME-NOT, JEWEL WEED.
On seepage slopes, alluvium of streams and open areas along river margins. Common. May- Frost. No. W-418.

RHAMNACEAE

Ceanothus americanus L., NEW JERSEY-TEA.
Deciduous forests and forest margins. Common. May-June. No. W-402.

VITACEAE

Parthenocissus quinquefolia (L.) Planchon, VIRGINIA CREEPER.
Alluvial and Oak-dominated forests. Common. May-July. No. W-461.

Vitis rotundifolia Michaux, MUSCADINE.
In disturbed areas. Common. May- June. No. W-336.

Vitis labrusca L., FOX GRAPE.
Rich woods and stream banks. Alluvial, Oak-dominated and mesic forests. Common. May-June. No. W-522.

Vitis cinerea var. *baileyana* (Munson) Comeaux, POSSUM GRAPE.
Low wooded areas and stream banks. Common. May-June. No.W-510.

TILIACEAE

Tilia americana var. *heterophylla* (Vent) Loud, BASSWOOD.
Rich woods. Common. June. No. W-279.

CLUSIACEAE

Hypericum hypericoides (L.) Crantz, ST. ANDREW'S CROSS.
Dry woods, roadsides, disturbed areas. Common. May- Aug. No. W-395.

Hypericum multilum L., DWARF ST. JOHN'S WORT.
Bogs, marshes, ditches, and meadows. Common. June- Oct. No. W-375.

VIOLACEAE

Viola pedata L., BIRD-FOOT VIOLET.
Open pine forests disturbed areas, and rocky or sandy upland woods. Common. March-May. No. W-443.

Viola triloba var. *triloba* Schweintz, THREE-LOBED VIOLET.
Wooded slopes and alluvial forests. Uncommon. Late March-May. No. W-554.

Viola sororia Willd., HOODED BLUE VIOLET.
Wooded slopes and Oak-dominated forests. Common. Late March-May. No. W-439.

Viola blanda Willd.,SWEET WHITE VIOLET.
Oak-dominated cove forests in conjunction with seepage areas. Common. April-June. No. W-447. JFT-1653, 1655.

Viola primulifolia L., PRIMROSE-LEAVED VIOLET.
Alluvium along streams and river margins. Common. April- July. No. W-289.

Viola rotundifolia Michaux.,ROUND-LEAF YELLOW VIOLET.
Slopes of mesic forests and rich wooded coves. Common. March-April. No. W-445.

Viola hastata Michaux, HALBERD-LEAF VIOLET.
Oak-dominated and alluvial forests. Common. Late March-May. No. W-437.

Viola canadensis L., CANADA VIOLET.
Oak-dominated cove forests. Uncommon. April- July. No. W-201.

Viola rostrata Pursh., LONG-SPUR VIOLET
Rich moist woods. Uncommon. April-May. No. W-436.

PASSIFLORACEAE

Passiflora incarnata L., MAYPOPS.
Fields, roadsides, and thickets. Common. May-July. No. W-390.

Passiflora lutea L., YELLOW PASSION-FLOWER.
River margins and alluvial forests. Common. June- Sept. No. W-278.

ELAEAGNACEAE

Elaeagnus umbellata Thunberg, SILVERBERRY,AUTUM-OLIVE.
Escaped species established at scattered localities. Common. **I**. April- May. No. W-282.

MELASTOMATACEAE

Rhexia virginica L., MEADOW BEAUTY.
Ditches and low meadows. Common. May-Oct. No. W-394.

ONAGRACEAE

Ludwigia alternifolia L., SEED BOX.
River margins and open disturbed areas. Common. May- Oct. No. W-404.

Ludwigia palustris (L.) Ell., MARSH PRIMROSE.
Bog and seepage areas. Common. May- Oct. No. W-472.

Oenothera biennis L., EVENING PRIMROSE, KING'S-CUREALL.
River margins and open disturbed areas. Common. June- Oct. No. W-400.

Circaea lutetiana ssp. *canadensis* (L.) Ascherson and Magnus, FALSE INTERMEDIATE ENCHANTER'S NIGHTSHADE.
Mesic oak dominated forests. Locally common. **G5T5/S1/SC**. May- Sept. No. W-348.

ARALIACEAE

Panax quinquefolius L., AMERICAN GINSENG.
Mesic Oak-dominated forests. Uncommon. **G4/S2S3/RC**. May-June. No. W-455.

Aralia spinosa L., HERCULES CLUB, DEVIL'S WALKING STICK.
Alluvial and Oak-dominated forests. Common. June-Sept. No. W-477.

Aralia racemosa L., AMERICAN SPIKENARD.
Mesic cove and Oak-dominated cove forests. Common. June-Aug. No. W-518.

APIACEAE

Sanicula odorata (Raf.) K.M. Pryer & L.R. Phillippe Bicknell, CLUSTERD BLACK-SNAKEROOT.
Oak-dominated cove and mesic forests. Common. May-June. No. W-359.

Sanicula canadensis L., CANADIAN BLACK-SNAKEROOT.
Open disturbed areas. Common. April- May. No. W-353.

Eryngium yuccifolium Michaux, BUTTON SNAKEROOT.
Roadsides and open woods. Common. June-Aug. No. W-401.

Daucus carota L., WILD CARROT, QUEEN ANN'S LACE.
Open disturbed areas and roadsides. Locally common. **I**. May-Sept. No. W-584.

Zizia aurea (L.) Koch, GOLDEN ALEXANDERS.
Alluvial woods, swamp forests, and creek bottoms. Common. April- May.
No. W-229.

Cryptotaenia canadensis (L.) de Candolle, CANADIAN HONEWORT.
Moist woods, woodland margins and stream banks. Common. May- June.
No W-323.

Angelica venenosa (Greenway) Fernald, HAIRY ANGELICA.
Open disturbed areas. Common. June- Aug. No. W-386.

Oxypolis rigidior (L.) Rafinesque, STIFF COWBANE.
Moist roadside banks and stream banks. Common. Aug.-Oct. No.W-585.

CORNACEAE

Cornus florida L., FLOWERING DOGWOOD.
Oak-dominated, mesic and alluvial forests. Common. March- April. No. W- 449

Cornus alternifolia L., ALTERNATE-LEAF DOGWOOD.
Deciduous rich woods and stream banks. Locally common. May- June.
No. W-306.

Cornus amomum P. Miller, SWAMP DOGWOOD.
Marshes, swamp forests and alluvial woods. Common. May-June.
No. W-551.

Nyssa sylvatica Marshall, BLACK GUM, BLACK TUPELO
Pine-Oak-dominated forests. Common. April-June. No. W-524.

CLETHRACEAE

Clethra acuminata Michaux, WHITE ALDER, SWEET PEPPER BUSH.
Usually mesic forests, but also in rich moist woods at high elevations. Common.
July-Aug. No. W-583.

ERICACEAE

Rhododendron maximum L., ROSEBAY, GREAT LAUREL.
Mesic cove forests, along streams and seepage slopes. Common. June- Aug.
No. W-356.

Rhododendron minus Michaux, PIEDMONT RHODODENDRON.
Mesic cove forests and oak-dominated forests. Common. Late April- June.
No. W-290.

Rhododendron periclymenoides (Michaux) Shinners, WILD AZALEA.
Disturbed gorge slopes and alluvial forests. Common. Late March-May.
No. W-451.

Kalmia latifolia L., MOUNTAIN LAUREL.
All forests types, river margins, and open disturbed areas. Common. April- June.
No. W-235.

Leucothoe recurva (Buckley) Gray, RED-TWIG DOGHOBBLE.
Rocky woods and thickets at high elevations. Common. Late April- Early June.
No. W-301.

Leucothoe fontanesiana (Steudell) Sleumer, HIGHLAND DOGHOBBLE.
Stream banks and seepage areas. Common. Late March- Early June. No. W-221.

Oxydendrum arboreum (L.) de Candolle, SOURWOOD.
Pine and oak-dominated forests and open disturbed areas. Common. June- July.
No. W-373.

Epigaea repens L., TRAILING ARBUTUS.
Pine and Oak-dominated forests, also sandy and rocky woodlands, and in open disturbed areas. Common. Late Feb.-Early May. No. W-525.

Gaultheria procumbens L., WINTERGREEN, EASTERN TEABERRY.
Ridge tops of Pine- dominated forests. Rare. **G5/S1/SC**. June-Aug. No. W-434. JFT-1658.

Gaylussacia dumosa (Andrz.) Torrey and Gray, DWARF HUCKLEBERRY.
Sandy and xeric habitats. Common. March- June. No. W- 302.

Gaylussacia frondosa (L.) Torrey and Gray, BLUE HUCKLEBERRY.
Sandy or rocky woods at higher elevations. Common. Late March- May. No. W-288.

Gaylussacia ursina(M.A. Curtis) T. & G. ex Gray, BEAR HUCKLEBERRY.
River margins and high elevations. Uncommon. May-June. No. W- 453.

Vaccinium arboreum Marshall, TREE SPARKLEBERRY.
Pine and Oak-dominated forests and river margins. Common. April- June. No. W-333.

Vaccinium stamineum L., GOOSEBERRY, LOWBUSH BLUEBERRY.
Pine and Oak-dominated forests and alluvial forests. Common. April-June No.W-527.

PYROLACEAE

Chimaphila maculata (L.) Pursh, SPOTTED WINTERGREEN, PIPSISSEWA.
Oak-dominated and alluvial forests. Common. May- June. No. W-334.

MONOTROPACEAE

Monotropa uniflora L., ONE-FLOWER INDIAN PIPE.
Oak-dominated cove and mesic cove forests. Locally common. June- Oct. No. W-299.

DIAPENSIACEAE

Shortia galacifolia Torrey & A. Gray, OCONEE BELLS.
Rich woods on stream banks. Locally abundant. **G2/S2/NC**. March-April. No. W- 218.

Galax aphylla L., SKUNKWEED.
Mesic cove and alluvial forests. Common. May- July. No. W-300.

PRIMULACEAE

Lysimachia quadrifolia auct. Non L., WHORLED YELLOW LOOSESTRIFE.
River margins. Common. May- July. No. W-296.

EBENACEAE

Diospyros virginiana L., PERSIMMON.
Dry deciduous forest, pinelands, and old fields. Common. May-June.
No. W- 567.

SYMPLOCACEAE

Symplocos tinctoria (L.) L'Her., HORSE SUGAR.
Pine and Oak-dominated forests and open disturbed areas. Common. March-May. No. W-309.

STYRACEAE

Halesia carolina L., CAROLINA SILVERBELL.
Alluvial forests and river/stream margins. Common. March-May. No. W-452.

OLEACEAE

Fraxinis pennsylvanica Marshall, GREEN ASH.
Low, rich woods generally on slight slope. Common. April. No. W-547.

Ligustrum sinense Loureiro, CHINESE PRIVET.
Open disturbed areas, alluvial forests, and roadsides. Uncommon. **I**. May- June.
No. W-209.

LOGANIACEAE

Spigelia marilandica L., INDIAN PINK, WOODLAND PINKROOT.
Oak-dominated forests and alluvial forests. Common. May- June. No. W-311.

GENTIANACEAE

Sabatia angularis (L.) Pursh, ROSE PINK, BITTER BLOOM.
Alluvial forests and open disturbed areas. Common. July- Aug. No. W-372.

BUDDLEJACEAE

Polypremum procumbens L., JUNIPER LEAF.
Open disturbed areas. Common. Late May- Sept. No. W-371.

ASCLEPIADACEAE

Asclepias variegata L., RED-RING MILKWEED.
Open upland woods and woodland margins. Common. May-June. No. W-559.

Matelea carolinensis (Jacquin) Woodson, MAROON CAROLINA MILKVINE.
Rich wooded slopes most commonly bordering streams or creeks. Uncommon. April-June. No. W-549.

CONVOLVULACEAE

Calystegia catesbeiana Pursh, CATESBY'S FALSE BLINDWEED.
Along dry roadsides and disturbed areas. Common. June- July. No. W-295.

Ipomoea purpurea (L.) Roth, COMMON MORNING GLORY.
Open disturbed areas, roadsides, and thickets. Locally common. July-Sept. No. W-367.

Ipomoea pandurata (L.) G. F. W. Meyer, MAN ROOT, MAN-of the-EARTH.
Oak-pine forests and open disturbed areas. Common. May- July. No. W-378.

CUSCUTACEAE

Cuscuta compacta Juss. Ex Choisy, COMPACT DODDER.
On a variety of woody or semi-woody hosts in moist thickets. Common. Aug.-Frost. No. W-393.

POLEMONIACEAE

Phlox amoena Sims, HAIRY PHLOX.
Open disturbed areas and associated with rock outcrops along rivers. Common. April- June. No. W-308.

Phlox stolonifera Sims, CREEPING PHLOX.
Oak-dominated and alluvial forests. Common. April- May. No. W-440. JFT-1665.

Phlox carolina L., CAROLINA PHLOX, THICK-LEAF PHLOX.
Open disturbed areas and shallow soils along the river margin. Common. May-July. No. W-337.

BORAGINACEAE

Cynoglossum virginianum L., HOUND'S TONGUE, WILD COMFREY.
Deciduous woods, infrequent near roadsides and in meadows. Common. April-June. No. W-239.

VERBENACEAE

Phryma leptostachya L., AMERICAN LOP-SEED.
Oak-dominated mesic forests. Uncommon. April- June. No. W-363.

LAMIACEAE

Scutellaria elliptica Muhlenberg Ex Spreng., HAIRY SKULLCAP.
Oak-dominated and alluvial forests. Common. Late May- June. No. W-343.

Glechoma hederacea L., GROUNDIVY.
Moist woods, pastures, and roadsides. Common. Late March-June. No. W-398.

Prunella vulgaris L., HEAL-ALL.
Open disturbed areas. Common. **I**. April- Frost. No. W-380.

Stachys nuttallii Shuttlew Ex Benth , HEART-LEAF HEDGE NETTLE.
Low meadows and bog areas. Locally common. June- Aug. No. W-360.

Stachys latidens Small ex Britt., BROAD-TOOTH HEDGE NETTLE.
Alluvial forests. Uncommon. June-Aug. No. W-384.

Salvia lyrata L., LYRE-LEAF SAGE.
Dry forests and open disturbed areas. Common. April-May. No. W-491.

Monarda clinopodia L., BEE BALM, WHITE BERGAMONT.
In open alluvial forests. Locally common. Late May- Sept. No. W-313.

Pycnanthemum incanum (L.) Michaux, HOARY MOUNTAIN MINT.
Alluvial forests and open disturbed areas. Common. Late June- Aug. No. W-369.

Lycopus virginicus L., VIRGINIA WATER-HOREHOUND.
Seepage slopes and along stream/river margins. Common. July-Frost. No. W-419.

Collinsonia canadensis L., HORSE BALM, RICHWEED.
Oak-dominated forests and rich wooded areas. Locally abundant. Late July-Sept. No. W-548.

SOLANACEAE

Solanum carolinense L., CAROLINA HORSE-NETTLE.
Found on gravel and in open disturbed areas. Common. May- July. No. W-391.

SCROPHULARIACEAE

Paulownia tomentosa (Thunberg) Sieb. & Zucc. Ex Steud., PRINCESS TREE.
Alluvial forests but has escaped to roadsides and disturbed areas. Rare. **I**. April-May. No. W-532.

Verbascum thapsus L., WOOLY MULLEIN, GREAT MULLEIN.
On xeric cliff faces, road-cuts, rock outcrops, and open disturbed areas along roadsides. Locally abundant. **I**. June- Sept. No. W-370.

Mimulus ringens L., ALLEGHENY MONKEY-FLOWER.
Seepage slopes and river margins. Common. June-Sept. No. W-581.

Chelone obliqua L., RED TURTLEHEAD.
Stream banks and swamp margins. Oct. Common. No. W-441.

Chelone glabra L., WHITE TURTLEHEAD.
Seepage slopes and along stream margins. Common. Aug. Oct. No. W-433.

Penstemon laevigatus Ait., EASTERN SMOOTH BEARDTONGUE.
Low meadows and forest edges. Common. May-June. No. W-471.

Nuttallanthus canadensis (L.) D.A. Sutton, OLDFIELD TOAD FLAX.
Roadsides and disturbed areas. Common. March-May. No. W-504.

Aureolaria laevigata (Raf.) Raf., ENTIRE-LEAF YELLOW FALSE FOXGLOVE.
Pine and oak-dominated forests. Common. Aug. Sept. No. W-513.

Pedicularis canadensis L., CANADIAN LOUSEWORT.
Open alluvial forests. Common. April- May. No. W-238.

BIGNONIACEAE

Bignonia capreolata L., CROSS VINE.
Open alluvial forests and river margins. Common. April- May. No. W-283.

Campsis radicans (L.) Seem. Ex Bureau, TRUMPET VINE.
Alluvial forests, woodland, and roadsides. Common. June-July. No. W-553.

Catalpa speciosa (Warder) Warder ex Engelm., NORTHERN CATALPA.
Alluvial forests, low woodlands, and waste areas. Common. July-Aug.
No-W-231.

OROBANCHACEAE

Epifagus virginiana (L.) Barton, AMERICAN BEECH-DROPS.
In rich woods near the base of *Fagus grandifolia*. Locally common. Sept.- Nov.
No. W-432.

Conopholis americana (L.) Wallroth, SQUAW ROOT.
Dry woods usually near the base of *Quercus sp.* Locally common. March- June.
No. W-210.

PLANTAGINACEAE

Plantago rugelii Dcne., BLACK-SEED PLANTAIN.
Open disturbed areas and roadsides. Common. June-Frost. No. W-563.

RUBIACEAE

Diodia virginiana L., VIRGINIA BUTTONWEED.
Moist areas along river margins. Common. June-Frost. No. W-403.

Mitchella repens L., PARTRIDGE BERRY.
Oak-dominated, alluvial and mesic cove forests. Common. May- June.
No. W-252.

Houstonia serpyllifolia Michaux, THYME-LEAF BLUET.
River and stream margins in moist sand-filled depressions on boulders, gravel-bars and seepage slopes. Common. May- June. No. W-237.

Houstonia purpurea L., SUMMER BLUET, VENUS' PRIDE.
Alluvial forests and open disturbed areas. Common. May- July. No W-307.

Houstonia longfolia Gaertner, LONG-LEAF SUMMER BLUET.
Deciduous forests and ericaceous balds. Common. June- Aug. No W-342.

Galium circaezans Michaux, LICORICE BEDSTRAW.
Open alluvial and oak-dominated forests. Common. April- June. No. W-255.

Galium aparine L., BEDSTRAW, STICKY-WILLY.
Meadows, woodlands, roadsides and disturbed areas. Common. April- May. No. W-362.

Galium latifolium Michaux, PURPLE BEDSTRAW.
Rich deciduous forests. Common. May-July. No. W-519.

CAPRIFOLIACEAE

Lonicera japonica Thunberg, JAPANESE HONEY-SUCKLE.
Oak-dominated forests and open disturbed areas. Common. **I**. April-June. No.W-503.

Sambucus nigra ssp. *canadensis* (L.) R. Bolli, ELDERBERRY.
Along river margins. Common. July- Aug. No. W-325.

CAMPANULACEAE

Triodanis perfoliata (L.) Nieuwl. , CLASPING-LEAF VENUS' LOOKING-GLASS.
Open disturbed areas, roadsides and fields. Common. April-June. No. W-514.

Campanula divaricata Michaux, BLUEBELLS.
Rocky woods and cliffs. Common. July-Oct. No. W-397.

Lobelia cardinalis L., CARDINAL FLOWER.
In moist depressions along river and streams. In open disturbed areas. Common. July- Oct. No. W-408.

Lobelia puberula Michaux, DOWNY LOBELIA, BLUE BELLS.
In open disturbed areas. Common. Late July- Oct. No. W-406.

Lobelia inflata L., INDIAN TOBACCO.
Open disturbed areas. Common. July-Frost. No. W-374.

ASTERACEAE

Ambrosia artemisiifolia L., RAGWEED.
Open disturbed areas. Common. Aug.-Frost. No. W-543.

Hieracium venosum L., HAWKWEED, RATTLESNAKE-WEED.
In dry open pine-oak forests and open roadsides. Common. Late April- Early July. No. W-230.

Prenanthes serpentaria Pursh, CANKERWEED.
Alluvial and oak-dominated forests. Common. Aug.-Oct. No. W-481.

Krigia virginica (L.) Willd., VIRGINIA DWARF DANDELION.
Open disturbed areas. Common. Late March-Early June. No. W-467.

Arnoglossum atriplicifolium (L.) H.E. Robins., PALE INDIAN-PLANTAIN.
Alluvial forests and open disturbed areas. Common. June-Oct. No. W-485.

Arnoglossum muehlenbergii(Schultz-Bip) H.E. Robins, GREAT INDIAN PLANTAIN.
Open alluvial forests, open roadsides and cutover areas. Common. June- Oct. No. W-345.

Packera anonyma (Wood) W.A. Weber & A. Love, SMALL'S GROUNDSEL.
Along dry roadsides and open alluvial meadows. Common. May-Early June. No.W-284.

Packera aurea (L.) A. & D. Love, GOLDEN GROUNDSEL.
Bogs, meadows, pastures and moist woods. Common. Late March- June. No. W-272.

Packera obovata (Muhl.ex Willd.) W. A. Weber & A Love, ROUND LEAF GROUNDSEL.
Wooded slopes associated with basic soil. Common. April-June. No. W-460.

Elephantopus tomentosus L., ELEPHANT'S FOOT, DEVIL'S GRANDMOTHER.
In open alluvial forests. Common. Late July- Sept. No. W-411.

Liatris spicata (L.) Willd., DENSE GAYFEATHER.
Moist pine barrens, savannahs, and ditches. Common. Late July- Early Sept. No. W-539.

Eupatorium fistulosum Barratt, TRUMPETWEED.
Stream and river margins and seepage slopes. Common. July-Oct. No. W-480.

Eupatorium purpureum L., SWEET-SCENTED JOE-PYE-WEED.
Wooded slopes, disturbed areas. Common. July- Oct. No. W-354.

Eupatorium capillifolium (J.B. de Lamarck) Small, DOG-FENNEL.
In disturbed cutover areas. Common. Mid Sept.- Frost. No W-413.

Ageratina altissima var.*altissima* (L.) King & H.E. Roins.
Oak-dominated forests. Common. Late July-Oct. No. W-541.

Centaurea cyanus L., BACHELORS BUTTON, GARDEN CORNFLOWER.
Open fields, roadsides, disturbed areas. Common. April-June. No. W-508.

Cirsium altissimum (L.) Spreng., THISTLE.
Alluvial forests. Common. Sept.-Frost. No. W- 512.

Vernonia glauca (L.) Willd., BROAD-LEAF IRONWEED.
Upland woods and open disturbed areas. Common. Late June-Sept. No. W-402.

Vernonia noveboracensis (L.) Michaux, NEW YORK IRONWEED.
Alluvial forests and low woodlands. Common. July-Sept. No. W-476.

Antennaria plantaginifolia (L.) Richardson, PUSSY-TOES, WOMAN'S TOBACCO.
Disturbed areas with shallow soil in conjunction with rock outcrops and ditches. Common. Late March- Early May. No. W-577.

Pseudognaphalium obtusifolium (L.) Hilliard & Burtt, RABBIT TOBACCO.
Fields, pastures, disturbed places and open woodlands. Common. Aug.- Oct. No. W-421.

Erigeron quercifolius Lamark, OAK-LEAF FLEABANE.
Sandy moist roadsides and waste places. Common. April- June. No. W-331.

Erigeron pulchellus Michaux, ROBIN'S PLANTAIN.
In rocky oak-dominated forests and on moist rock ledges along gorges. Common. April- Early June. No. W-207.

Symphyotrichum cordifolium (L.) Nesom, COMMON BLUE AMERICAN ASTER.
Open disturbed areas, rich woodlands, and wooded roadsides. Common. Sept.-Oct. No.W-423.

Symphyotrichum pilosum (Willd.) Nesom, WHITE OLDFIELD AMERICAN ASTER.
Old fields, meadows, and waste areas. Common. Sept.- Nov. No W-352.

Solidago caesia L., BLUE-STEM GOLDENROD, WREATH GOLDENROD.
In mesic oak-dominated forests. Common. Sept.- Oct. No. W-426.

Solidago roanensis Porter, ROAN MOUNTAIN GOLDENROD.
Woodlands and roadsides. Common. Aug.-Oct. No. W-424.

Solidago odora Aiton, ANISE-SCENTED GOLDENROD.
In disturbed open cutover areas. Common. July- Oct. No. W-410.

Solidago gigantea Aiton, LATE GOLDENROD.
In open disturbed areas. Common. July- Oct. No. W-399.

Pityopsis graminifolia (Michaux) Nutt.
Upland woods and roadsides. Common. July-Oct. No. W-425.

Pityopsis pinifolia (Ell.) Nutt.
Sandy soil areas in open woodlands. Common. Late Aug.- Sept. No. W-415.

Smallanthus uvedalius (L.) MacKenzie ex. Small, BEARSFOOT.
In open alluvial forests, usually on low ground. Common. July- Oct.
No. W- 382.

Silphium compositum Michaux, KIDNEY-LEAF ROSINWEED.
On dry roadsides and dry open forests. Common. May- Sept. No W-412.

Chrysogonum virginianum L., GREEN AND GOLD.
In dry oak-dominated forests and shallow soils associated with rock outcrops.
Common. Late March- Early June. No. W-251.

Rudbeckia fulgida Aiton, ORANGE CONEFLOWER.
Woodlands, meadows and pastures. Common. Aug.-Oct. No.W-573.

Rudbeckia hirta L., BLACK-EYED SUSAN.
Along open roadsides and disturbed areas. Common. May- July. No. W-338.

Helianthus hirsutus Rafinesque, HIRSUTE SUNFLOWER.
Open disturbed areas, woodlands, and road banks. Common. July-Oct.
No. W-405.

Verbesina occidentalis (L.) Walt,. YELLOW CROWNBEARD.
Woodlands, fields, and pastures. Common. Late Aug.-Oct. No. W-396.

Coreopsis major Walter, STIFFLEAF COREOPSIS, TICKSEED.
Open disturbed areas. Common. May- July. No. W-344.

Leucanthemum vulgare Lam., OX-EYE DAISY.
Open disturbed areas. Common. April-July. No. W-560.

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Vitis cinerea var. *baileyana*, p. 80
Vitis labrusca, p. 80
Vitis rotundifolia, p. 80

Woodwardia areolata, p. 60

Xanthorhiza simplicissima, p. 73
Xerophyllum asphodeloides, p. 67

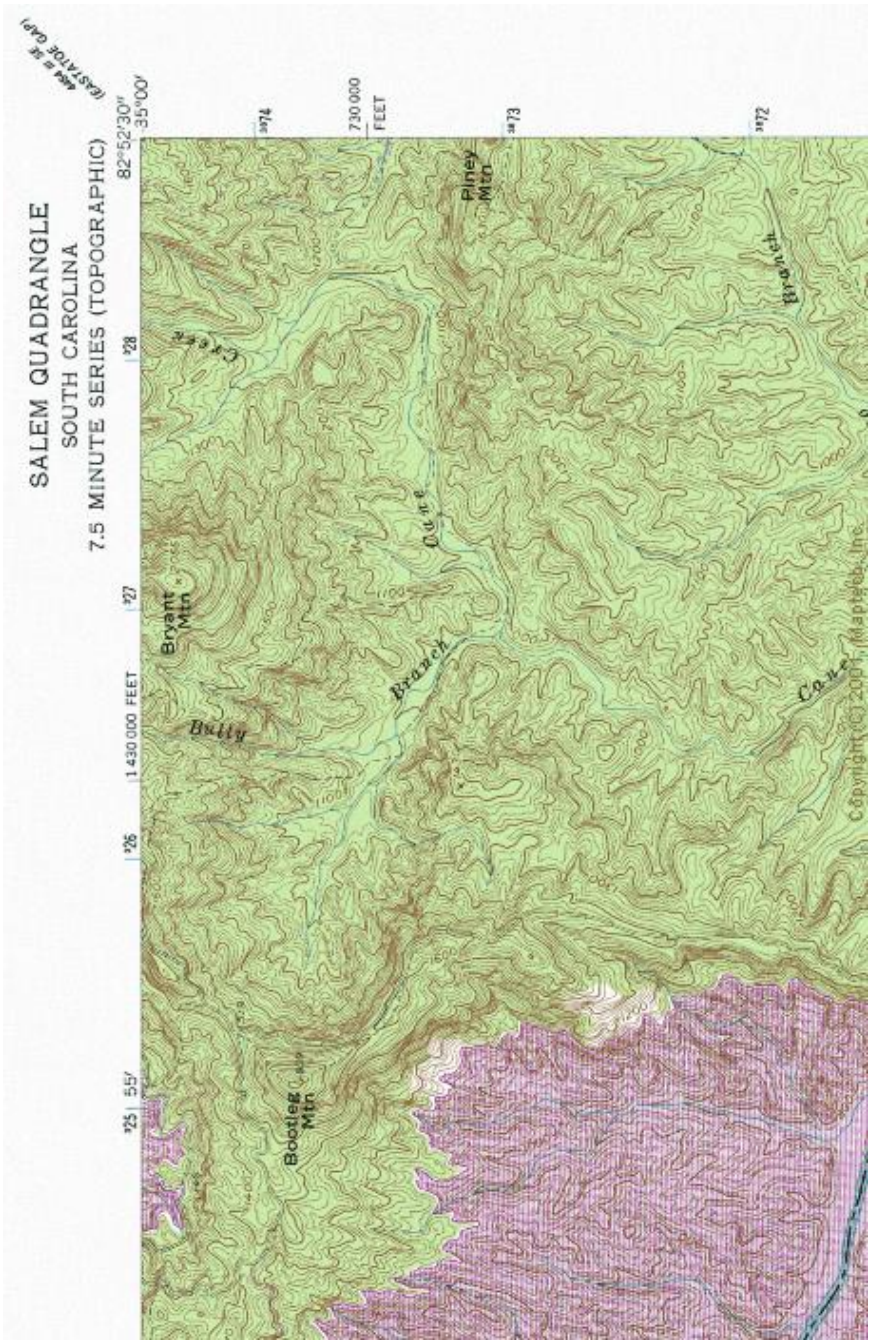
Yucca filamentosa, p. 69

Zizia aurea, p. 82

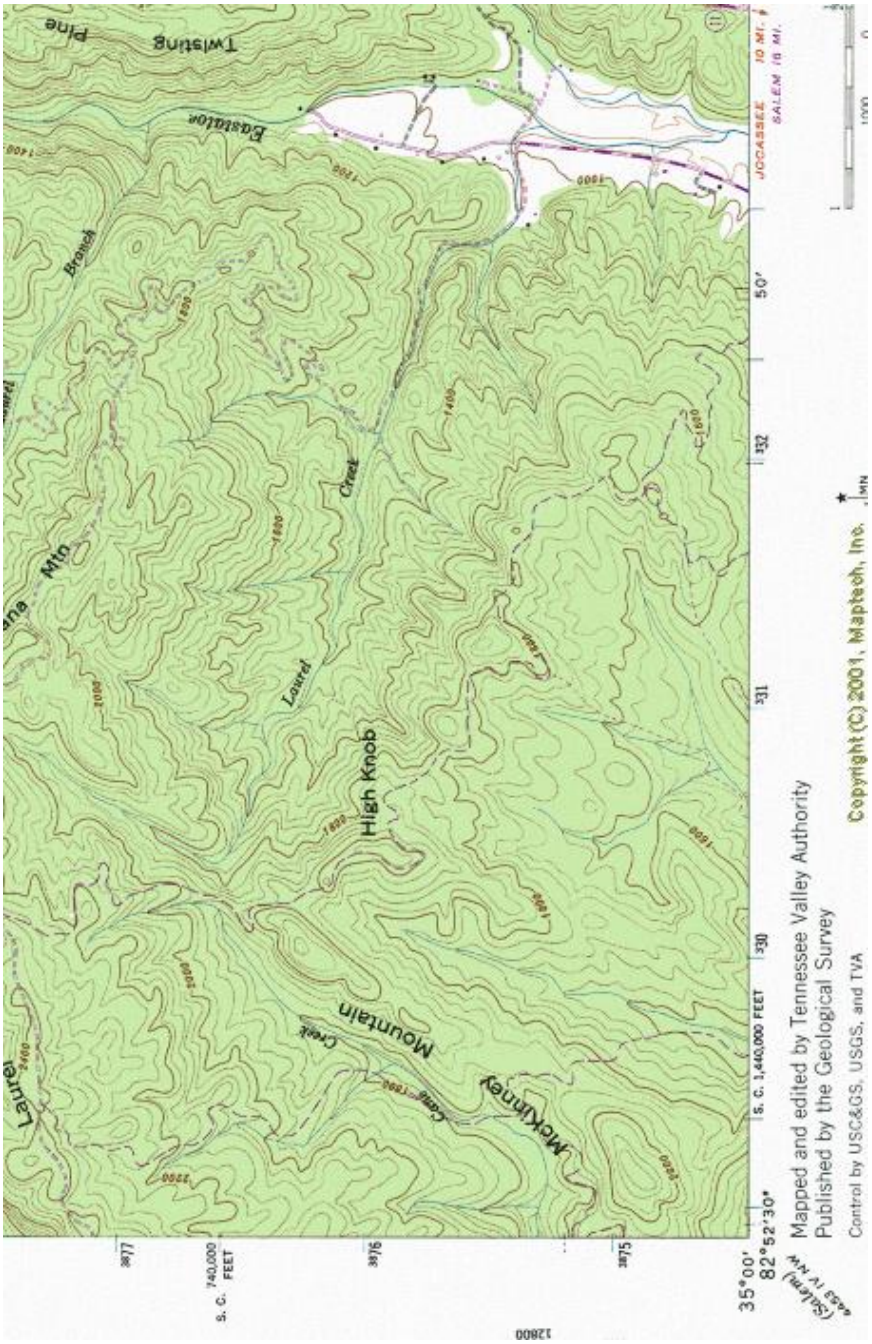
APPENDIX E

Topographical and U. S. Geological Survey Maps Indicating Quadrangles Included Within the Cane Creek Watershed

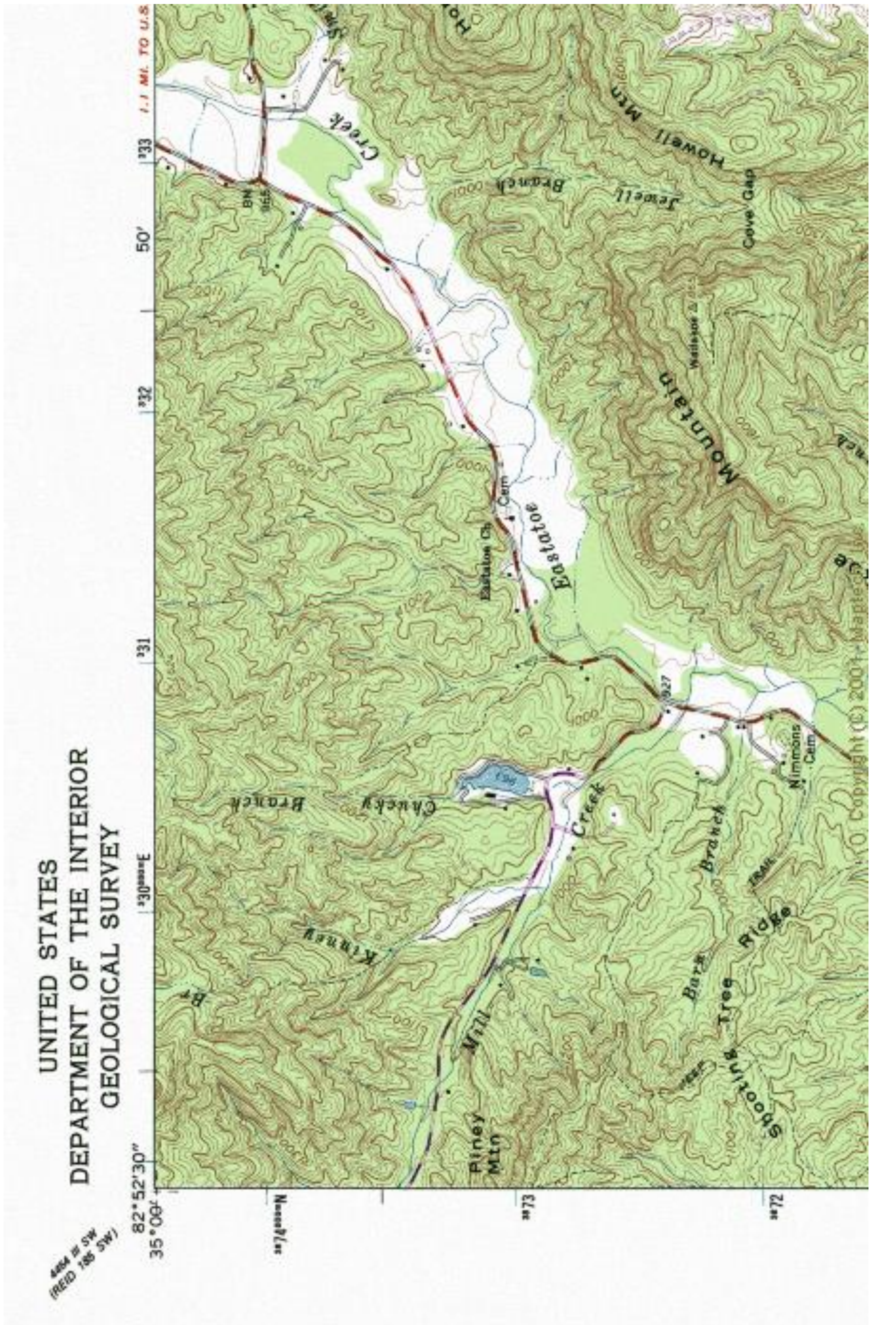
1. Salem Quadrangle- S.C.
2. Eastatoe Quadrangle- S.C.-N.C.
3. Sunset Quadrangle- S.C.- Pickens Co.
4. Reid Quadrangle- S.C- N.C.



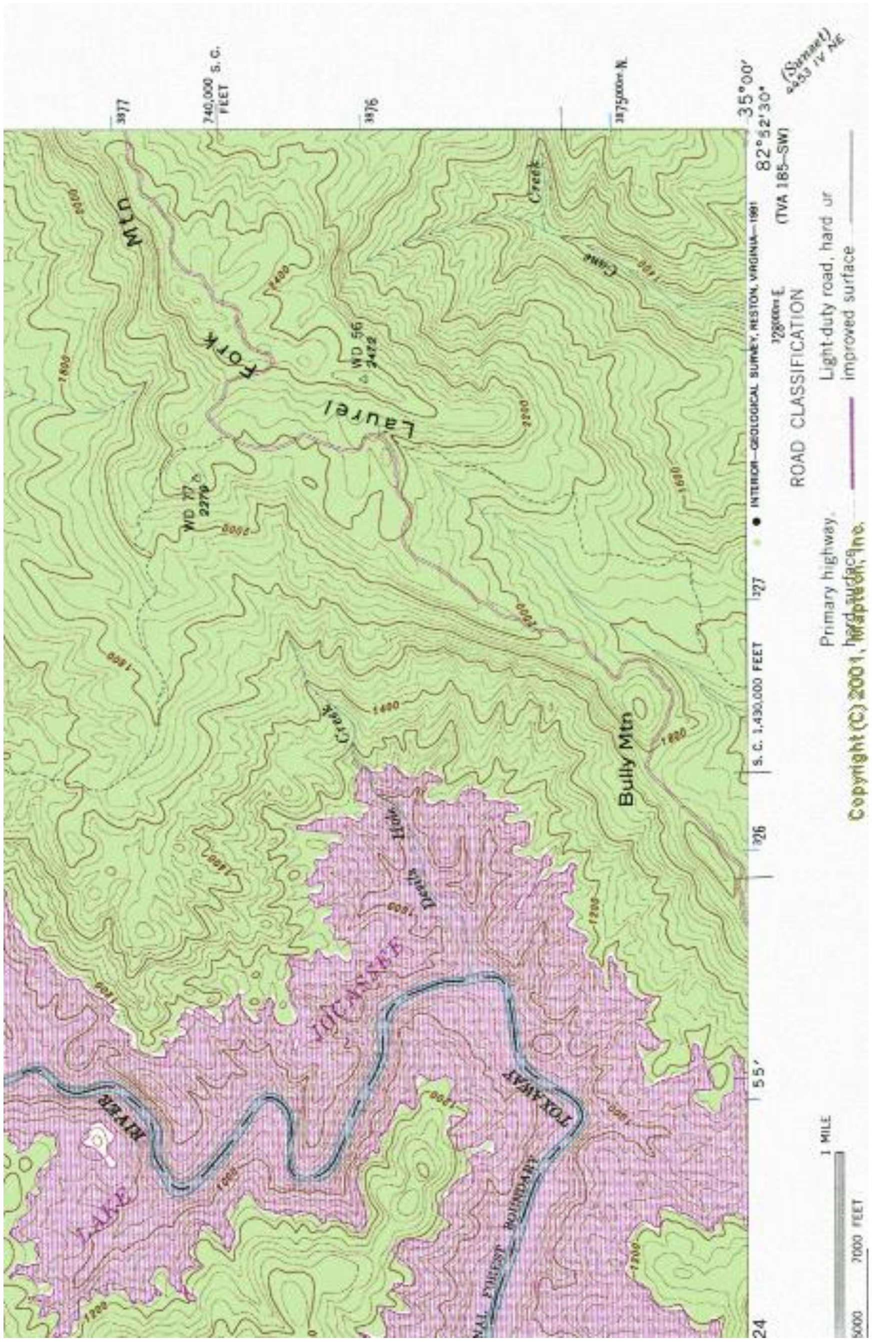
Map 1. Salem Quadrangle- S.C.



Map 2. Eastatoe Gap Quadrangle- S.C.-N.C.



Map 3. Sunset Quadrangle- S.C.- Pickens Co.



Map 4. Reid Quadrangle- S.C.- N.C.

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