To the Graduate Council:

I am submitting herewith a thesis written by Bobby Christopher Bullington entitled "The Vascular Flora of the Upper Clinch River in Claiborne, Grainger, and Hancock Counties, Tennessee." I have examined the final copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Botany.

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Major Professor

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Associate Vice Chancellor and
Dean of the Graduate School

THE VASCULAR FLORA OF THE UPPER CLINCH RIVER IN CLAIBORNE, GRAINGER, AND HANCOCK COUNTIES, TENNESSEE

A Thesis

Presented for the

Master of Science

Degree

University of Tennessee, Knoxville

Bobby Christopher Bullington

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DEDICATION

To my son Galen, in hope that he will someday paddle the Clinch.

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ABSTRACT

The vascular flora along a portion of the Upper Clinch River (UCR) in Claiborne, Grainger, and Hancock Counties, Tennessee was inventoried for two full growing seasons in 1994 and 1995. A total of 526 species and lesser taxa in 108 families and 338 genera were documented. Three hundred and twenty-six taxa were determined to be county records. Six taxa are state listed as threatened or special concern species in Tennessee.

Distributions of the taxa indicate a strong northern extraneous influence on the flora. However, intraneous elements still represent the single largest category. Northern taxa comprise almost 52% of the total flora when all categories are considered. As well, introduced taxa constitute a relatively large percentage of the flora at 15%.

The Clinch River has been designated as one of the most biologically important river systems in Tennessee. Many of the prime habitats of the river are found in its upper stretches. Considering the importance of the UCR, no significant portions are under public domain. Similarly, no long-term systematic studies of the flora have ever been conducted. Hopefully, this study will help to further knowledge of the vascular plants of the region, and aid in the protection of the resources of this river in the future.

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CHAPTER I

INTRODUCTION

The Clinch River is considered to be one of the most biologically important river systems in Tennessee. Much of this importance is due to the river's unusual diversity of aquatic organisms, particularly freshwater mussels. Few rivers in the state can match the number of mussel species known to occur in the Clinch. Unfortunately, many of these mussels are classified as rare or endangered. As a result, the Clinch is recognized as the most significant river system in the state for federally and state listed aquatic species. It is this distinction that prompted the Nature Conservancy to declare the entire Clinch River Valley of "immense biological importance", a phrase they reserve for only 28 ecosystems worldwide (Nature Conservancy, 1994a).

The Clinch River has been subject to much environmental degradation. Logging, farming, and a series of dams have combined to alter much of the habitat. However, some portions of the river have remained in pristine condition, especially the region referred to here as the Upper Clinch River (UCR). While much of the Clinch River is trapped within the confines of two reservoirs, the UCR lies beyond these impoundments and contains over 200 miles of free-flowing water. Beginning at slackwater on Norris Reservoir, this region stretches all the way to the Clinch River's headwaters in the mountains of southwest Virginia.

For the purposes of this study, a section of the UCR within Claiborne, Grainger, and Hancock counties was selected. A wide variety of habitat types can be found within the complex terrain of this area: cool mesic coves, river bluffs, dry rock outcrops, islands, and gravel bars. Humans have also left their

mark by pasturing and cultivating much of the flatter bottomlands along the river. Nevertheless, it is the unusual mix of ruderal and natural habitats in the landscape that makes the study area of great interest.

Despite the importance of the UCR, no detailed studies of the region's flora have ever been attempted. Therefore, the primary goal of this research was to document as much of the vascular flora as possible within the boundaries of a study area representative of the region. Special effort was made also to seek out endangered plant species and assess the condition of their populations. Considering the important role plants play in the environment, a vascular plant inventory could yield valuable information in regard to the many endangered aquatic organisms of the area. In addition, this study may be useful as a baseline for further botanical and ecological investigations.

CHAPTER II

THE UPPER CLINCH RIVER STUDY AREA

Location

The Clinch River, the largest tributary of the Tennessee River, cuts across the northern portion of the Great Valley of East Tennessee (Figure 1). The study area is located along a section of the river in Claiborne, Grainger, and Hancock counties (Figure 2) between 36^0 23' 45" and 36^0 28' 46" N latitude and 83^0 27' 33" and 83^0 16' 41" W longitude (Figure 3). The mid-point of the area, designated roughly by the intersection of the river with the Claiborne-Hancock county line, lies approximately 75 miles northeast of the city of Knoxville. Details of the site can be seen on two U. S. Geological Survey 7.5 minute topographic maps: the Howard Quarter Quadrangle and the Swan Island Quadrangle.

Boundaries

Due to the intricate terrain of the study area, precise boundaries were difficult to establish. Nevertheless, the following account describes the manner in which the boundaries were ascertained. The study site consists of a long segment of the Clinch River and immediate portions of the adjacent ridge systems to both sides of the river.

The southwest boundary of the study area is denoted by the U. S. Highway 25E bridge. Coincidentally, the bridge also marks the approximate location of slackwater on Norris Reservoir. The northeast boundary of the study site lies at Swan Island about 20 river miles upstream. However, it should

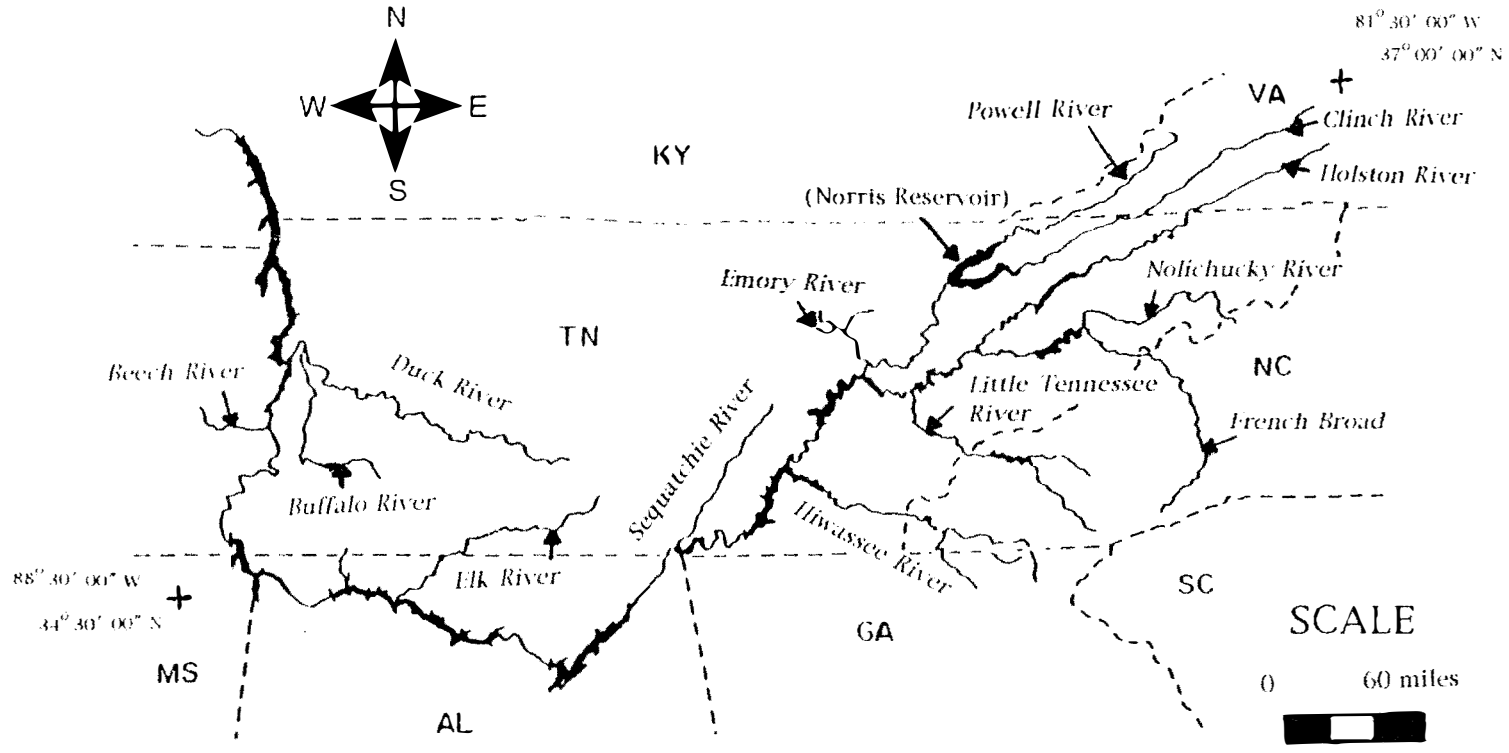


Figure 1: Major Tributaries of the Tennessee River System

(*Map adapted from Webb and Bates, 1989)

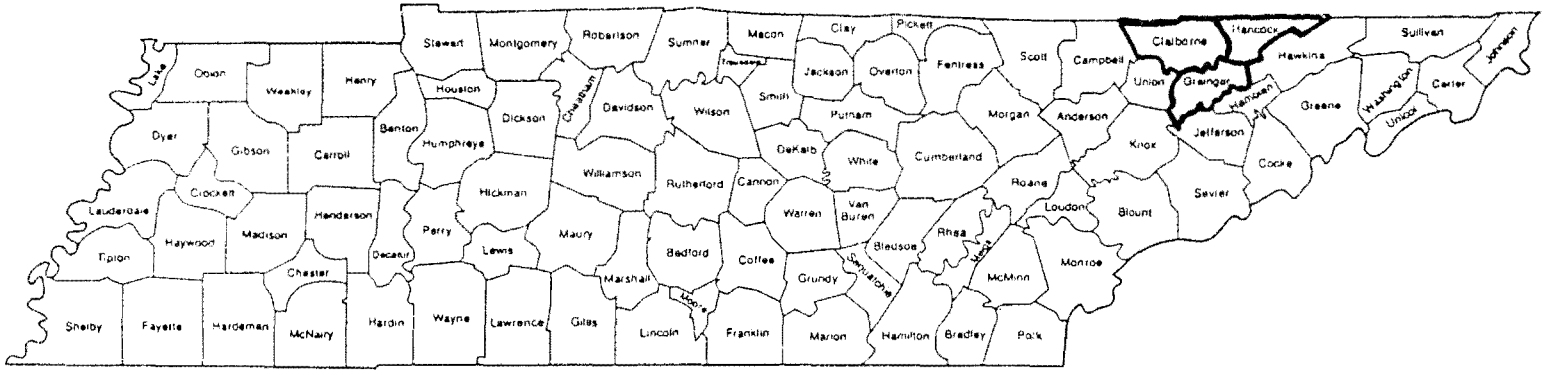


Figure 2: County Map of Tennessee (study site counties in outline)

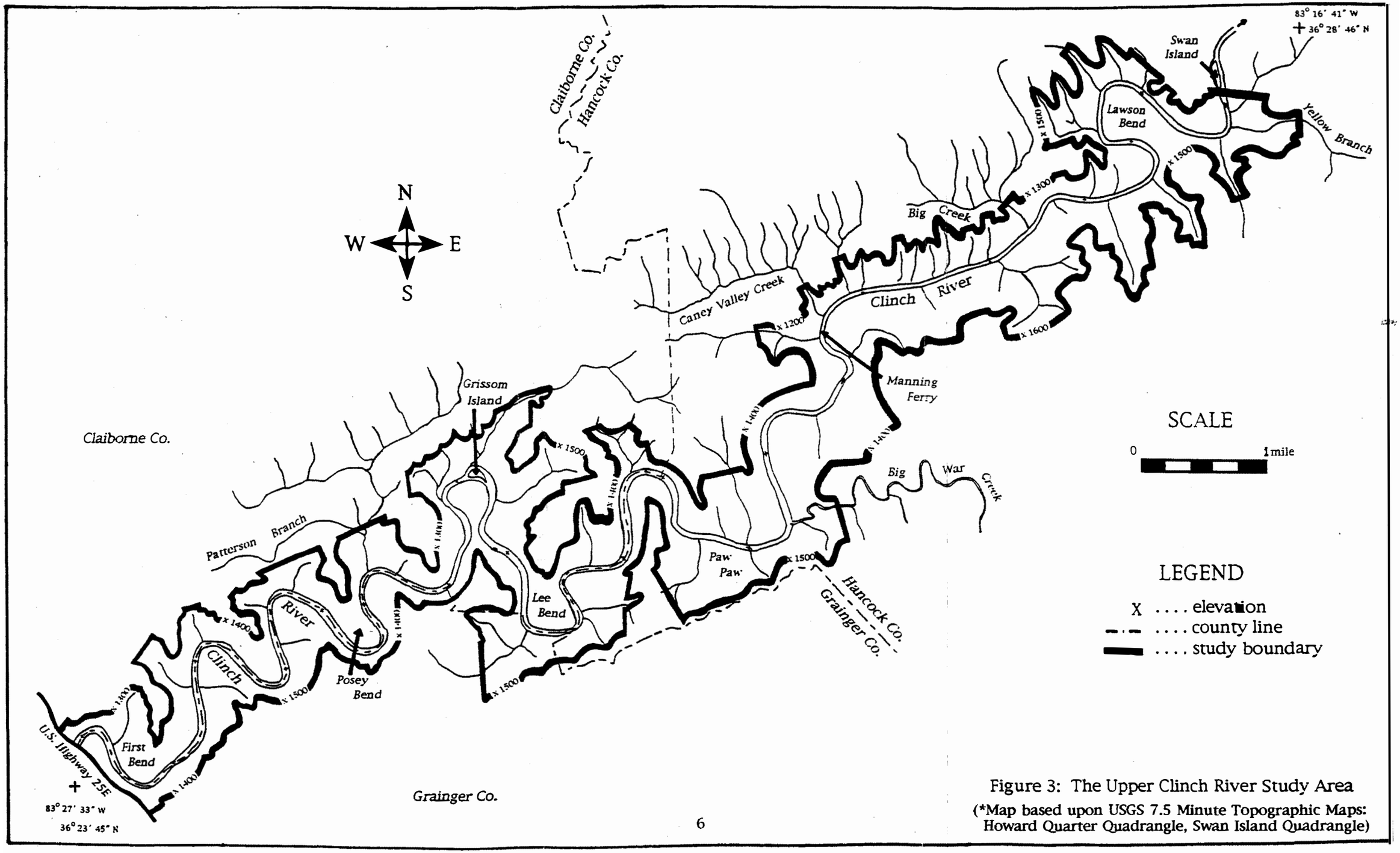


Figure 3: The Upper Clinch River Study Area

(*Map based upon USGS 7.5 Minute Topographic Maps: Howard Quarter Quadrangle, Swan Island Quadrangle)

be noted that Swan Island is not included within the confines of the study area.

The northwest and southeast boundaries fall along a complex system of ridges that roughly follow the course of the river. In the field, the boundary line along these ridges was generally delineated by the crest of a ridge. However, for purposes of map making, the boundary line follows the highest continuous contour line of the ridge system on the USGS 7.5 minute topographic maps. For areas in which the ridge system became disjunct, a straight line was drawn from the point of discontinuation to the highest continuous contour line of the next ridge. Elevation varies along each of the boundaries from 1200 feet to 1600 feet above sea level.

In a few places, several minor ridges are completely contained in the study area due to severe contortions in the course of the river. These ridges can be found near Grissom Island, Manning Ferry, and Lawson Bend. Overall, the study area consists of approximately 5,000 hectares of land.

Access

Given the relative remoteness of the region, the study area contains a wide array of roads and trails imperative to access. Much of the study site can be reached within a reasonable distance by automobile. However, road conditions vary from paved highways to gravel and dirt. Often where a road ends, a trail or path begins to further access. Regardless, several places are completely inaccessible by car or foot due to the rugged terrain of the area. In such cases, the river itself serves as the only viable means of transport.

A map of the area's roads and trails can be seen in Figure 4. Road names have been given in accordance with the Howard Quarter and Swan Island Quadrangle maps. For instances in which road names were not given, the names were assigned by the author based upon the most noticeable landform of the area. Minor roads and trails were not assigned any names. References

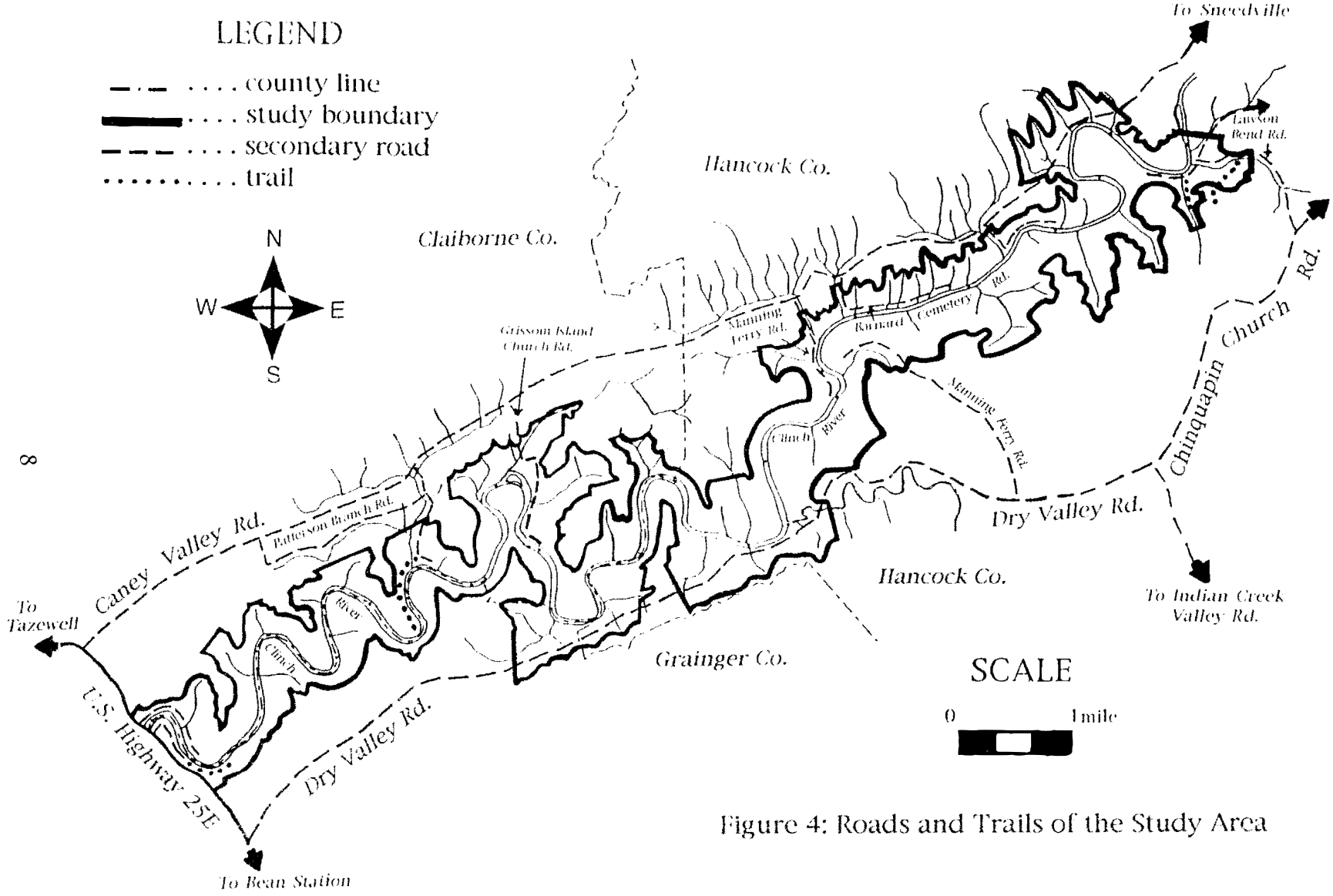


Figure 4: Roads and Trails of the Study Area

to unnamed routes are by association to a particular map locality. It should be noted also that many of the secondary roads indicated on the 7.5 minute topographic maps are no longer present or have fallen into private hands. Only roads that allow viable transport by automobile are depicted in Figure 4.

Roads

The primary route to the study site is via U. S. Highway 25E. As the major link between the towns of Bean Station and Tazewell, this paved two-lane road crosses the Clinch River and forms the southwestern boundary of the study area. At this junction, two unnamed gravel roads turn off the highway and run parallel for less than a mile on opposite sides of the river. Both roads deadend, but provide access into a floristically rich area designated as First Bend.

Along the southeastern boundary, Dry Valley Road runs approximately 11 miles from U. S. Highway 25E to Chinquapin Church Road. Though located mostly outside the boundaries, this paved and gravel secondary road does enter Lee Bend and Paw Paw. At Lee Bend, the route runs atop the ridge and overlooks the river. Access to drier upland habitats with rock outcrops and cedar-pine forests can be made along this segment of road. At Paw Paw, the road actually cuts between the river and the adjacent ridge. This section lies close to the banks of the river and provides access to both lowland riparian forests and mixed mesophytic forests.

Numerous side roads branch from Dry Valley Road, but only Manning Ferry Road penetrates the study area. From its starting point, this gravel road runs approximately 3.5 miles until it deadends at private property not far from the river. The ferry was closed in the 1950's, so traffic on the road has been at a minimum for some time (personal communication with property owner). Overall, the road descends almost straight down from the ridge top cutting through a variety of habitat types.

From Chinquapin Church Road, Lawson Bend Road provides access to a long stretch of forested river bottom. Starting at ridge top, the road runs about two miles before ending at a private drive. One other route, Yellow Branch Road, splits from Lawson Bend Road through another stretch of river bottom. These two roads provide access to over a mile of rich, mesic bottomland forests.

Caney Valley Road is a paved secondary byway that runs along the entire course of the northwestern boundary. From U. S. Highway 25E, the road continues for approximately 14 miles before entering the study area at Lawson Bend. Here, the road cuts between the river and adjacent ridge exposing a large sandstone formation.

Five other gravel roads branch from Caney Valley Road to deadend near the river. The first of these, Patterson Branch Road, forms a 3.5 mile loop that connects to a graveled drive. The drive provides the only automobile access to Posey Bend, a very floristically rich area. Further down, Grissom Island Church Road cuts through a gap in the ridge to terminate at a water gaging station at the river's edge. The other half of Manning Ferry Road also cuts across the ridge and ends near the river. Both of these provide access to a variety of upland and lowland habitats. Barnard Cemetery Road runs along a straight two mile section of flat bottomland. Most of the area is in pasture and is the largest ruderal habitat of the study site. Finally, Big Creek Road follows the banks of Big Creek for about a mile before the creek empties into the river. The road provides the only extended access to one of the major tributaries of the Clinch.

Trails

Not many established trail systems are present. The few trails that do exist are mostly remnants of secondary roads that became privatized and abandoned to the forest. The longest of these is a half mile trail at Lawson Bend that was a gravel road connecting to Yellow Branch Road. This trail runs

uphill from mid-slope to the top of the ridge through several forest types. The next longest trail lies along the northeast-facing slopes of Posey Bend. Here, an old wagon road squeezes between the steep hillside and the river for about one third of a mile before ending at an open field. Finally, along the northern half of Manning Ferry Road, a short trail lies along a connector road to the old ferry landing. The trail is almost overgrown and runs about 200 yards through lowland riparian forests to the river.

A couple of other trails have been indicated in Figure 4, but both should be more correctly identified as footpaths. The more prominent of these lies along the north-facing banks of the river at First Bend. Though disjunct at certain points, this path is well worn for about a half mile around the bend. A few minor paths also branch upslope from this path to several bluff areas. At Lawson Bend, another well-worn footpath originates near the river bottom at the base of a large waterfall. Located just beyond the mid-point of Lawson Bend Road, the path ascends about 175 yards to the top of the falls. Though steep and treacherous, the path provides access to one of the larger coves in the study area.

River

Many areas of the study site can only be accessed by river. Due to the difficult terrain, a canoe is often the only viable means of transport. Travel on the river is one-directional for the most part, as the current is too swift to paddle upstream. Motor boat traffic is restricted on this portion of the Clinch also due to the shallow water. However, heavy rains during the spring season will occasionally permit some motor boats to reach into the UCR from Norris Reservoir for about a mile.

During the late summer season, water levels are often so low as to make travel by canoe difficult. Numerous shoals and rocky areas interrupt the river and can be quite treacherous. In such places, it is necessary to portage the

canoe. Only four sites are suitable for put-in or take-out. The first is at Lawson Bend, which is the furthest site upstream. Two other sites, Paw Paw and Grissom Island Church, provide access to the lower half of the river. The final site at First Bend is only a take-out point near the southwestern boundary.

Physiography

The study area lies entirely within the confines of the Ridge and Valley Physiographic Province (Fenneman, 1938). Extending over 1,200 miles, this province stretches from central Alabama to New York state. In Tennessee, the Ridge and Valley is delineated by the Blue Ridge Mountains to the east and the Cumberland Plateau & Mountains to the west. Overall, the province averages only about 40 miles in width throughout the state.

In the northern section of the Ridge and Valley in Tennessee, ridges dominate the landscape more than in the southern section (Fenneman, 1938). The valleys are more narrow and contain fewer lowlands. Several prominent ridges dominate the terrain in this area, namely: Clinch, Powell, and Wallen Mountains. Most minor ridges are associated in some way with these larger ridge systems. A primary characteristic of all these ridges is that they trend in a parallel northeasterly direction and are roughly uniform in height. As a result of this terrain, the major rivers of the area run in a similar pattern, with their drainages entering perpendicularly from the adjacent ridges.

Drainage

There are 49 streams that drain directly into the Clinch River within the confines of the study area. Most of these streams are minor and are unnamed on the Howard Quarter and Swan Island Quadrangle maps. However, five larger streams are named: Big Creek, Big War Creek, Caney Valley Creek, Patterson Branch, and Yellow Branch. Of these, Big War Creek is the only

major stream. The flow of water is enough to float a canoe during much of the year. The other four streams are not navigable but have a considerable flow of water in comparison to the other minor streams. Furthermore, Big Creek, Big War Creek, Caney Valley Creek, and Patterson Branch culminate from drainages of ridge systems outside of the study area. The remaining streams all arise from ridge systems immediately adjacent to the Clinch River.

Topography

The topography of the UCR is very complex. Overall, the river and its associated ridge systems trend in a northeast to southwest direction. However, the flow of water through time has carved an intricate pattern into the landscape. Slope aspect can vary greatly, especially in the lower section of the UCR where the river forms a series of winding bends. At Grissom Island, the river almost completely curves back into itself forming an oxbow. Though, in the upper section, the river straightens and the slopes become less variable.

The elevation of the surrounding ridges range from a maximum of about 1,700 feet to approximately 1,300 feet. The river itself lies at an elevation of just over 1,000 feet where it enters Norris Reservoir. Slopes are quite steep for the most part with many over 70% in grade. Others are segmented with individual steps varying from 5% to 50% in grade.

In some areas, the ridges have eroded away into cliffs with a resultant talus slope below. Often, the cliffs are quite prominent with several over 150 feet in height. It is not uncommon for these precipices to arise straight from the river's edge. In other upslope locations, rock outcrops and boulder fields are present. Both cliffs and rock outcrops tend to occur along the cut bank in the deepest bends of the river.

While steep ridges dominate the landscape of the region, other topographic features include various islands, gravel bars, and floodplain areas. Some of these can be rather ephemeral with the rise and fall of water

levels in the river. However, these areas still constitute a significant portion of the study site.

Geology

The UCR forms a unique area geologically as it cuts through the Ridge and Valley province. Overall, this portion of the province is characterized by a series of long parallel ridges that trend toward the northeast. According to Vest (1963), the topography resulted directly from the deposition of sedimentary rocks into nearly horizontal layers. These layers subsequently developed under a variety of deformations into long narrow belts that repeat (Figure 5). More resistant sedimentary rocks such as sandstone form the ridges while less resistant sedimentary rocks such as limestones and shales underlie the floors of the valleys. However, the entire area is extensively faulted and folded with various combinations of sedimentary rocks present in different areas.

The rock strata range in age from lower Cambrian to upper Ordovician (Table 1). All three major types of sedimentary rocks (sandstones, shales, and limestones) are present, but the study site is primarily underlain with Chickamauga limestone and Knox dolomite from the middle and lower Ordovician. Approximately a third of the study area is underlain with Conasauga limestone and shale from the upper and middle Cambrian. Also, a limited amount of shale, siltstone, and sandstone of the Rome Formation from the lower Cambrian can be found.

The Ordovician age rocks consist of the Chickamauga and Knox Groups. Within the Chickamauga Group, four unnamed units of strata predominantly from a limestone sequence are found. Combined, these strata are 2,000 feet thick approximately with individual stratum ranging from 350 to 625 feet (Hardeman, 1966).

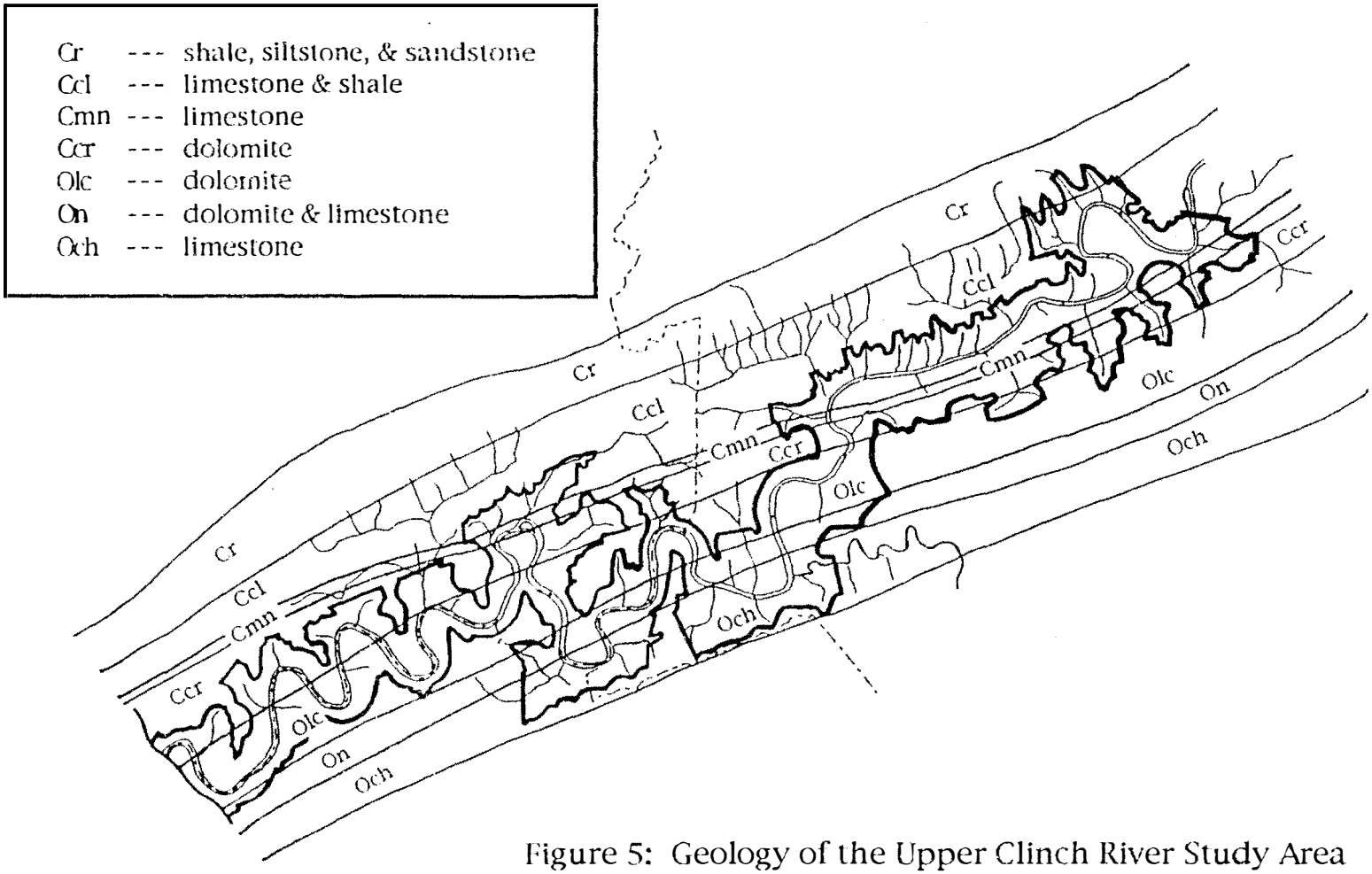


Figure 5: Geology of the Upper Clinch River Study Area

(*Map adapted from Hardeman, 1966)

Table 1: Rock Formations of the Upper Clinch River Study Area

System		Name				Thickness in Feet
Ordovician	U					
	M	Chickamauga Group	Och	Unit IV		625
				Unit III		600
				Unit II		350
				Unit I		500
	L	Knox Group	On	Mascot Dol.	Omn	550
				Kingsport Fm.	Ok	225
			Olc	Longview Dol.	Olv	275
				Chepultepec Dol.	Oc	725
			Copper Ridge Dol.		Ccr	900
Cambrian	U	Conasauga Group	Ccl	Maynardville Ls.	Cmn	350
				Nolichucky Sh.	Cn	475
	M			Maryville Ls.	Cm	400
				Rogersville Sh.	Crg	250
				Rutledge Ls.	Crf	150
				Pumpkin Valley Sh.	Cpv	250
	L	Rome Formation		Cr		800

(*Table adapted from Vest, 1963)

The Knox Group consists of five units of strata: Mascot Dolomite, the Kingsport Formation, Longview Dolomite, Chepultepec Dolomite, and Copper Ridge Dolomite. The Mascot Dolomite consists of light-gray, fine-grained cherty dolomite about 550 feet thick. Similarly, the Kingsport Formation is composed of a gray, fine-grained cherty dolomite, but also contains a dense, basal gray limestone sequence approximately 225 feet thick. Longview Dolomite is a siliceous, gray, fine-grained dolomite about 275 feet thick with interbeds of gray limestone in the upper part. Chepultepec Dolomite is a light-gray, fine-grained, moderately cherty dolomite that is 725 feet thick and also contains a fine-grained limestone in its upper part with quartz sandstone beds at the base. Finally, Copper Ridge Dolomite is a coarse, dark gray, knotty dolomite with abundant chert that is approximately 900 feet thick (Hardeman, 1966).

The Cambrian age rocks of the study area consist of the previously described Copper Ridge Dolomite of the Knox Group, the members of the Conasauga Group, and the Rome Formation. Maynardville Limestone of the Conasauga Group is a thick-bedded, bluish-gray nodular limestone about 350 feet thick with a thinly bedded, noncherty dolomite in its upper part. Nolichucky Shale is a pastel-colored, flaky clay shale 475 feet thick with shaly limestone lenses and a thin blocky siltstone near the middle. Maryville Limestone is a gray, ribboned (silt and dolomite), fine-grained, evenly bedded limestone 400 feet thick. Rogersville Shale is a light-green, fissile clay shale 250 feet thick with some limestone in its upper part. Rutledge Limestone is a medium-dark gray, ribboned limestone that is medium-grained and well-bedded, but only about 150 feet thick. Pumpkin Valley Shale is a dull-brown to maroon shale with numerous interbeds of siltstone 250 feet thick. The Rome Formation is composed of variegated shale and siltstone about 800 feet thick with sandstone, limestone, and dolomite limited to certain portions of the

formation (Hardeman, 1966).

Minerals

The mineral resources of the Clinch River Valley consist primarily of coal, zinc, limestone, dolomite, shale aggregate, and high-silica sand (Clinch-Powell River Valley Association, 1963). Of these, only zinc, limestone, dolomite, and shale aggregate are found in any sizable quantities within the UCR. Coal seams are restricted to the Powell River watershed to the northwest and to the lower portions of the Clinch below Norris Reservoir (Luther, 1959). Similarly, deposits of high-silica sand are limited to the eastern side of Clinch Mountain and to portions of Walden Ridge to the west (Hershey, 1960).

Rocks that contain high-magnesian dolomite are considered to be the dominant mineral resource (Clinch-Powell River Valley Association, 1963). Other minerals such as zinc are known to occur along the northeastern fringe of Lawson Bend (Maher, 1958). Also, shales that may be "bloated" for lightweight aggregate have prospects in this area (Clinch-Powell River Valley Association, 1963). It should be noted that none of these mineral resources have been mined within the confines of the study site though. However, rocks that contain high-calcium limestones have been mined for various uses in areas nearby. Currently, a limestone quarry is in operation near the U. S. Highway 25E bridge in Grainger County. Future plans for the exploration of mineral resources are not known.

Soils

The soils of the UCR have been partially mapped through a soil survey of Hancock and Hawkins counties, Tennessee (U. S. Dept. of Agriculture, 1972). This survey covers approximately 60 percent of the study site and provides much information about the soils of the area. While a significant amount of the study area was not included, it is reasonable to assume that many of the

same soil series will be found given the repetitive geologic features of the area.

Four main soil associations have been described within the included portions of the study site: the Fullerton-Claiborne-Clarksville association, the Lehew-Wallen-Calvin association, the Talbott-Rock Outcrop association, and the Montevallo-Talbott-Rock Outcrop association. Generally, these associations contain soils within the orders of Ultisols, Inceptisols, and Alfisols. Ultisols are described as having a clay-enriched B horizon and a base saturation of less than 35 percent. Inceptisols are mineral soils that have formed mostly in young, but not recent material. Finally, Alfisols are described as soils that have an accumulation of aluminum and iron with argillic and natric horizons, and a base saturation of more than 35 percent. The four associations are comprised mostly of eight soil series which constitute a majority of the soils within the study site. However, many other soil series can be found scattered throughout the area (U. S. Dept. of Agriculture, 1972).

The Fullerton-Claiborne-Clarksville association is characterized by dominantly cherty soils more than six feet deep over dolomitic limestone on high hills and ridges. This association is dominated by three major soil series. The Fullerton series consists of relatively deep, well-drained soils on slopes ranging from 5 to 35 percent. Permeability and water capacity are moderate, with most of the profile being strongly acidic. Overall, Fullerton soils are well suited for hay and pasture, and many have been converted to that usage. The Claiborne series consists of soils on high hills and ridges that are similar but somewhat less cherty and more strongly acidic. Due to a high available water capacity, Claiborne soils are often used for crops such as corn and tobacco along lower slopes. The Clarksville series consists of cherty, deep, well-drained soils on narrow ridge crests and steep slopes ranging from 5 to 40 percent. Permeability and water capacity of these soils are moderate to low

and acidity is often very high. Clarksville soils are commonly referred to as "gravelly ridgeland" and most of the acreage is in woods (U. S. Dept. of Agriculture, 1972).

The Lehew-Wallen-Calvin association is characterized by shaly and gravelly soils one to three feet deep over shale and sandstone on steep to very steep hills and ridges. The Lehew series consists of "channery", moderately deep, excessively drained soils on slopes of 25 to 60 percent. Permeability is somewhat high, and available water capacity is low. Reaction of these soils is strongly to very strongly acidic, and natural fertility is low. Most of the acreage of Lehew soils is in forest with the remainder in pasture. Wallen soils are similar in most respects to Lehew soils except that they are found on steep sandstone and siltstone ridges. In many places, hard sandstone bedrock is present at a depth of only 28 inches. Soils of the Wallen series are mainly in forests dominated by oaks, hickories, and Virginia pine. The Calvin series consists of moderately deep, shaly soils on hillsides, ridges, and low irregular hills that slope from 15 to 60 percent. These soils are of moderate permeability and have a low available water capacity. Calvin soils are also strongly acidic and respond poorly to agricultural management (U. S. Dept. of Agriculture, 1972).

The Talbott-Rock Outcrop association is characterized by soils less than three and a half feet deep over limestone and rock outcrop in long narrow valleys. The Talbott series consists of moderately deep, clayey, red soils on slopes ranging from 5 to 50 percent. Permeability is moderately low, and water capacity is medium. The soils are of medium to low acidity, and most commonly grown crops are fairly well suited to these soils. However, much of the area is in pasture and hay with a small amount of forest land. Rock outcrop areas are interspersed with Talbott soils on limestone valley floors and on moderately steep hillsides near the edges of valleys. Within this complex,

rock outcrop comprises anywhere from 15 to 40 percent of the area. Pasture is found along lower slopes with rock outcrop, but steeper slopes are predominantly forests (U. S. Dept. of Agriculture, 1972).

Similarly, the Montevallo-Talbott-Rock Outcrop association is characterized by soils less than three and a half feet deep over shale or limestone, and limestone outcrops in long narrow valleys. In this association, Montevallo soils are typically side by side with the Talbott soils described previously. This series consists of shallow, shaly, droughty soils underlain by multicolored fissile shale. Slopes range from approximately 8 to 50 percent. Permeability is moderate and available water capacity is low. The soils are strongly acidic and respond poorly to agricultural management. Rock outcrops are more extensive in this association than in the Talbott-Rock Outcrop association. In places, rock outcrop can cover as much as 80 percent of the area. As a result, Montevallo soils often support scrubby woodland and pasture (U. S. Dept. of Agriculture, 1972).

Fourteen other soil series are found within the boundaries of the study site: the Cloudland, Dewey, Etowah, Greendale, Hamblen, Hayter, Lindside, Litz, Melvin, Minvale, Nella, Sensabaugh, Sequoia, and Staser series. Most of these are silt-loam soil types that occur in low bottomlands along the river. Permeability is often moderate and the available water capacity high. These soils are not as strongly acidic and respond well to agricultural management. Much of the land containing these series has been converted to agricultural use. Crops such as corn, tobacco, and hay are commonly found. Often, the areas containing these soil series are prone to flooding (U. S. Dept. of Agriculture, 1972).

Climate

The regional climate of the Ridge and Valley province in Tennessee is

directly influenced by the topography of the adjacent physiographic provinces. With the Cumberland Plateau & Mountains to the west and the Blue Ridge province to the east, precipitation amounts are significantly less for the Ridge and Valley. As prevailing weather patterns move storms from west to east across the state, moist air is pushed up and over the plateau where it condenses more readily than in the lower elevations of the Ridge and Valley. To the east, the tall mountains of the Blue Ridge also impede the progress of moist air, producing greater precipitation for that province as well. As a result, many weather systems pass across the Ridge and Valley province leaving lesser amounts of precipitation (Dickson, 1960).

Rainfall for the entire Clinch-Powell Valley averaged about 49 inches per year over the 1,766 square mile area of the watershed from 1935 to 1961. Annual precipitation for the UCR was estimated to be somewhat less during this period at 45.31 inches (Table 2). This estimate was based upon measurements taken at Tazewell, Tennessee located about 10 miles west of the study site. The wettest year during the 27 year interval of measurements at Tazewell was 1951 with over 62 inches of rainfall. The driest year was 1941 with approximately 35 inches. On average, April was the rainiest month at 5.27 inches. October was the driest month with only 2.39 inches. Average monthly runoff measurements were also at a maximum and minimum for the months of April and October at 3.30 inches and 0.44 inches respectively (Clinch-Powell River Valley Association, 1963).

Temperature data at Tazewell from 1935 to 1961 indicated an average annual air temperature of 58 degrees Fahrenheit. The two coldest months on average for this period were December and January at 40 degrees Fahrenheit. July and August were the hottest months on average at 78 and 77 degrees Fahrenheit, respectively (Clinch-Powell River Valley Association, 1963).

Water temperature data for the Clinch River above Tazewell closely

Table 2: Precipitation, Runoff, and Temperature Data For Tazewell, Tennessee (1935-1961)

Month	Average Precipitation (in.)	Average Runoff (in.)*	Average Water Temp. (°F)*	Average Air Temp. (°F)
January	4.24	2.69	41	40
February	4.06	3.02	42	42
March	4.50	3.30	48	48
April	5.27	2.27	58	58
May	4.19	1.73	72	67
June	4.04	0.93	80	75
July	3.50	0.84	82	78
August	3.86	0.76	81	77
September	2.82	0.38	76	71
October	2.39	0.44	64	60
November	2.96	0.76	51	47
December	3.48	1.76	43	40
Total	45.31	18.88	61	58

*(Average Runoff and Water Temperature Values are for the Clinch River above Tazewell.)

followed that of the air temperatures during this period. The average annual water temperature was 61 degrees Fahrenheit, three degrees higher than the recorded air temperature average. Similarly, January and July had the highest and lowest monthly water temperature averages at 41 and 80 degrees Fahrenheit. All other monthly water temperature averages were either greater or equal to their corresponding monthly air temperature averages. This trend suggests that the river has some capacity to buffer itself against changes in air temperature (Clinch-Powell River Valley Association, 1963).

Precipitation and temperature data were also collected at Tazewell from 1966 to 1993 (Table 3). Average annual precipitation during this 28 year interval was 50.94 inches, almost six inches greater than the average annual precipitation for the preceding 27 year interval. December had the highest amount of precipitation on average for this period at 5.15 inches. October had the lowest average precipitation at 3.21 inches (EarthInfo, 1994).

The average annual maximum air temperature from 1966 to 1993 was 66.8 degrees Fahrenheit. Similarly, the average annual minimum air temperature was 41.0 degrees Fahrenheit. July and January were also the hottest and coldest months on average during this period.

The two year period of this study was fairly typical in regard to climatic averages. For 1994, precipitation measurements were below par across the Ridge and Valley (approximately 1.5 inches). Air temperature measurements for the same year were slightly above the annual average of 58 degrees Fahrenheit from 1935 to 1961. For 1995, precipitation and temperature measurements varied only marginally from their long-term averages (U. S. Dept. of Commerce, 1994; 1995).

Vegetation

The vegetation of the Ridge and Valley province in Tennessee has been

Table 3: Precipitation and Temperature Data For Tazewell, Tennessee (1966-1993)

Month	Average Precipitation (in.)	Average Maximum Air Temp. (°F)	Average Minimum Air Temp. (°F)
January	4.49	43.7	21.2
February	4.13	48.0	22.3
March	4.91	58.1	30.6
April	4.01	68.1	38.6
May	4.99	75.1	48.1
June	3.85	82.5	56.7
July	4.68	86.0	61.8
August	4.07	84.8	61.0
September	3.43	79.2	53.8
October	3.21	68.8	39.8
November	4.20	57.6	31.1
December	5.15	47.8	24.5
Total	50.94	66.8	41.0

classified by a number of botanists. Weaver and Clements (1938) placed the region within the Oak-Chestnut Association. Braun (1950) also mapped the area as part of the Oak-Chestnut Forest Region, with the vegetation south of the Hiwassee River being classified as part of the Oak-Pine Forest Region. With the loss of chestnut, Küchler (1964) provided a more contemporary classification scheme with placement of the entire Great Valley in the Appalachian Oak Forest.

American chestnut (*Castanea dentata*) played an important role in the forests of the Ridge and Valley. The disappearance of this tree from the canopy initiated a series of changes in forest composition that continue today (Martin, 1989). Several researchers have studied the effects on vegetation with the loss of chestnut. Wolfe (1956), Hardaway (1962), Thor and Summers (1971), and Skeen (1973) all concluded that an increase in various species of pines, red maple (*Acer rubrum*), and black gum (*Nyssa sylvatica*) has occurred. West (1970) claimed more of a replacement by oaks, hickories, red maple, and tulip poplar (*Liriodendron tulipifera*). Other researchers, Martin (1978) and Shugart and West (1977), also noted an increase in the number of oak species, primarily black oak (*Quercus velutina*), chestnut oak (*Quercus montana* [*Q. prinus*]), and white oak (*Quercus alba*). Martin (1978, 1989) placed particular emphasis upon the rise of white oak as a replacement species.

White oak forests are the most widespread in the Great Valley. By one estimate, forty percent of old-growth forests in the central valley were found to be dominated by white oak. The species is also considered a primary constituent of successional forests, and is found in all but the most extreme habitat types (Martin, 1989). Co-dominants and major associates vary considerably among white oak communities. Martin (1971) suggested a White Oak Complex with 25 different variants, many of which are widespread throughout the Ridge and Valley province.

Braun (1950) also recognized the importance of white oak as a unifying species in the Great Valley. She noted that pure stands of white oak were rarely present, but the species was dominant or co-dominant in numerous communities. As well, white oak was found to dominate in all size classes. In other parts of the Ridge and Valley province, Braun noticed that white oak dominated in the Oak-Hickory and Oak-Pine regions, and was commonly present in the Mixed Mesophytic Forest region.

While white oak forests occupy the majority of the landscape in the Great Valley, chestnut oak forests dominate many upland areas. These habitats are located along the drier, middle to upper slopes of prominent ridges and lesser slopes with southerly exposures. In the central part of the valley, chestnut oak communities are often found on ridges associated with the Rome Formation and on lower ridges underlain by dolomitic limestone from the Knox Group (Martin, 1971; Martin and DeSelm, 1976). Important constituents in these communities are black oak, tulip poplar, white oak, and shortleaf pine (*Pinus echinata*). Hickories (*Carya spp.*) are also important members, but their contribution varies among ridge systems (Crownover, 1983). Herbaceous species in the chestnut oak forest are typically low in number, with the understory often dominated by ericaceous shrubs (Condley, 1984).

The Mixed Mesophytic Forest (*sensu* Braun 1950) is restricted in the Great Valley to mesic slopes and protected coves often oriented to the north and east. Martin and DeSelm (1976) found they were also associated with knobs underlain by calcareous shale, particularly in the eastern valley. The dominant tree species in this forest type is beech (*Fagus grandifolia*). Major associates include tulip poplar, northern red oak (*Quercus rubra*), sugar maple (*Acer saccharum*), basswood (*Tilia heterophylla*), and buckeye (*Aesculus octandra*). Other species include hemlock (*Tsuga canadensis*), white pine (*Pinus strobus*), and various magnolias (*Magnolia spp.*) in the more

protected mesic areas (Martin, 1989). It is the Mixed Mesophytic Forest in the Ridge and Valley that most often contains the undisturbed herb layers where many rare plants are found (DeSelm, 1984). It is likely these forests were more widespread on the lower slopes and terraces of many tributaries that are now impounded (Martin, 1989).

Successional forests also comprise a large portion of the landscape in the Great Valley. With few exceptions, all the forests of the area have been logged at least once and could be considered to be in a "successional" state. However, the successional forests referred to here have arisen as well-defined communities from abandoned pastures, croplands, and forests that were heavily logged. Many of these communities have existed for decades and may be very long-lived (Martin, 1989).

Pine communities form one of the more notable successional forest types in the valley. Normally, pines can be found on the dry, exposed ridges of south and west-facing slopes. However, successional pine communities may be found on upper slopes where heavy logging has occurred and on lower slopes with abandoned fields. The two primary species of this community type are Virginia pine (*Pinus virginiana*) and shortleaf pine. Other successional pine species are white pine and loblolly pine (*Pinus taeda*). Though white pine can occur naturally in small stands on lower mesic slopes and draws, it can also be found along with loblolly pine on plantations across the valley (Martin, 1971).

Another major successional forest type in the valley is dominated by cedar (*Juniperus virginiana*). Often, entirely closed forests of this species can be found, especially on areas of limestone and dolomitic limestone (Tennessee Valley Authority, 1941). Cedars are commonly considered as indicators of shallow soils, but they are not limited to such sites. The species frequently invades old fields and pastures soon after more invasive vine and shrub

species have established themselves (Smith, 1968). Cedar communities can persist for very long periods of time with numerous stands of different age, composition, and density present. Eventually, later stages of development begin with pines, tulip poplar, and other hardwoods integrating with cedar (Martin, 1989).

Tulip poplar communities also form a major successional forest type in the Great Valley. This tree species is a permanent fixture in a variety of forest types, especially the Mixed Mesophytic Forest (Braun, 1950). However, Martin (1971) recognized a Tulip Poplar Complex composed of old-growth tulip poplar communities in the central part of the valley. These communities are found on mesic draws and the lower to middle slopes of upland areas. Though tulip poplar is shade intolerant, it can establish itself quite readily in cleared patches of forest. Larger forest clearings often develop into communities that can persist for centuries (Martin, 1989).

Restricted and relic communities make up the remainder of the landscape of the Great Valley in Tennessee. In recent years, many of these communities have become endangered due to human activities such as logging, farming, and dam building. Others are limited simply due to low frequency of occurrence. Nevertheless, these communities are unique and form an integral part of the forest ecosystem.

Riparian forests located along the flood plains and lower terraces of major streams have become one of the more endangered community types in the valley. The soils associated with these areas are very rich and have long been exploited for agriculture. As well, impoundments built by the Tennessee Valley Authority have permanently flooded the forest communities of numerous streams. Today, smaller tracts of these riparian forests are present, but their vegetation still reflects the basic composition and structure of larger habitats (Martin, 1989). Typical dominants of these forests are sycamore

(*Platanus occidentalis*), green ash (*Fraxinus pennsylvanica*), black willow (*Salix nigra*), red maple, river birch (*Betula nigra*), and various elms (*Ulmus spp.*). Many communities also contain cane (*Arundinaria gigantea*) as a dominant understory species. Before the vast destruction of many flood plain areas, cane was once present in large communities known as "cane brakes". However, only small remnants of these communities exist today (DeSelm, 1984).

River bluffs also provide habitat for some unique forest communities in the Great Valley. White oak and Mixed Mesophytic Forests typically dominate on the steep, rocky terrain of these areas. However, drier portions of the bluffs contain a distinct forest type dominated by either southern red oak (*Quercus falcata*) or shumard oak (*Quercus shumardii*) and chinquapin oak (*Quercus muhlenbergii*) (Martin, 1989). On more mesic sites, hemlock can be found in large stands, particularly on low slopes along river bends oriented to the north and northeast (DeSelm, 1984). Northern white cedar (*Thuja occidentalis*) communities are also present in these areas and along rocky cliffs. It is believed this species is a relic from the Pleistocene that became trapped in small pockets of suitable habitat with the retreat of the glaciers (Walker, 1987).

Finally, other restricted communities occur on valley uplands where rock outcrop and shallow soils create natural forest openings. These openings, called glades or barrens, are small and are typically associated with limestone from the Chickamauga Group (DeSelm, 1993). Various herbs dominate these rock outcrop areas with cedar, pine, and shrub species on the periphery. Deeper soil areas support forests of mixed oaks, ash (*Fraxinus spp.*), cedar, and pine (Martin, 1989). Though infrequent, other forest openings such as bogs and marshes sometimes occur in place of glade and barren areas. Often, these communities contain floristically significant species that occur nowhere else in the valley (DeSelm, 1985).

Wildlife

Though the majority of the landscape in the UCR consists of steep ridgeland, many habitat types are present. From mature forests to open fields and the river itself, a large array of terrestrial, aquatic, and semi-aquatic habitats exist that support a diversity of species.

Terrestrial habitats contain vertebrate species common throughout much of the southeastern United States. In forests and fields, small mammals such as the gray squirrel, raccoon, chipmunk, cottontail rabbit, striped skunk, and groundhog are present. Other small animals such as rats, mice, shrews, and moles are also abundant, but are not as evident. The largest animal spotted during the course of this study was a whitetail deer.

Other vertebrate species found within the study area include reptiles, amphibians, and birds. Snakes in particular are quite abundant on the rocky talus slopes along the river. Species personally encountered include the copperhead, black rat snake, and northern water snake. Other venomous and non-venomous snakes are likely present, including the timber rattlesnake. Several lizards and turtles were also sighted in the study area, but were not identified. Similarly, many amphibians such as frogs, salamanders, and newts were seen along river banks and the damper portions of mesic woodlands.

Avian fauna include a large number of songbirds, raptors, and water fowl. More prominent species encountered include the great blue heron, turkey vulture, wood duck, pileated woodpecker, and the red-tailed hawk. Game species such as ruffed grouse, quail, and wild turkey are known from nearby hunting preserves, but were not observed.

The river provides habitat to perhaps the greatest diversity of animals in the study area, as innumerable aquatic insects, fish, and molluscs can be found. Combined, the entire Clinch-Powell watershed contains over 125 species of fish (Tennessee Valley Authority, 1996). Norris Reservoir, which

extends into the lower portion of the study site, is stocked with 11 species of gamefish. These species include walleye, white crappie, sauger, largemouth bass, smallmouth bass, rock bass, channel catfish, carp, suckers, bluegill, and trout (Clinch-Powell River Valley Association, 1963). It is not known by the author how many of these species are found within the study site, nor the extent of their range.

In addition, the Clinch-Powell watershed is home to 89 aquatic species listed as threatened or endangered by state and federal authorities (Tennessee Valley Authority, 1996). Many of these organisms are small species of fish such as darters, chub, and madtoms. However, freshwater mussels comprise the majority of threatened and endangered species found. The Clinch River has perhaps the greatest diversity of freshwater mussels in the world. According to the Nature Conservancy (1994b), one ten-mile stretch of the Clinch near Kyles Ford, Tennessee (not within the study area) contains more species of freshwater mussels than the entire European continent. It has not been determined how many mussel species inhabit the study area. Table 4 provides a listing of rare and endangered animal species known from Claiborne, Grainger, and Hancock Counties.

Table 4: Rare and Endangered Animal Species of
Claiborne, Grainger, and Hancock Counties, Tennessee

Scientific Name	Common Name
Invertebrates:	
Cumberlandia monodonta	Spectaclecase
Cyprogenia irrorata	Eastern fanshell pearlymussel
Dromus dromas	Dromedary pearlymussel
Epioblasma brevidens	Cumberlandian combshell
Epioblasma capsaeformis	Oyster mussel
Epioblasma florentina florentina	Yellow-blossom
Epioblasma torulosa gubernaculum	Green-blossom
Epioblasma triquetra	Snuffbox
Epioblasma turgidula	Turgid-blossom
Fusconaia cuneolus	Fine-rayed pigtoe
Fusconaia edgariana	Shiny pigtoe
Hemistena lata	Cracking pearlymussel
Io fluvialis	Spiny riversnail
Lampsilis abrupta	Pink mucket
Lemiox rimosus	Birdwing pearlymussel
Lexingtonia dolabelloides	Slabside pearlymussel
Medionidus conradicus	Cumberland moccasinshell
Plethobasus cicatricosus	White wartyback
Pleurobema oviforme	Tennessee clubshell
Pleurobema plenum	Rough pigtoe
Pleurobema rubrum	Pyramid pigtoe
Ptychobranchus subtentum	Fluted kidneyshell
Quadrula cylindrica strigillata	Rough rabbitsfoot pearlymussel
Quadrula intermedia	Cumberland monkeyface
Quadrula sparsa	Appalachian monkeyface
Total: 25 species	
Vertebrates:	
Aegolius acadicus	Northern saw-whet owl
Ammocrypta clara	Western sand darter
Cnemidophorus sexlineatus	Six-lined racerunner
Cryptobranchus alleganiensis	Hellbender
Cyprinella monacha	Spotfin chub
Erimystax cahni	Slender chub
Etheostoma sagitta	Arrow darter
Etheostoma tippecanoe	Tippecanoe darter
Mustela nivalis	Least weasel
Myotis grisescens	Gray bat

Table 4 (cont'd.): Rare and Endangered Animal Species of Claiborne, Grainger, and Hancock Counties, Tennessee

Scientific Name	Common Name
Vertebrates (cont'd.):	
Myotis sodalis	Indiana bat
Neotoma floridana	Eastern woodrat
Notropis rubellus rubellus	Rosyface shiner
Noturus flavipinnis	Yellowfin madtom
Noturus stanauli	Pygmy madtom
Nycticorax nycticorax	Black-crowned night-heron
Percina aurantiaca	Tangerine darter
Percina macrocephala	Longhead darter
Phoxinus cumberlandensis	Blackside dace
Sorex cinereus	Common shrew
Sorex fumeus	Smoky shrew
Sorex longirostris	Southeastern shrew
Synaptomys cooperi	Southern bog lemming
Tyto alba	Common barn-owl
Total: 24 species	

(*Tennessee Department of Environment and Conservation, 1994)

CHAPTER III

HISTORY OF THE STUDY AREA

Quaternary Vegetation

Climate change over the past two million years, the Quaternary Period, has produced major shifts in North American forest composition. At least twenty glacial episodes have occurred during this period. However, geologic evidence in the vicinity of the Ridge and Valley province has been preserved for only the last three (Delcourt, P. and Delcourt, H., 1984). Generally, fossil remains from the last glacial event date from approximately 20,000 years ago in eastern North America. Many of these remains are in the form of pollen preserved within sedimentary deposits. Vegetation reconstructions based upon these pollen assemblages reflect some of the major climatic changes that have occurred, and help provide an understanding of the prehistoric flora of the region (Watts, 1980; Whitehead, 1973).

With the last full-glacial interval of the Pleistocene (20,000 to 16,500 years ago), glacial ice advanced southward across Pennsylvania to a maximum of about 41 degrees north latitude (Delcourt, P. and Delcourt, H., 1984). Tundra existed south of the ice front for at least 60 km and was comprised mostly of various grasses, ericaceous shrubs, and dwarf birch (*Betula glandulosa*) (Watts, 1979). Also, geomorphic evidence indicates that alpine tundra occurred at high elevations of the Appalachian Mountains as far south as the Great Smoky Mountains of Tennessee and North Carolina (Clark, 1968).

At lower elevations within the Ridge and Valley province, boreal forest was present, and was dominated by jack pine (*Pinus banksiana*) and spruce (*Picea spp.*). Studies of pollen and plant macrofossils from sites at Bob Black

Pond, Quicksand Pond, and Green Pond verified that these boreal forests occurred as far south as northern Georgia (Watts, 1970). Such evidence contradicted Braun's theory that forests in the southeastern United States had remained unchanged for several million years (Braun, 1955).

Temperate forests appeared at the southernmost limit of the Ridge and Valley near Birmingham, Alabama (Delcourt and Delcourt, 1981). The ecotone there between the boreal and temperate forests consisted of a mixed conifer forest type that resembled the present day Northern Hardwoods Forest of the Great Lakes region. It is also believed that some temperate species survived north of the ecotone in protected pockets along major Gulf Coast river drainages (Delcourt, H. and Delcourt, P., 1984).

The late-glacial interval (16,500 to 12,500 years ago) was marked by the beginning of a minor climatic warming event. The event initiated the melting of glacial ice near its maximum extent in present day Pennsylvania, and caused the Laurentide Ice Sheet to retreat to the north (Dreimanis, 1977). Studies at two sites, Longswamp and Wigwam Creek Bog, show that tundra persisted near the glacial boundary as it retreated throughout the late-glacial interval (Watts, 1979; Sirkin, 1977). However, another site near the glacial boundary at Tannersville Bog contained evidence that boreal species such as aspen (*Populus tremuloides*), juniper (*Juniperus spp.*), alder (*Alnus crispa*), and spruce were beginning to invade the new terrain by 13,300 years ago (Watts, 1979).

Other studies also suggest that the boreal forest followed the retreat of the glaciers. At Crider's Pond in southern Pennsylvania, fossil evidence revealed a successional state from tundra to boreal plants. Pollen from species such as spruce, balsam fir (*Abies balsamea*), alder, birch (*Betula papyrifera*), and aspen were dated at approximately 15,000 years ago. In central Pennsylvania at Panther Run, boreal forests of spruce, jack pine, alder, and

birch were established by 12,600 years ago (Watts, 1979).

Further south, the boreal forest persisted through much of the late-glacial interval. However, elements of the temperate forest slowly began to displace boreal species. In northwestern Georgia, fossil evidence from Quicksand Pond showed that a major increase in oak (*Quercus spp.*) corresponded with a significant decline in jack pine populations at 13,500 years ago (Watts, 1970).

The early Holocene interval (12,500 to 8,000 years ago) ushered in a further transition from late-glacial to interglacial conditions. However, this transition was not synchronous throughout eastern North America (Delcourt, P. and Delcourt, H., 1984). The extreme southern portion of the eastern United States experienced a major transition to interglacial vegetation by 12,500 years ago. However, areas closer to the original glacial maximum lingered with much of the glacial vegetation still intact 10,000 years ago. Variations in vegetational change during the early Holocene interval have been attributed to differences in regional climate, as well as the biological tolerances and survival strategies of individual species (Davis and Webb, 1975).

In the southern Ridge and Valley, fossil evidence at Cahaba Pond in Alabama provided evidence of regional vegetation during the early Holocene. Between 12,000 and 10,000 years ago, forest communities there were dominated by both mesic and hydric hardwood species. Common were species such as beech (*Fagus grandifolia*), Atlantic white cedar (*Chamaecyparis thyoides*), hornbeam (*Ostrya/Carpinus*), ash (*Fraxinus spp.*), hickory (*Carya spp.*), oak, hemlock (*Tsuga canadensis*), eastern white pine (*Pinus strobus*), cucumber magnolia (*Magnolia acuminata*), and six species of maple (*Acer negundo, A. pensylvanicum, A. spicatum, A. rubrum, A. saccharum,* and *A. saccharinum*) (Delcourt *et al.*, 1983).

At approximately 10,000 years ago, the climate began to change from

being cool and moist to warm and dry. The warming resulted in the elimination of many cool-temperate species from the southern Ridge and Valley (Delcourt, P. and Delcourt, H., 1984). However, such species were able to survive farther north in the province and in the adjacent Blue Ridge and Cumberland Plateau provinces. In these areas, cool-temperate forests and coniferous forests displaced boreal forests all the way into southwestern Virginia (Delcourt and Delcourt, 1979).

During the mid-Holocene interval (8,000 to 4,000 years ago), the southern Ridge and Valley became much warmer and wetter with the Hypsithermal period. Hydric trees and shrubs such as sweetgum (*Liquidambar styraciflua*), black gum (*Nyssa sylvatica*), and buttonbush (*Cephalanthus occidentalis*) became established during this time. These species were found in the pollen record at Cahaba Pond in Alabama and at Quicksand and Bob Black Ponds in Georgia (Delcourt *et al.*, 1983; Watts, 1970). Fossil evidence from the two sites in Georgia also indicated that aquatic plants from the southern coastal plain had become established as disjuncts by the mid-Holocene (Watts, 1970).

Further north, the Ridge and Valley and other provinces were warm but not as wet as areas to the south. Forests were dominated by oak, hickory, and chestnut (*Castanea dentata*), and had spread as far as northern Pennsylvania by 5,000 years ago (Delcourt and Delcourt, 1981). At Anderson Pond in Middle Tennessee, the pollen record indicated a reduction in mesic hardwood species during this time. (Delcourt and Delcourt, 1979). Mesic species remained in the region throughout the mid-Holocene, but were restricted to steep slopes, ravines, and higher elevation areas (Delcourt, P. and Delcourt, H., 1984).

Also during the mid-Holocene interval, forest composition was significantly altered by a number of pathogen outbreaks. One of the most notable outbreaks of the time was a blight that struck hemlock and decreased its population significantly throughout eastern North America. It is estimated

that forests in the region took several thousand years to recover from the event (Davis, 1978).

The late-Holocene interval (4,000 years ago to present) proceeded under much the same climate as the mid-Holocene, as the strong influence of the Maritime Tropical Airmass continued over the southeastern United States (Delcourt, P. and Delcourt, H., 1984). Studies in the southern and central portions of the Ridge and Valley showed that species such as oak, hickory, and chestnut remained dominant components of the forest (Delcourt *et al.*, 1983; Watts, 1970). Likewise, this vegetation has remained stable and virtually unchanged by climate over the past 4,000 years (Watts, 1979).

Meanwhile, the northern portion of the Ridge and Valley, along with adjacent provinces, experienced a southerly shift in the cool, moist climatic zone of the north. This shift allowed populations of white pine, hemlock, and birch to expand southward into the Great Valley. Also, higher elevations in the Appalachian Mountains became dominated with spruce and fir. Overall, this climatic shift initiated the establishment of the boundary of the Northern Hardwoods Forest and the Appalachian Oak-Chestnut Forest to its present day level (Delcourt, P. and Delcourt, H., 1984; Watts, 1979).

Native American Inhabitation

The first Paleoindians arrived about 12,000 years ago in eastern North America. However, evidence of impacts left by these early people on forest ecosystems is obscure. Recent excavations have documented evidence of forest clearance and cultivation along major river valleys of the Ridge and Valley province in East Tennessee through the last 10,000 years (Chapman *et al.*, 1982; Delcourt *et al.*, 1986).

It is believed that many types of deciduous forests covered the landscape of the Great Valley during this time. Oak and mixed mesophytic forests are

thought to have dominated uplands and drier terrace areas, while more hydric deciduous species occupied lower terraces and flood plains along rivers and streams (Martin, 1989).

Lowland areas were the first to be exploited by early native Americans. From the beginning of the Archaic Period (9,500 to 2,800 years ago), bottomland habitats served as seasonal settlements for many Indian groups. However, it was not until the Late Archaic Period (6,000 to 2,800 years ago) that cultivation of these bottomlands occurred. The first cultivated plant in the area is presumed to have been squash. Evidence of this cultigen introduced from Mexico has been dated in the lower Little Tennessee River Valley from approximately 4,400 years ago (Chapman *et al.*, 1982).

Widespread clearing of bottomland forests for cultivation and settlements continued into the Woodland Period (2,800 to 1,000 years ago). Permanent villages arose for the first time along river terraces in the Great Valley during this period (Chapman *et al.*, 1982). In Alabama, the pollen record indicated that maize was cultivated along mid-level stream terraces beginning about 2,000 years before present (Delcourt, P. and Delcourt, H., 1984).

By the Mississippian Period (1,000 to 300 years ago), native American culture was beginning to flourish in the Great Valley. Ceremonial mounds and palisaded villages were constructed in many areas. Villages started to depend less on gathered forest plants and more on cultivated plants as a food source. Excavated wood charcoal in the Little Tennessee River Valley from this period was mostly from successional species such as cedar, hop hornbeam (*Ostrya virginiana*), pine (*Pinus spp.*), and tulip poplar (Chapman *et al.*, 1982). Such evidence suggests that the majority of available wood sources were probably successional forests that developed from earlier periods of clearing and cultivation. By this time, many archaeological sites show that cultivated

fields and successional forests existed at least 1.5 km from the active flood plain (Chapman *et al.*, 1982).

During the historic Overhill Cherokee Period (300 to 130 years ago), beans, corn, and squash were widely grown and provided a major portion of the food consumed. By this period, native American culture had developed into well-organized tribes composed of multiple villages. Much of the southern Ridge and Valley was controlled by the Cherokee and Creek Indian tribes. Approximately 80 villages are known to have been established in the area by these two tribes alone. Other tribes such as the Yuchi and Kaskinampo maintained a limited presence in the region as well (Corlew, 1981; Delcourt *et al.*, 1986; DeSelm, 1993).

It was also during the Overhill Cherokee Period that the use of fire in the landscape became prevalent. Such a practice may have played an important role in the establishment of barrens in the southern Ridge and Valley. As well, the use of fire may have been partially responsible for the spread of disturbance species such as pine and cedar in the landscape (DeSelm, 1993).

European Colonization

By the time the first European hunters and trappers arrived in the vicinity of the Great Valley in the mid-1700's, pristine forests no longer completely blanketed the region. Instead, early explorers encountered a vegetational mosaic that had been manipulated by native Americans for several hundred years. Indian settlements and croplands were present on the flood plains and terraces of many rivers and streams. Open fields and forests in various stages of succession were also common throughout the landscape (Martin, 1989).

The Cherokee Indians claimed virtually all of the Great Valley as tribal

land during this time. Initial contacts with Europeans had mixed results, but the Cherokee eventually established good relations with English traders. France and England had long been territorial rivals for trade with the Indians of the region. However, with the onset of the French and Indian War, the Cherokee, unlike many tribes, sided with England. By 1757, a British military garrison called Fort Loudon was established near present-day Knoxville with permission of the Cherokee (Corlew, 1981).

Nevertheless, good relations between the English and the Cherokee were short lived and conflict ensued. In 1759, the first Cherokee War led to a number of skirmishes, including the besiege and destruction of Fort Loudon. However, victories by the English soon pressed the Cherokee to sue for peace in 1761. With the Proclamation of 1763, the English colonial government barred settlers from crossing the Appalachian Mountains, partly to ease tensions with the Indians (Corlew, 1981).

The first Euro-American settlers moved into the upper portions of the Great Valley of East Tennessee around 1769. Known as the Wataugans, these early pioneers defied the territorial government in North Carolina and crossed the mountains to begin new settlements. There were several reasons for this early exodus of settlers. Many of the Wataugans were of Scotch-Irish and German descent and had historically been at odds with the English majority. As well, many people in western North Carolina believed they were not well represented by government in comparison to citizens in the eastern half of the territory. Therefore, many wished to move beyond the influence of the territorial government. Also, an influx of new immigrants into the western half of North Carolina pressured many people to travel farther in the pursuit of good land (Corlew, 1981).

By 1770, hundreds of people had moved into areas of upper East Tennessee. The Wataugans found that relations with the Cherokee had

improved somewhat, as the Cherokee seemed more than willing to cede land in exchange for trade. At least four different settlements were founded in the region by this time (Corlew, 1981).

The Wataugans were very independent, and resisted attempts by the territorial governments of Virginia and North Carolina in 1771 to declare them as squatters on Indian land. An appeal to the Cherokee resolved the situation and the settlers were allowed to remain. Being alone on the boundaries of civilization, the Wataugans later established their own body of government known as the "Watauga Association" (Corlew, 1981).

By 1774, growing unrest in the colonies over British rule resulted in the start of the American Revolution. The Wataugans supported the revolution but soon found themselves in a desperate situation. By 1776, the British had managed to incite the Cherokee and other tribes to attack frontier settlements. Requests for assistance from the colonial government were largely ignored. Nevertheless, the Wataugans remained and built several forts to defend their claims on the region. Though the settlers sustained heavy losses, they managed to fend off Indian attacks until the colonial government relented and sent reinforcements (Corlew, 1981).

With the end of the Revolutionary War in 1783, new state governments were urged to cede their frontier territorial rights to the federal government in order to raise money for the treasury. North Carolina initially agreed but later refused. Meanwhile, political disagreements delayed the statehood of North Carolina. In limbo, Wataugans in present day Greene, Sullivan, and Washington Counties, Tennessee decided to establish their own state of Franklin in 1784 (Corlew, 1981).

Indian hostilities continued with the Wataugans through this time. However, by 1785 the Treaty of Dumplin Creek allowed settlers to move into the heart of the Great Valley from south of the French Broad River to the Little

Tennessee River. The state of Franklin was short lived after this and came to an end in 1786. Better relations quickly ensued with the government of North Carolina, which itself became a state in 1789 (Corlew, 1981).

In 1790, a second cession law was offered to the states by the federal government. North Carolina agreed to give up the territory, and the area officially became known as United States Territory South of the Ohio River. With an official status, more settlers poured into the region. The arrival of thousands of pioneers essentially led to the end of Cherokee culture in East Tennessee (Corlew, 1981).

Throughout the 18th and 19th centuries, settlers cleared and extensively farmed the flood plains, terraces, and lower ridges of the Great Valley. Upland areas were logged to build homes and provide other lumber. During this time, grazing in woodlands was a common practice (Martin, 1989). Also, fire was often used in clearing forests for pasture. In fact, such burning of woodlands continued in Tennessee until the 1930's (DeSelm, 1993).

Recent Land Use

The trend of clearing forests for logging, farming, and development has continued through the 20th century. As a result, many of the floodplains, terraces, and lower ridges of the Great Valley have been completely cleared and developed. Despite such intense activity, it is estimated that fifty percent of the Ridge and Valley in Tennessee is still forested (Clinch-Powell River Valley Association, 1963; Martin, 1989). Most of these forest lands are in dissected upland areas. Though many forests are early-successional, others are closed with different age classes and distinct plant communities present (Martin, 1989).

In recent years, the amount of forest land has increased slightly in the Great Valley. This increase is due largely to the number of idle and abandoned

farms that have been allowed to revert to forest. However, these gains may soon be offset by the rapid urban and industrial development that has prevailed throughout the state (Martin, 1989).

Regardless, modern human influences have already profoundly changed the vegetation of the region. This change has even been reflected in the pollen record from the past two to three hundred years. At several sites, pollen sequences have documented declines in pollen from many tree species. The record has also revealed an increase in pollen from early invasive species such as ragweed (*Ambrosia spp.*) (Delcourt, P. and Delcourt, H., 1984). Such evidence clearly demonstrates how quickly modifications to the environment can result in dynamic changes in vegetation.

CHAPTER IV

METHODS

An inventory of the flora of the upper Clinch River was conducted over a two year period in 1994 and 1995. Plant collections were made approximately every two weeks from March through October of each year. However, weekly trips were occasionally required during periods of more prolific flowering. Travel time to the study area was about one hour each way, which permitted trips to last virtually an entire day. Plant specimens were collected typically from early morning until late afternoon. A total of 36 excursions were made throughout the course of this study.

The first growing season of 1994 was largely devoted to widespread gathering of specimens across the study area. The second growing season of 1995 allowed further investigation of habitats previously found to be unique or high in species richness. Similarly, areas more accessible by roads or trails were surveyed first. Remote areas of the study site were investigated later in each season as soon as the river allowed travel by canoe.

An effort was made to cover as much territory as possible within the boundaries of the study site. However, the immensity of the area did not allow complete investigation of every segment of the river. After close examination of the quadrangle maps, the study area was segregated into sections of similar exposure and topographic relief. Field investigations were then conducted to prioritize sites within each section according to species richness and habitat type. Overall, plant collections focused on the portions of the river listed previously in Figure 3.

Specimens gathered in the field were documented as to their location

relative to a particular road, river bend, or other noted landmark. Additional recorded information included habitat type, topography, exposure, and associated taxa if pertinent. Attempts were made to obtain multiple collections of species from different areas.

Plants collected in the field were pressed and dried as soon as possible according to standard procedures at the University of Tennessee Herbarium (TENN). Taxa that were likely to have important features destroyed were identified prior to being pressed. All other taxa were identified upon completion of the drying process.

Numerous sources aided in the identification of specimens at the herbarium. However, the following field manuals were used primarily to key plants: Gleason (1952), Gleason and Cronquist (1991), and Wofford (1989). All nomenclature followed that of Wofford and Kral (1993). Voucher specimens will be mounted with labels containing collection information and put on deposit at TENN.

Rare plants known to occur within the region of the study site were researched prior to collecting. When found, both federal and state listed species were documented in the field with a photograph. Status reports were prepared for each rare plant according to a format similar to that used by the Nature Conservancy. These reports include information on populations, locations, number of individuals, associated taxa, and potential threats to survival (Appendix B).

Furthermore, a checklist for all collected taxa was compiled in order to provide more detail on the flora of the study site (Appendix A). The checklist was arranged in alphabetical order by family and includes the scientific name of each taxon, common name(s), relative abundance within the study area, habitat(s), field collection number(s), and county name(s). Also, information on important synonomy, the native range of exotic species, and notation on

county records were given for appropriate taxa.

Finally, distribution analysis of each member of the flora was conducted in accordance with the methods of Oxendine (1971) and Clements (1987). Using county dot maps and Gray's Manual of Botany, 8th edition (Fernald, 1950), the range characteristics of each taxon was categorized as being intraneous, extraneous, interior, or introduced. Taxa were further divided into species with northern or southern affinities based upon their primary center of distribution. Statistics and a summary of the results of these distributions were provided.

CHAPTER V

RESULTS

Summary of the Upper Clinch River Flora

A total of 867 collections of vascular plants were made in the upper Clinch River study area. From these collections, 526 species and lesser taxa in 338 genera and 108 families were identified (Table 5). Three hundred and twenty-six species were determined to be county records after reviewing county dot maps at TENN and the Atlas of Tennessee Vascular Plants, Volumes 1 & 2 (Chester *et al.*, 1993 & 1997). These first time collections represent approximately 62 percent of the total flora documented in the UCR.

Forty-four taxa were records in multiple counties. Hancock County had the most county records with 179. Grainger County and Claiborne County followed with 114 and 77 records, respectively. Of total collections made for this study, almost half (43%) were collected in the region for the first time.

The largest family in the flora was Asteraceae with 77 species and lesser taxa in 39 genera. Poaceae was the second largest family with 35 species and lesser taxa in 26 genera. The genus with the most members was *Carex* with 13 species.

Angiosperms were by far the largest taxonomic group represented, comprising almost 95 percent of the flora. Dicots alone constituted 77 percent of the total flora. Overall, the ratio of monocots to dicots was slightly less than 1 to 4.

A more detailed account of the upper Clinch River flora is given in the form of an annotated checklist in Appendix A.

Table 5: Floristic Summary of the Upper Clinch River Study Area

Taxonomic Group	Number of Families	Number of Genera	Number of Species and Lesser Taxa
Pteridophytes	9	16	22
Gymnosperms	2	4	5
Angiosperms: Monocots/Dicots	16/81	57/261	92/406
Totals:	108	338	526

Plant Habitats and Communities

Descriptions of the following habitats and communities were taken in part from Martin (1989). However, based upon observation and the general impressions of the author, certain portions of these descriptions were ammended. No attempt was made to measure or quantify habitats. Furthermore, no attempt was made to determine exact community composition through plots or other statistical methods of sampling. An outline of all habitats and communities can be seen in Table 6.

Natural Habitats

The natural habitats described here are considered to be present in areas that have not been significantly altered by recent human activity. Six principal natural habitats can be encountered within the boundaries of the study site: Ridge & Knob Woodlands, Rock Outcrops, River Bluffs, Terraces, Flood Plains, and Aquatic Zones. As well, each of these habitats may be comprised of several distinct forest and community types.

Ridge & Knob Woodlands

Typically, the Ridge & Knob Woodlands habitat consists of xeric, open forests that dominate from high ridge tops and knobs down to mid-level terraces or often to the river itself. Forests within this upland habitat are influenced by a number of environmental factors. Foremost among these factors is elevation, which plays a primary role in the segregation of communities. Other key factors include exposure, slope aspect, geology, and soils. Three distinct forests comprise this habitat type: Chestnut Oak Forests, White Oak - Oak Forests, and Mixed Mesophytic Forests.

The Chestnut Oak Forest occurs primarily on upper portions of the highest ridges and knobs of the study area. Occasionally, it may extend down to the middle slopes of high ridges if the appropriate environmental

Table 6: Plant Habitats and Communities
of the Upper Clinch River Study Area

I. Natural Habitats
- A. Ridge & Knob Woodlands
  1. Chestnut Oak Forests
  2. White Oak - Oak Forests
  3. Mixed Mesophytic Forests
- B. Rock Outcrops
- C. River Bluffs
  1. Oak Bluff Forests
  2. Mixed Mesophytic Forests
     a. Hemlock Communities
     b. Northern White Cedar
- D. Terraces
- E. Floodplains
  1. Sycamore - Ash - Elm Riparian Forests
  2. Island and Gravel Bar Communities
- F. Aquatic Zones

II. Ruderal Habitats
- A. Roads and Trails
- B. Pastures and Croplands

(*Table adapted from Martin, 1989)

conditions exist. Also, it can be found on a few lesser ridges that are very dry and exposed. Chestnut Oak Forests are somewhat limited in size and number due to the fact that few exceedingly elevated ridges are located within the boundaries of the study area.

As the name implies, the dominant tree of this forest type is chestnut oak (*Quercus montana*). However, only in the highest reaches of the study area does this species exist in relatively large stands. More frequently chestnut oak is encountered as a dominant in upland areas with other oak species such as white oak (*Q. alba*) and southern red oak (*Q. falcata*). Occasionally, hickories such as mockernut hickory (*Carya tomentosa*) and pignut hickory (*C. glabra*) are present with chestnut oak along mid to upper level slopes. Overall, hickories do not maintain a strong presence with chestnut oak in the study area. Also, on some dry, mid-level slopes, shortleaf pine (*Pinus echinata*) can occur in mixed stands.

Understory taxa are few in the Chestnut Oak Forest, which is largely dominated by ericaceous shrubs. Species such as lowbush blueberry (*Vaccinium pallidum*) and deerberry (*Vaccinium stamineum*) are often encountered. Likewise, herbaceous plants are very infrequent. Spotted wintergreen (*Chimaphila maculata*) and lycopodiums such as ground pine (*Lycopodium obscurum*) and running-pine (*Diphasiastrum digitatum*) are the primary taxa, but they are not abundant in any location.

White Oak - Oak Forests are widespread and generally occur along the middle to lower slopes of high ridges. Occasionally, this forest type extends to the top of lower ridges. As a single tree, white oak (*Quercus alba*) is perhaps the most prevalent species encountered in the study area. It has tremendous capacity to inhabit a broad spectrum of landforms. White oak occupies almost every environment except wet areas near the banks of the river and the very driest ridge tops.

There is considerable variation in the composition of other oak species found with white oak. For mid to upper slope areas, southern red oak (*Quercus falcata*) and chinquapin oak (*Q. muhlenbergii*) can be found as co-dominants. Upland White Oak - Oak Forests are relatively dry and open, though not as much as the Chestnut Oak Forest. Other arboreal taxa include sourwood (*Oxydendrum arboreum*), pignut hickory (*Carya glabra*), mockernut hickory (*C. tomentosa*), and bitternut hickory (*C. cordiformis*).

Understory taxa consist mostly of juvenile members of the canopy, Allegheny chinquapin (*Castanea pumila*), highbush blueberry (*Vaccinium corymbosum*), and serviceberry (*Amelanchier laevis*). Herbaceous species are few and are similar to those found in the Chestnut Oak Forest. However, species such as hawkweed (*Hieracium gronovii*), pussy-toes (*Antennaria plantaginifolia*), white thoroughwort (*Eupatorium album* var. *vaseyi*), and goldenrod (*Solidago nemoralis*) are occasional.

Lower slope areas contain a mix of white oak, northern red oak (*Quercus rubra*), and Shumard oak (*Q. shumardii*). Other canopy members are shagbark hickory (*Carya ovata*), sour gum (*Nyssa sylvatica*), and hop hornbeam (*Ostrya virginiana*). Tulip poplar (*Liriodendron tulipifera*) is also present, especially in areas where logging has occurred. Generally, these forests are rich and become more diverse in downslope areas before blending into upper reaches of the Mixed Mesophytic Forest. For some aspects, lower slope White Oak - Oak Forests extend all the way to the river.

Members of this understory include flowering dogwood (*Cornus florida*), root sprouts of American chestnut (*Castanea dentata*), redbud (*Cercis canadensis*), witch hazel (*Hamamelis virginiana*), strawberry bush (*Euonymus americanus*), maple leaf viburnum (*Viburnum acerifolium*), and bladdernut (*Staphylea trifolia*). Common herbaceous species are wild ginger (*Hexastylis arifolia* var. *ruthii*), liverleaf (*Hepatica acutiloba*), Christmas fern

(*Polystichum acrostichoides*), and wild yam (*Dioscorea villosa*).

The Mixed Mesophytic Forest occurs on low slopes and mesic draws along the river. Generally, it is limited to wetter portions of the study area on slopes facing north or northeast. However, extensive mixed mesophytic forests can be found in protected bends of the river with other orientations. A slightly different version of this forest type also appears on talus slopes associated with certain river bluffs. It will be discussed in more detail with the section describing the River Bluffs habitat.

Mixed mesophytic forests are not dominated by any single tree species. Instead a true mix of arboreal taxa share the upper canopy. Important species are beech (*Fagus grandifolia*), sugar maple (*Acer saccharum*), buckeye (*Aesculus flava*), hemlock (*Tsuga canadensis*), basswood (*Tilia heterophylla*), tulip poplar (*Liriodendron tulipifera*), and cucumber magnolia (*Magnolia acuminata*). Other species include northern red oak (*Quercus rubra*), ironwood (*Carpinus caroliniana*), black walnut (*Juglans nigra*), white ash (*Fraxinus americana*), red maple (*Acer rubrum*), bigleaf magnolia (*Magnolia macrophylla*), blue ash (*Fraxinus quadrangulata*), hackberry (*Celtis occidentalis*), American elm (*Ulmus americana*), red mulberry (*Morus rubra*), and yellow birch (*Betula alleghaniensis*).

Understory taxa in the Mixed Mesophytic Forest can be quite diverse as well. Commonly encountered species are pawpaw (*Asimina triloba*), hydrangea (*Hydrangea arborescens*), spicebush (*Lindera benzoin*), bladdernut (*Staphylea trifolia*), and boxelder (*Acer negundo*). Other occasional understory taxa include Carolina buckthorn (*Rhamnus caroliniana*) and leatherwood (*Dirca palustris*). Numerous viny species are also present such as poison ivy (*Toxicodendron radicans*), cross vine (*Bignonia capreolata*), Virginia creeper (*Parthenocissus quinquefolia*), grape vine (*Vitis spp.*), Dutchman's pipe (*Aristolochia macrophylla*), pepper vine (*Ampelopsis*

cordata), virgin's bower (*Clematis virginiana*), and greenbrier (*Smilax spp.*).

The Mixed Mesophytic Forest contains the richest assemblage of herbaceous taxa in the study area. Beginning in early spring, a profusion of flowering species blanket the ground. Common to frequent plants include: trillium (*Trillium grandiflorum, T. luteum, T. erectum*), longspur violet (*Viola rostrata*), Canada violet (*Viola canadensis*), toothwort (*Dentaria heterophylla, D. laciniata*), bloodroot (*Sanguinaria canadensis*), wild ginger (*Asarum canadense*), spring beauty (*Claytonia caroliniana, C. virginica*), liverleaf (*Hepatica acutiloba, H. americana*), twinleaf (*Jeffersonia diphylla*), Jack-in-the-pulpit (*Arisaema triphyllum*), squirrel corn (*Dicentra canadensis*), Dutchman's breeches (*Dicentra cucullaria*), Devil's bit (*Chamaelirium luteum*), phacelia (*Phacelia bipinnatifida*), wild geranium (*Geranium maculatum*), phlox (*Phlox divaricata, P. ovata*), rue anemone (*Thalictrum thalictroides*), bishop's cap (*Mitella diphylla*), foam flower (*Tiarella cordifolia*), trout lily (*Erythronium americanum*), wood sorrel (*Oxalis spp.*), dwarf crested iris (*Iris cristata*), celandine poppy (*Stylophorum diphyllum*), May apple (*Podophyllum peltatum*), Solomon's seal (*Polygonatum biflorum, P. pubescens*), false Solomon's seal (*Smilacina racemosa*), and bellwort (*Uvularia grandiflora*). Other later species include: Indian pink (*Spigelia marilandica*), dwarf larkspur (*Delphinium tricorne*), black cohosh (*Cimicifuga racemosa*), blue cohosh (*Caulophyllum thalictroides*), alumroot (*Heuchera villosa*), yellow mandarin (*Disporum lanuginosum*), aster (*Aster divaricatus*), and numerous sedges (*Carex spp.*). Common fern species are walking fern (*Asplenium rhizophyllum*), northern maiden-hair fern (*Adiantum pedatum*), and marginal wood fern (*Dryopteris marginalis*).

Rock Outcrops

Along the upper slopes of some ridges in the study area, limestone

outcrops of the Chickamauga Group have created natural openings in the forest. These openings are the result of extreme environmental conditions caused by shallow soils and other harsh micro-climatic factors. While some large areas of rock outcrop have become exposed artificially due to pasturing of upper slopes, several naturally occurring sites exist. However, signs of man-made disturbance are present in varying degrees at every site. Often, it is difficult to assess whether a site is natural or man-made in areas where pasture has reverted back to forest. The size of rock outcrop areas also varies considerably. A couple of sites are an acre or more in size, but most are much smaller. Overall, rock outcrop areas do not comprise much territory of the study site.

Vegetation of the Rock Outcrops habitat is sparse. Primarily, tree species such as Virginia pine (*Pinus virginiana*) and eastern red cedar (*Juniperus virginiana*) surround the periphery of these localities. The central portions of the outcrops are treeless except in areas with sufficient soil depth. Frequently, woody species common to marginal or disturbed habitats are also found scattered with the pine and cedar. These taxa include honey locust (*Gleditsia triacanthos*), black locust (*Robinia pseudoacacia*), winged elm (*Ulmus alata*), sassafras (*Sassafras albidum*), and fragrant sumac (*Rhus aromatica*).

Herbaceous taxa are also few in rock outcrop habitats. Generally, various members of the Poaceae dominate most of the shallow soil areas. However, other herbaceous taxa include ebony spleenwort (*Asplenium platyneuron*), beggar's ticks (*Bidens bipinnata*), and several members of the mint family (*Calamintha nepeta, Mentha piperita, Prunella vulgaris*). A few species in the study area are found exclusively in this habitat type. They include blue waxweed (*Cuphea viscosissima*), bush clover (*Lespedeza procumbens*), dovesfoot cranebill (*Geranium columbinum*), panic grass

(*Panicum flexile*), and blunt-lobed cliff fern (*Woodsia obtusa*).

A number of species associated with wet areas were also encountered. Seeps and wet depressions were discovered at several rock outcrop sites and contained species such as: sedge (*Carex frankii, C. vulpinoidea*), bulrush (*Scirpus atrovirens, S. pendulus*), and umbrella sedge (*Cyperus strigosus*).

River Bluffs

The River Bluffs habitat occurs in limited areas along the river where steep slopes have eroded away leaving rocky cliffs. Generally, these precipices extend from water level of the river to varying heights up the slope. However, lesser slopes composed of fallen rock called talus exist at the bottom of some bluffs. These talus slopes are often developed enough to support large tracts of forest. At a few sites, the bluffs have eroded to the very top of the ridge. Several bluffs of one hundred and fifty feet or more exist in the study area, although, the majority of the cliffs are fifty feet or less in height.

Two distinct forest types can be found in the River Bluffs habitat. On top of many cliffs, the Oak Bluff Forest is present. Where talus slopes exist below, a unique version of the Mixed Mesophytic Forest can be found with large hemlock communities and northern white cedar (*Thuja occidentalis*).

The Oak Bluff Forest is composed of several species. Common dominants in this forest type are southern red oak (*Quercus falcata*) or shumard oak (*Q. shumardii*) and chinquapin oak (*Q. muhlenbergii*). Typically, Oak Bluff forests develop in association with either the White Oak or Mixed Mesophytic Forest depending on factors such as the height of the bluff, slope aspect, and exposure. On dry bluffs facing south or west, species such as chestnut oak (*Q. montana*) and eastern red cedar (*Juniperus virginiana*) are common associates. Often, eastern red cedar trees establish themselves in crevices in

the upper rock face and appear to grow directly from the side of the cliff. For mesic bluffs, associate species shift to those found in the Mixed Mesophytic Forest. Overall, most Oak Bluff Forests are dry and open with an understory resembling that of upslope White Oak Forests.

The Mixed Mesophytic Forest occurs mostly on the mesic talus slopes of bluffs oriented to the north or northeast. Dominant species are similar to those described previously for this forest type in the Ridge and Knob Woodlands habitat. However, there is probably less species diversity given the limited size of most talus slopes. Another difference is that hemlock (*Tsuga canadensis*) seems to prefer these areas to other Mixed Mesophytic Forest sites in the study area. Large hemlock communities can be seen in several bluff areas along the river. Another species partial to these mesic cliffs and talus slopes is northern white cedar (*Thuja occidentalis*). This species is limited to only a few localities, and is restricted to the River Bluffs habitat. Northern white cedar is often hidden by other trees on these talus slopes. It can be more easily seen clinging to low and mid-level bluffs in the study area.

Many herbaceous species are also partial to the rocky bluffs just above the talus slopes in the Mixed Mesophytic Forest. Common flowering species are columbine (*Aquilegia canadensis*), stonecrop (*Sedum ternatum*), liverleaf (*Hepatica acutiloba*), rockcress (*Arabis laevigata*), spotted mandarin (*Disporum maculatum*), and sedge (*Carex eburnea*). Many ferns are partial to the boulders and cliff faces of this area as well. Species such as wall-rue (*Asplenium ruta-muraria*), black-stemmed spleenwort (*Asplenium resiliens*), bulblet fern (*Cystopteris bulbifera*), and purple cliff-brake (*Pellaea atropurpurea*) can all be found.

Terraces

Terraces created from deposits of rich, alluvial soil on point bars along

the river are abundant throughout the study area. Commonly referred to as bottomland, these terraces have long been used for agriculture. Croplands and pastures prevail along most of these terraces, with forests limited to the periphery.

Undisturbed bottomland forests are rare in the UCR. The few tracts that do exist are dominated mostly by mixed mesophytic species. More disturbed forests in terrace areas often contain large openings with clusters of species such as sweetgum (*Liquidambar styraciflua*), black walnut (*Juglans nigra*), and occasionally butternut (*Juglans cinerea*).

A few terraces often contain large tracts of cane (*Arundinaria gigantea*). This species completely covers sections of many bottomland areas in the UCR. However, none of these tracts resemble the enormous 'cane brakes' described by early settlers to the region.

Older terraces laid down by prior courses of the river also occur above bottomland areas, but are usually less expansive. The vegetation of these terraces can vary in different locations, but are typically covered with species common to the White Oak - Oak Forest. The flat terrain has allowed heavy logging to occur on many older terraces also. As a result, extant secondary forests dominated by tulip poplar (*Liriodendron tulipifera*) are often present. Understory and herbaceous species vary with the prevailing forest type.

Floodplains

Floodplains consist of low areas close to the river that are periodically inundated with water. The amount of water a particular floodplain is covered with and the duration of coverage varies with the season and the weather. Typically, flooding occurs during winter and spring and recedes by the middle of summer. Floodplains along the banks of the river may be only a few yards wide in some places while others are much more extensive. Generally, these

areas consist of very silty soils that remain muddy throughout much of the year.

For the most part, floodplains along the river are dominated by riparian forests consisting of sycamore (*Platanus occidentalis*), green ash (*Fraxinus pennsylvanica*), and slippery elm (*Ulmus rubra*). Other common tree species are black willow (*Salix nigra*) and swamp willow (*S. caroliniana*). Also, species such as red maple (*Acer rubrum*), silver maple (*A. saccharinum*), and silky cornel (*Cornus amomum*) are occasionally found along the river's edge.

Frequent shrub species along the banks of the river include sweetshrub (*Calycanthus floridus* var. *floridus*, *C. floridus* var. *glaucus*), false indigo (*Amorpha fruticosa*), button bush (*Cephalanthus occidentalis*), mock orange (*Philadelphus hirsutus*), and ninebark (*Physocarpus opulifolius*). Also, gooseberry (*Ribes cynosbati*) is sometimes located in the upper floodplains of mesic bends in the river.

Herbaceous species become more abundant in floodplain areas as drier conditions prevail later in the season. However, even in early spring, violet species such as blue marsh violet (*Viola cucullata*), downy yellow violet (*V. pubescens*), and pale violet (*V. striata*) can be found along muddy banks in riparian forests. Other spring flowers include Virginia bluebells (*Mertensia virginica*) and star-of-Bethlehem (*Ornithogalum umbellatum*). A number of ferns and fern allies are partial to these muddy areas also: sensitive fern (*Onoclea sensibilis*), broad beech fern (*Thelypteris hexagonoptera*), glade fern (*Diplazium pycnocarpon*), scouring rush (*Equisetum hyemale*), and field horsetail (*E. arvense*). Later in the growing season, species such as smartweed(*Polygonum caespitosum*, *P. punctatum*, *P. virginianum*), river oats (*Chasmanthium latifolium*), phlox (*Phlox paniculata*), sneezeweed (*Helenium autumnale*), and cardinal flower (*Lobelia cardinalis*) can be found in bloom along the banks of the river.

Other seasonally flooded locations include islands and gravel bars. Grissom Island is the only island large enough to support mature trees. However, even full-grown trees have a tenuous foothold on this island, as floods often wash away large chunks of ground. Nevertheless, small stands of sycamore (*Platanus occidentalis*), green ash (*Fraxinus pennsylvanica*), and slippery elm (*Ulmus rubra*) continue to prosper. Also, black willow (*Salix nigra*) and swamp willow (*S. caroliniana*) are common, along with button bush (*Cephalanthus occidentalis*). Smaller ground species are virtually non-existent due to the flooding. Herbaceous taxa are restricted largely to vines such as swallowwort (*Cynanchum laeve*) and pepper vine (*Ampelopsis cordata*). Aquatic plants surround the periphery of the island, and will be discussed in more detail in the next section.

Small islands and gravel bars are much more common in the study area. However, most of these sites are rather ephemeral, and appear only during low water periods in the summer. Arboreal taxa are often absent in both areas, or consist only of scrubby forms of black willow, swamp willow, and slippery elm. Similarly, herbaceous species are composed mostly of annuals, deep-rooted perennials, and aquatic plants as these sites are scoured by the river throughout most of the year.

Small island communities in the river tend to be more mesic than gravel bar communities. Typically, these areas are covered with many sedges (*Carex spp.*), umbrella sedge (*Cyperus lancastriensis*), monkey flower (*Mimulus alata*), and grasses such as canary grass (*Phalaris arundinacea*), wild rye (*Elymus virginicus*), and wood reed (*Cinna arundinacea*). Another frequent species that often blankets these areas is the parasitic plant known as love vine (*Cuscuta gronovii*). Also, many emergent aquatic plants surround the margins of these small islands.

Gravel bars occur mostly near the banks of the river and are often

relatively xeric environments. Communities are usually very open and contain many disturbance species. Such plants include hedge bindweed (*Calystegia sepium*), morning glory (*Ipomoea pandurata, I. purpurea*), cocklebur (*Xanthium strumarium*), thorny pigweed (*Amaranthus spinosus*), beggar's ticks (*Bidens cernua, B. polylepis*), fog fruit (*Phyla lanceolata*), and bur cucumber (*Sicyos angulatus*).

Aquatic Zones

Aquatic areas consist of those portions of the river that maintain year-round water coverage. Generally, these areas can be divided into zones according to factors such as depth, current, and water clarity. Three distinct aquatic zones have been delineated in the study area based upon average summer water levels.

The first zone consists of shallow water areas that occur near banks of the river, island perimeters, and some gravel bars. These areas are the most prolific for aquatic plants, as the depth and current of the river are not excessive. Emergent species such as water willow (*Justicia americana*) and lizard's tail (*Saururus cernuus*) dominate in this zone. Other common species include spike rush (*Eleocharis erythropoda*), bulrush (*Scirpus americanus, S. polyphyllus*), and soft stem bulrush (*Juncus effusus*). In some muddy-water areas along the river bank, species such as water primrose (*Ludwigia decurrens*), water cress (*Nasturtium officinale*), and arrowhead (*Sagittaria latifolia*) occur infrequently. Under very dry conditions, water levels in this zone often decrease leaving many taxa exposed on narrow mud flats. However, such conditions usually do not persist very long.

The second zone is composed of shallow to medium-depth areas of clear, fast-moving water in the main channel of the river. Riffle areas and rocky rapids are typical of this zone type. Generally, the water depth varies from a

few inches to several feet in these areas. Due to the strong current, emergent aquatic plants do not occur. However, submerged species such as eelgrass (*Vallisneria americana*), water stargrass (*Heteranthera dubia*), American pondweed (*Potamogeton nodosus*), and sago pondweed (*Potamogeton pectinatus*) are very frequent. Typically, these species are found alone or as clusters of individuals. However, in protected rocky areas, water stargrass often exists in the form of large floating mats.

The third aquatic zone occurs in deep areas of slow-moving water in the main channel. Typically, this zone is found near broad bends in the river where the current slows. It also occurs in several long, unconstricted, straight sections of the river. Water depths in these areas are generally in excess of several feet. As a result, aquatic plants are mostly absent from this zone. One exception is American pondweed (*Potamogeton nodosus*) which is able to survive under deep, murky water conditions. While this species does not live in the very deepest portions of the river, it does occur in the shallower depths of the main channel.

Ruderal Habitats

Ruderal habitats can be defined as areas that endure periodic episodes of human disturbance. While much of the study site has been disturbed, only areas such as roads, trails, pastures, and cropland are considered as ruderal. These regions comprise a sizable portion of the study site and contain numerous species not found in natural habitats.

Roads and Trails

An extensive network of roads and trails are present in the study area. Many of these routes pass through both natural and disturbed locations creating a multitude of different ruderal habitats. Generally, ruderal sites are more extensive along major roads. However, minor roads and trails also

contain large numbers of disturbance species, as well as many species from surrounding natural areas.

Primary roads in the study area are ditched and often have wide right-of-ways that are mowed several times a year. As a result, grasses are primary constituents of these areas. Such species as orchard grass (*Dactylis glomerata*), fescue (*Festuca pratensis*), redtop (*Agrostis gigantea*), manna grass (*Glyceria striata*), foxtail grass (*Setaria pumila*), and brome grass (*Bromus commutatus*) are all plentiful. Other taxa in these areas include common roadside weeds such as chicory (*Cichorium intybus*), Queen Anne's Lace (*Daucus carota*), dandelion (*Taraxacum officinale*), plantain (*Plantago rugelli, P. virginica*), bush clover (*Lespedeza cuneata, L. virginica*), and buttercup (*Ranunculus bulbosus*).

Secondary roads in the study area contain more diverse assemblages of plants. These roads are mostly gravel and provide access to more remote locations. Furthermore, secondary roadsides are seldom mowed and are less disturbed generally. Grasses also comprise a large portion of the vegetation, with species such as cut grass (*Leersia virginica*), beard grass (*Erianthus alopecuroides*), bottlebrush grass (*Elymus hystrix*), and wild rye (*Elymus villosus*) often occurring in addition to many of the species found along primary roads. In open areas, other frequent taxa include butterfly weed (*Asclepias tuberosa*), milkweed (*Asclepias syriaca*), curly dock (*Rumex crispus*), verbena (*Verbena simplex, V. urticifolia*), moth mullein (*Verbascum blattaria*), woolly mullein (*V. thapsus*), daisy fleabane (*Erigeron annuus, E. strigosus*), hypericum (*Hypericum perforatum, H. punctatum*), multiflora rose (*Rosa multiflora*), prairie rose (*R. setigera*), blackberry (*Rubus occidentalis*), and bristly locust (*Robinia hispida*).

In forested areas along secondary roads, species such as spotted touch-me-not (*Impatiens capensis*), pale touch-me-not (*I. pallida*), wood nettle

(*Laportea canadensis*), false nettle (*Boehmeria cylindrica*), bellflower (*Campanula americana*), great blue lobelia (*Lobelia siphilitica*), thimbleweed (*Anemone virginiana*), leaf cup (*Polymnia canadensis*), bearsfoot (*Polymnia uvedalia*), cup leaf (*Silphium perfoliatum*), mistflower (*Conoclinum coelestinum*), and fire pink (*Silene virginica*) appear frequently. While these taxa occur also in several natural habitats, they are especially abundant along roadsides.

Trails in the study area vary tremendously in the number and types of species that may be found. Some trails consist of nothing but narrow footpaths through wooded areas. Other trails are composed of abandoned secondary roads or logging roads that have cut wide paths through the forest. Established woodland trails in upslope areas often contain species such as barren strawberry (*Waldsteinia fragarioides*), panic grass (*Panicum boscii*), little bluestem (*Schizachyrium scoparium*), blue grass (*Poa cuspidata*, *P. sylvestris*), bedstraw (*Galium lanceolatum*), aster (*Aster urophyllus*), whorled milkweed (*Asclepias quadrifolia*), rattlesnake root (*Prenanthes altissima*), and wild comfrey (*Cynoglossum virginianum*).

Bottomland trails along the river tend to contain greater numbers of disturbance species. Mostly, these trails consist of well-worn paths through wet woods. However, openings do occur as floods often wash away trees leaving gaps in the canopy. Also, many locals have cleared some sections of the bank as fishing spots. Frequent to occasional species along these trails and clearings include tick trefoil (*Desmodium cuspidatum*, *D. glutinosum*, *D. nudiflorum*, *D. pauciflorum*), buttonweed (*Diodia virginiana*), Tennessee chickweed (*Stellaria corei*), chickweed (*Stellaria media*), path rush (*Juncus tenuis*), rush (*Juncus dudleyi*), crowsfoot (*Ranunculus abortivus*), hooked buttercup (*Ranunculus recurvatus*), mouse-ear chickweed (*Cerastium semidecandrum*), corn salad (*Valerianella radiata*), periwinkle (*Vinca minor*),

yucca (*Yucca filamentosa*), and grasses such as microstegium (*Microstegium vimineum*) and arthraxon (*Arthraxon hispidus*).

Pastures and Croplands

Pastures and croplands comprise large portions of the study area. Most pastures occur in upslope areas that have been extensively logged, while croplands exist primarily along terraces of the river. However, these generalizations are not always true, as many hills are covered in grassy fields from their summit all the way to the edge of the river. Likewise, crops such as corn are often grown on upper slopes.

Many pasture and cropland areas have fallen into disuse with declines in agriculture. As a result, a multitude of disturbance species have invaded these sites. Common taxa include pokeweed (*Phytolacca americana*), wild lettuce (*Lactuca canadensis*), thistle (*Cirsium vulgare, C. discolor*), spotted knapweed (*Centaurea maculosa*), teasel (*Dipsacus fullonum*), horseweed (*Conyza canadensis*), red clover (*Trifolium pratense*), white clover (*T. repens*), sunflower (*Helianthus tuberosus*), black-eyed Susan (*Rudbeckia hirta, R. triloba*), ox-eye daisy (*Chrysanthemum leucanthemum*), common ragweed (*Ambrosia artemisifolia*), giant ragweed (*A. trifida*), goldenrod (*Solidago canadensis, S. arguta* var. *caroliniana, S. gigantea*), and ironweed (*Vernonia gigantea*). Also, many grasses occur such as barnyard grass (*Echinochloa crusgalli*), wild rye (*Elymus virginicus*), broomsedge (*Andropogon virginicus*), orchard grass (*Dactylis glomerata*), fescue (*Festuca pratensis*), goose grass (*Eleusine indica*), Timothy (*Phleum pratense*), purpletop (*Tridens flavus*), and bent grass (*Agrostis perennans*). Areas with fence rows often contain trumpet creeper (*Campsis radicans*), Japanese honeysuckle (*Lonicera japonica*), dewberry (*Rubus flagellaris, R. phoenicolasius*), elderberry (*Sambucus canadensis*), and smooth sumac (*Rhus glabra*).

Range Characteristics

In order to access overall patterns in the distribution of the flora, each taxon was assigned to one of four categories based upon its individual range characteristics (Table 7). The categories were devised in accordance with Oxendine (1971) and Clements (1987) and are summarized below:

(1) Intraneous - Taxa with ranges that extend well beyond Tennessee.

(2) Extraneous - Taxa for which Tennessee marks the limit of their range.

(3) Interior - Taxa that are native to the Appalachian provinces of the eastern U. S. and include Tennessee in their range.

(4) Introduced - Taxa that are introduced to the flora from other countries.

In addition, all taxa were classified into northern or southern groups based upon whether their primary center of distribution was considered to be more northern or more southern as described by Fernald (1950). Overall, there are seven groups of taxa: three intraneous groups, two extraneous groups, one interior group, and one introduced group. However, introduced species were not evaluated for centers of distribution.

For the total flora, 272 taxa (51.7%) have centers of distribution that are northern and 175 (33.3%) have centers of distribution that are southern. Seventy-nine taxa (15.0%) are considered to be introduced species. Of the intraneous taxa, 109 (42.4%) are northern and 148 (57.6%) are southern. Similarly, for extraneous taxa, 157 (86.3%) are northern and 25 (13.7%) are southern. Only 8 interior taxa were discovered in the UCR. Likewise, these species comprise a very small percentage of the flora (1.5%). Nevertheless, for this category, 6 (75%) are northern and 2 (25%) are southern. Further results of this analysis can be seen in Table 8.

Table 7: Range Characteristics of the Upper Clinch River Flora

Category	Range	Sample Taxon	# of Taxa	Percentage
Intraneous				
I	S - Florida and Texas north to Canada	*Lobelia cardinalis*	52	(9.9%)
	N - Canada south to Florida and Texas	*Cryptotaenia canadensis*	79	(15.0%)
II	S - Florida to Texas north to New England or Upper Midwest	*Sabatia angularis*	54	(10.3%)
	N - New England and/or Upper Midwest south to Florida and Texas	*Desmodium cuspidatum*	27	(5.2%)
III	S - Florida and Texas to Central Midwest north to Kentucky, Ohio, or S. Ohio	*Spigelia marilandica*	42	(8.0%)
	N - Central States south to Florida and Texas	*Solidago curtisii*	3	(0.6%)
Extraneous				
IV	S - Tennessee north to New England and North-Central States	*Arisaema triphyllum*	11	(2.0%)
	N - New England or North-Central States	*Dioscorea villosa*	58	(11.0%)
V	S - Florida and Texas north to Tennessee	*Cocculus carolinus*	14	(2.7%)
	N - Canada south to Tennessee	*Satureja vulgaris*	99	(18.8%)
Interior				
VI	S - Appalachian Interior north to Ohio, Pennsylvania, Kentucky, or Virginia	*Phlox ovata*	6	(1.1%)
	N - Appalachian Interior south to Tennessee, Georgia and Alabama	*Astilbe biternata*	2	(0.4%)
Introduced				
VII	----------	*Lonicera japonica*	79	(15.0%)
		Total	526	(100%)

Table 8: Summary of the Range
Characteristics of the Upper Clinch River Flora

Category	Northern Taxa	Southern Taxa	Total	Percentage
Intraneous	109	148	257	(48.9%)
Extraneous	157	25	182	(34.6%)
Interior	6	2	8	(1.5%)
Introduced	----	----	79	(15.0%)
Total (Percent)	272 (51.7%)	175 (33.3%)	526	(100%)

Rare Plants

Table 9 lists rare plants found with the study area. The status of these plants was determined with the aid of the Rare Plant List of Tennessee (Tennessee Department of Environment and Conservation, 1997). Currently, all six taxa are listed as threatened or special concern species at the state level in Tennessee. The term threatened has been defined by the state as, "those species that are likely to become endangered in the immediate foreseeable future as a result of rapid habitat destruction or commercial exploitation". Likewise, a special concern species is considered to be rare because the state represents the limit of its geographic range. Also, a species whose status is undetermined because of insufficient information may be listed as special concern. None of the six taxa are federally listed under current guidelines by the U. S. Fish and Wildlife Service.

In addition, the state rare plant list provides the global and state ranks of each rare plant in accordance with the Nature Conservancy. Appalachian bugbane (*Cimicifuga rubifolia*) has the highest global rank of any taxon in the rare plant list at G3. Species in this category are considered to be rare and uncommon globally with only 21 to 100 occurrences and fewer than 10,000 individuals. Ginseng (*Panax quinquefolius*) has a G4 ranking. Species with this designation are widespread, abundant, and apparently secure globally with usually more than 100 occurrences. The global rank of butternut (*Juglans cinerea*) has been approximated to be either G3 or G4. Heavy sedge (*Carex gravida*), Canada lily (*Lilium canadense*), and heartleaf meehania (*Meehania cordata*) are listed as G5. Species with this ranking are considered to be demonstrably widespread, abundant, and secure globally with stable populations.

Heavy sedge (*Carex gravida*) has been given the highest state rank S1. Species with this designation are critically imperiled in the state due to

Table 9: Rare Plants in the Upper Clinch River Study Area

Taxon	Federal Status	State Status	Global Rank	State Rank
Carex gravida	- - - -	S	G5	S1
Cimicifuga rubifolia	- - - -	T	G3	S3
Juglans cinerea	- - - -	T	G3,G4	S2,S3
Lilium canadense	- - - -	T	G5	S2
Meehania cordata	- - - -	T	G5	S2
Panax quinquefolius	- - - -	S - CE	G4	S3,S4

LEGEND

State Status
S - (Special Concern Species)
T - (Threatened Species)
CE - (Commercially Exploited)

Global Rank
G3 - (Rare and Uncommon Globally)
G4 - (Widespread, Abundant, and Apparently Secure Globally)
G5 - (Demonstrably Widespread, Abundant, and Secure Globally)

State Rank
S1 - (Critically Imperiled in the State)
S2 - (Imperiled in the State)
S3 - (Rare and Uncommon in the State)
S4 - (Widespread, Abundant, and Apparently Secure Within the State, but of Long-Term Concern)

extreme rarity or because other factors make them vulnerable to local extirpation. Generally, such species have five or fewer known occurrences, or very few remaining individuals. Likewise, two other taxa in the list, Canada lily (*Lilium canadense*) and heartleaf meehania (*Meehania cordata*) are ranked S2. The S2 rank also consists of those taxa that are imperiled because of rarity in the state or because other factors make them vulnerable to local extirpation. Such taxa have six to twenty occurrences and less than 3,000 individuals. Appalachian bugbane (*Cimicifuga rubifolia*) is listed as S3. This rank is for those species that are rare and uncommon in the state with twenty-one to one hundred occurrences. Ginseng (*Panax quinquefolius*) is listed as either S3 or S4. The S4 rank is given to those species that are widespread, abundant, and apparently secure within the state, but that are rare in some portions of their range and are of long-term concern.

The Rare Plant List of Virginia (Virginia Department of Conservation and Recreation, 1996) was consulted to determine if any rare species from that state occurred in the study area as well. The headwaters of the Clinch River are located in southwest Virginia. Also, the study area is located less than twenty miles from the Virginia border. Thus, the probability of occurrence of rare species from Virginia was significant. Twelve species from the study area were found to be listed as rare in Virginia. Table 10 lists these taxa along with their rankings.

Table 10: Virginia Rare Plants in the Upper Clinch River Study Area

Taxon	Federal Status	Global Rank	State Rank
Blephilia hirsuta	- - - -	G4?	S2
Calycanthus floridus var. *floridus*	- - - -	G5,T4	S2?
Calycanthus floridus var. *glaucus*	- - - -	G5,T4	S1?
Cimicifuga rubifolia * *	- - - -	G3	S1,S2
Dasystoma macrophylla	- - - -	G4	S1
Desmodium cuspidatum var. *cuspidatum*	- - - -	G5,T?	S2
Magnolia macrophylla	- - - -	G5	S1
Philadelphus hirsutus	- - - -	G5	S2,S3
Phlox amplifolia	- - - -	G3,G5	S2
Rosa setigera	- - - -	G5	S1
Stellaria corei	- - - -	G4	S1
Stylophorum diphyllum	- - - -	G5	S2

LEGEND*

Global Rank

T4 - (Variety is Widespread, Abundant, and Apparently Secure Globally)

? - (Rank of Taxa is Unknown or Uncertain)

*note: Other rank descriptions were listed previously in Table 9.

**note: Taxon is also found in the Tennessee Rare Plant List.

CHAPTER VI

DISCUSSION

Flora

In order to provide an estimate of the diversity of the UCR, published accounts of taxa collected from other areas along the river, as well as areas in close proximity, were compared to the results of this study. However, it is difficult to give a complete assessment of species diversity, as few other published studies of vascular plant occurrences have been attempted for the region.

One of the primary sources used in this analysis is a report of the total flora on the Oak Ridge Reservation (Cunningham *et al.*, 1993). This site encompasses almost 15,000 hectares of land that lay partially along a stretch of the lower Clinch River in Anderson and Roane Counties, Tennessee. Much of the Oak Ridge Reservation is relatively undisturbed, as little of the land has been used since 1942. Extensive efforts by the federal government have been underway for a number of years to document the entire flora on the reservation.

Nine hundred and eighty-three verified species and lesser taxa have been collected from Oak Ridge through 1993. It is not known what percentage of these taxa are from areas adjacent to the Clinch River. Nevertheless, some correlations can be made to the UCR flora. Analysis of the data showed that 397 taxa occur in both sites. Thus, 75 percent of the taxa collected in the UCR also occur on the reservation.

It was expected that the Oak Ridge Reservation would contain a much larger flora given the greater size of the area and the greater diversity of

habitats. However, 25 percent of the UCR flora was not found at Oak Ridge. While it is possible that some of these species could be found at a later date, there is potential that many of the taxa may be typical of the UCR.

Another primary source of comparison comes from a vegetational study of nearby Hawkins County, Tennessee (Wolfe, 1956). This study documented plants at a number of sites in various geologic zones that cut across the mid-section of the county from Clinch Mountain to beyond the Holston River. Many of these sites are underlain by the same rock strata as those in the UCR. Likewise, much of the disturbance history of the landscape in Hawkins County is similar to that of adjoining Hancock County.

A total of 531 species were collected from the Hawkins County study. Though these species were not gathered as part of a flora within a defined territory, the number of taxa collected is approximately equal to that from the UCR. However, analysis of the data showed that only 289 species (<55%) were present in both studies. Such discrepancy is likely to be explained by the fact that the Hawkins County sites consisted of fewer riparian habitats.

Also, several studies with smaller collections of plants were examined. The first study involved samples of taxa collected in conjunction with northern white cedar (Walker, 1987). For this investigation, taxa were collected at three sites close to the UCR. Two sites were along Norris Reservoir in Campbell County, and the other site was along the Powell River in Claiborne County, Tennessee. A total of 58 species were collected at these sites. Forty-eight of these species (83%) were also found in the UCR flora.

The second study involved a survey of ferns along limestone bluffs on Norris Lake in Campbell and Union Counties, Tennessee (Bailey, 1969). Fifteen species and lesser taxa of ferns were collected from this study. However, two of the Norris Lake taxa, *Asplenium platyneuron* var. *incisum* and *Asplenium ruta-muraria* var. *ohionis*, are varieties that are no longer taxonomically

valid. Similarly, a third taxon, *Asplenosorus ebenoides*, is now considered to be of hybrid origin. Of the twelve remaining taxa, nine (75%) were found in the UCR.

Finally, the third study consisted of a compilation of submerged and floating aquatic species collected from major rivers and reservoirs of the Tennessee River system (Webb and Bates, 1989). The Clinch River was included on this list with seven species. Four of these species are found in the study area. Of the three not found, two taxa, *Elodea canadensis* and *Potamogeton crispus*, are limited to reservoirs and lakes. The third species, *Zannichellia palustris*, occurs infrequently in river and stream habitats. Of the twelve tributaries included in this study, the Clinch River was ranked fourth in the total number of sumberged and floating aquatic species that occurred.

Overall, the number of species collected in the UCR seems to be consistent with collections from other studies. However, exact conclusions on total species diversity are difficult, given the disparities that exist among all the sites. Nevertheless, many of the taxa analyzed in these studies were found only in the UCR, which may support the notion that the region has a distinct flora.

Plant Habitats and Communities

The composition of habitats and communities found in the UCR are virtually identical to those classifications given by Martin (1989) for the Great Valley. A few exceptions do exist however. Several taxa and forest types described by Martin are notably absent from the UCR. In many instances, these absences can be explained by various differences in site factors. However, the ommission of several taxa from the study area remains unresolved.

The Ridge and Knob Woodlands habitat contains several variants of the

White Oak - Oak Forest that are not present in the UCR. According to Martin, communities dominated by white oak and black oak (*Quercus velutina*), can be found on the dry, exposed slopes of cherty dolomitic ridges and upper river terraces. Many such ridges and terraces can be found along the Clinch River. However, black oak was never collected in the study area. It is quite possible that this species does not occur.

Similarly, Martin reports that white oak - scarlet oak (*Quercus coccinea*) communities exist on the slopes of some older terraces with Waynesboro and Cumberland soils. Neither of these soil types are present in the study area, which may account for the absence of scarlet oak. Another possibility is that scarlet oak occurs only in limited numbers today, as many of these terraces have been heavily logged.

Another community type consisting of white oak and mockernut hickory was linked by Martin to sites with non-calcareous shale. A major associate with this community is post oak (*Quercus stellata*). White oak and mockernut hickory are abundant in the study area. However, post oak was not found. The lack of sites underlain by non-calcareous shale in the UCR region may be a primary reason.

In the Rock Outcrops habitat, several oak species including post oak and blackjack oak (*Quercus marilandica*) are purportedly present in shallow soils. Yet, both of these species were missing from the rock outcrops in the study area. The reason for this absence is uncertain. One possibility is the low number of rock outcrops and the high degree of disturbance of these sites in the UCR.

Surprisingly, members of the Ericaceae are very underrepresented along ridges in the region. In fact, rhododendrons and mountain laurel are completely absent from the study area. Both taxa are abundant on higher ridges nearby, such as Clinch Mountain. Nevertheless, neither group contains

species in the UCR. One cause for this may be the large amounts of limestone and dolomite that underlie the region.

In the Mixed Mesophytic Forest, one characteristic species, white pine (*Pinus strobus*), was searched for extensively but never located. Martin reported that white pine was present in mesic ravines and draws throughout the Great Valley. However, repeated attempts to find this tree were unsucessful. White pine has a very distinctive growth pattern that is easy to spot from a distance. Thus, it is almost certain that this species does not occur in the study area.

Furthermore, another characteristic species, river birch (*Betula nigra*), appears to be absent from riparian forests along the river. Usually, this species can be found in abundance near rivers and streams with trees such as sycamore, ash, elm, and willow. Though the entire shoreline of the study area was traveled by canoe, river birch was never encountered. It is unlikely that this taxon was missed, as it has an unusual bark that is quite unique from other trees.

Finally, bottomland forests described by Martin were not discovered on any floodplains or other wet depressions in the study area. Dominants of this forest type are willow oak (*Quercus phellos*) and white oak. Major associates include southern red oak, sweetgum, red maple, cow oak (*Quercus michauxii*), and water oak (*Quercus nigra*). While many of these species are present in other community types, willow oak, cow oak, and water oak were not found in the UCR. However, it should be noted that most wetland areas with these forests have been drained and cleared throughout the Ridge and Valley province.

Exact reasons for the lack of representative species in some community types are unavailable. There is a possibility that the high degree of disturbance in the study area may have extirpated some taxa. However, this

explanation is unlikely to account for such a large number of gaps in the flora. A very strong prospect is that the appropriate habitats for these taxa do not exist within the UCR. Review of county dot maps from Tennessee confirm the absence of nearly all these species from Claiborne, Grainger, and Hancock Counties.

Range Characteristics

Analysis of the range characteristics of the UCR flora show that most taxa (52%) are northern in distribution. Likewise, extraneous taxa comprise almost 58 percent of these northerly species, and are the single largest group of plants represented in the flora. Given the abundance of cool, moist habitats in the study area, it is understandable that so many species from milder climates are present.

Intraneous elements constitute the largest category (49%) in this analysis, when both northern and southern taxa are considered. In other words, the majority of taxa in the study area can be found from Canada, New England, or the Upper Midwest to Florida and Texas. Since the study area occurs midway between these ranges, it is expected that many intraneous taxa would occur. There is a slight majority of southern species in this category. Therefore, many plants probably have a center of distribution south of Tennessee.

Surprisingly, very few interior taxa were discovered through this investigation. There are only eight species in this category. With the close proximity of the Ridge and Valley province to the Appalachian Interior, it was believed that more representatives would be present. A possible explanation is that many interior taxa are excluded due to the uniform geology of the UCR region.

Introduced taxa make up a relatively large portion of the flora at 15

percent. This percentage reflects the fact that many sections of the study area are highly disturbed. While many exotic species are sporadic in occurrence, others are widespread. The invasive tendencies of such taxa may pose a future threat to the UCR.

Rare Plants

Most of the rare plants in the study area were collected from only one or two localities. Also, many were limited to just a few individuals within each locality. While these taxa may occur in more sites along the river, they are not likely to be abundant anywhere.

Range analysis shows that all six of the rare plants discovered are northern in distribution. Likewise, five of these taxa are considered to be extraneous. Thus, Tennessee represents the southernmost limit of their range. Though not every taxon is considered rare due to range limitations alone, this is probably a primary factor.

Other rare plants known to occur in the three counties of the study site include: American barberry (*Berberis canadensis*), Porter's reedgrass (*Calamagrostis porteri*), round-leaf watercress (*Cardamine rotundifolia*), green-and-gold (*Chrysogonum virginianum*), showy lady's slipper (*Cypripedium reginae*), branching Whitlow-grass (*Draba ramosissima*), mountain witch-alder (*Fothergilla major*), goldenseal (*Hydrastis canadensis*), large round-leaved orchid (*Platanthera orbiculata*), alderleaf buckthorn (*Rhamnus alnifolia*), Carey saxifrage (*Saxifraga careyana*), rock skullcap (*Scutellaria saxatilis*), ovate catchfly (*Silene ovata*), shining ladies' tresses (*Spiranthes lucida*), and leatherleaf meadowrue (*Thalictrum coriaceum*). As well, spreading false-foxglove (*Aureolaria patula*) is known to occur along segments of the lower Clinch River. Nevertheless, none of these species was encountered in the study area.

Noteworthy Plants

Five plants collected in the UCR study area are worthy of special attention: mountain maple (*Acer spicatum*), mullein foxglove (*Dasystoma macrophylla*), purple loosestrife (*Lythrum salicaria*), skullcap (*Scutellaria serrata*), and northern white cedar (*Thuja occidentalis*). A plant may be considered noteworthy for any of the following reasons: (1) the taxon represents a physiographic record, (2) the taxon represents a significant range extension in the state, (3) the taxon is rare in distribution throughout the state. Table 11 lists each of the noteworthy plants above and provides a brief description of their relevance to the UCR.

Table 11: Noteworthy Plants of the Upper Clinch River Study Area

Taxon	Significance
Acer spicatum	Represents a physiographic record for the Ridge and Valley province of Tennessee. Occurs mainly in the Blue Ridge province.
Dasystoma macrophylla	Represents only the second collection within the Ridge and Valley province in Tennessee. Both collections are from the Clinch River. More common in Middle Tennessee and westward.
Lythrum salicaria	Exotic invasive plant of wetland areas whose populations are in need of monitoring. Collected for the first time along the Clinch River.
Scutellaria serrata	Represents a physiographic record for the Ridge and Valley province of Tennessee. More common northward and in the Blue Ridge province.
Thuja occidentalis	Populations in Tennessee represent the most southerly extension of this taxon. More common in the Northern U. S. and Canada.

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APPENDICES

APPENDIX A.

ANNOTATED CHECKLIST OF THE VASCULAR FLORA OF THE UPPER CLINCH RIVER

The format of this checklist is taken in part from Murrell (1985) and Clements (1987). Plant families are arranged alphabetically within four taxonomic groups:

Pteridophyta (Ferns & Fern Allies)
Spermatophyta
    Gymnospermae (Gymnosperms)
    Angiospermae (Angiosperms)
        Monocotyledoneae (Monocots)
        Dicotyledoneae (Dicots)

Genera are arranged alphabetically within their respective family. Likewise, species and lesser taxa are arranged alphabetically within each genus.

The scientific name and authority of each taxon is provided in accordance with Wofford and Kral (1993). However, taxonomic identifications were made with the aid of several manuals: Wofford (1989), Gleason & Cronquist (1991), and Gleason (1952). Common names are given for many taxa, but no attempt was made to prepare a listing of names beyond those listed in the aforementioned manuals.

Frequency designations for this checklist represent the relative occurrence of each taxon within the study site as perceived by the author. These designations are given merely as an estimate of general abundance, not as a measurement of total abundance. The terms used are from Murrell (1985) and can be interpreted as follows:

Very Rare - A single locality, few individuals
Rare - One or two localities, generally small populations
Scarce - Several localities, or scattered small populations
Infrequent - Scattered localities throughout
Occasional - Well distributed but not anywhere abundant
Frequent - Generally encountered
Common - Characteristic and dominant

Habitat descriptions are patterned after Martin (1989). However, some modifications to these descriptions have been made by the author to better reflect the study area (See Figure 6). Other habitat conditions such as community type, slope aspect, moisture, and substrate may also be given where appropriate.

Finally, some taxa in the checklist contain comments on relevant taxonomy, synonomy, and reference information. Exotic taxa are indicated by listing their native range(s). Plant collection numbers, along with country names, are given for herbarium reference. County records are denoted with an asterisk (*) after the county name. All specimens are on deposit at the University of Tennessee Herbarium (TENN).

ANNOTATED CHECKLIST OF THE VASCULAR FLORA OF THE UPPER CLINCH RIVER

PTERIDOPHYTA

ASPLENIACEAE

Asplenium

platyneuron (L.) Britton, Sterns, & Poggenb.; Ebony Spleenwort. Frequent. Mesic to subxeric woods, rock outcrops. In rocky areas generally. #163, #379 Grainger, Hancock.

resiliens Kunze; Black-stemmed spleenwort. Occasional. Rocky slopes in mesic woods. Mostly on rocky ledges. #23, #220 Claiborne, Grainger.

rhizophyllum L.; Walking Fern. Frequent. Mesic woods on limestone rocks and boulders. Often on talus slopes along river. [*Camptosorus rhizophyllus* (L.) Link]. #29 Grainger.

ruta-muraria L.; Wall-rue. Infrequent. On calcareous rock outcrops and boulders in mesic woods. #1, #221 Claiborne, Grainger.

DRYOPTERIDACEAE

Dryopteris marginalis (L.) A. Gray; Marginal Wood Fern. Frequent. Mesic rocky woods. Often on talus slopes along river. #21, #165 Grainger, Hancock.

Polystichum acrostichoides (Michx.) Schott; Christmas Fern. Common. Mesic to xeric woods throughout the study area. #101, #164, #246 Claiborne, Grainger, Hancock.

EQUISETACEAE

Equisetum

arvense L.; Field Horsetail. Frequent. Muddy banks along the river. Often partially submerged. #201 Claiborne.*

hyemale var. affine (Engelm.) A. A. Eaton; Scouring Rush. Frequent. Moist areas along the river in mesic woods. #27 Grainger.*

LYCOPODIACEAE

Diphasiastrum digitatum (A. Braun) Holub; Running-pine. Infrequent. Xeric wooded slopes and roadside embankments. [*Lycopodium digitatum* A. Braun]. #111 Claiborne.*

Huperzia lucidula (Michx.) Trevis.; Shining Club-moss. Scarce. Mesic rocky woods on north facing slopes. [*Lycopodium lucidulum* Michx.]. #158 Grainger.*

Lycopodium obscurum L.; Ground Pine. Infrequent. Subxeric woods on upper slopes and ridge tops. Often covering entire patches of ground. #8 Grainger.*

OPHIOGLOSSACEAE

Botrychium

biternatum (Sav.) Underw.; Southern Grape Fern. Scarce. Open woods along lower slopes. #387 Grainger.*

virginianum (L.) Sw.; Rattlesnake Fern. Infrequent. Rich woods along the river. #116 Hancock.

POLYPODIACEAE

Polypodium polypodioides (L.) Watt var. michauxianum Weath.; Resurrection Fern. Occasional. On calcareous rock outcrops. #22 Grainger.

SINOPTERIDACEAE

Adiantum pedatum L.; Northern Maiden-hair Fern. Occasional. Mesic slopes along the river. #96 Grainger.

Pellaea atropurpurea (L.) Link; Purple Cliff-brake. Scarce. Calcareous rock outcrops and ledges in mesic woods. #141 Hancock.

THELYPTERIDACEAE

Thelypteris

hexagonoptera (Michx.) Weath.; Broad Beech Fern. Frequent. Low woods, often along trails and streams. #114 Hancock.

noveboracensis (L.) Nieuwl.; New York Fern. Occasional. Rich woods, often clumped along trails and other clearings. #190 Hancock.*

WOODSIACEAE

Cystopteris bulbifera (L.) Bernh.; Bulblet Fern. Occasional. Mesic woods along ledges and boulder areas. Partial to talus slopes near the river also. #282 Hancock.

Diplazium pycnocarpon (Spreng.) M. Broun; Glade Fern. Infrequent. Mesic woods along river bottoms. Encountered mostly along roads and trails that cut through these areas. [*Homalosorus pycnocarpos* (Spreng.) Pic. Serm.; *Athyrium pycnocarpon* (Spreng.) Tidestr.]. #142 Hancock.

Onoclea sensibilis L.; Sensitive Fern; Frequent. Muddy areas along the river bank. #155 Grainger.*

Woodsia obtusa (Spreng.) Torr.; Blunt-lobed Cliff Fern. Rare. Rock outcrops in open cedar-pine woods. #176 Hancock.

GYMNOSPERMAE

CUPRESSACEAE

Juniperus virginiana L.; Eastern Red Cedar. Common. Fields and dry open woodlands. Very common on roadsides. #45 Grainger.

Thuja occidentalis L.; Arbor Vitae, Northern White Cedar. Scarce. Restricted to north-facing cliff faces and rocky ledges. Thought to be glacial relics from the Pleistocene. #324 Hancock.

PINACEAE

Pinus

echinata Mill.; Shortleaf Pine. Frequent. Dry slopes and fields. Large stands present in some locations. #47 Grainger.*

virginiana Mill.; Virginia Pine, Scrub Pine. Frequent. Dry slopes and fields. #202, #222 Claiborne, Grainger.

Tsuga canadensis (L.) Carriere; Eastern Hemlock, Canadian Hemlock. Occasional. Mesic woods along river on north-facing slopes and river bluffs. #252 Hancock.

ANGIOSPERMAE (MONOCOTS)

AGAVACEAE

Yucca filamentosa L.; Spanish Bayonet, Adam's Needle. Occasional. River banks and rocky woods along roadsides. #318 Claiborne.*

ALISMATACEAE

Sagittaria latifolia Willd.; Arrowhead. Very rare. Only a few individuals seen along the river in one area of murky water. [*Sagittaria latifolia* Willd. var. *pubescens*]. #298 Hancock.*

ARACEAE

Arisaema triphyllum (L.) Schott; Jack-in-the-Pulpit, Indian Turnip. Common. Mesic woods throughout the study area. #49 Grainger.

COMMELINACEAE

Commelina virginica L.; Day Flower. Infrequent. Low woods and wet areas along the river. #234 Claiborne.*

CYPERACEAE

Carex

amphibola Steud.; Sedge. Frequent. Rich woods along the river. #92 Grainger.*

blanda Dewey; Sedge. Common. Rich woods along the river. #135 Grainger.*

complanata Torr. & Hook.; Sedge. Frequent. Low mesic woods along the river and along trails. #98, #123 Grainger, Hancock.*

crebriflora Wiegand; Sedge. Infrequent. Rich rocky woods along the river. #105 Grainger.*

eburnea Boott; Sedge. Occasional. Rocky limestone outcrops and ledges in rich woods. #25 Grainger.*

festucacea Willd.; Fescue Sedge. Occasional. Mesic woods and clearings along the river. #208 Grainger.*

frankii Kunth; Frank's Sedge. Frequent. Wet depressions in fields and roadside ditches. #172, #512 Claiborne, Hancock.*

gravida L. H. Bailey; Heavy Sedge. Very rare. Only a few individuals seen in a clearing near the river. #249 Grainger.*

lurida Wahlenb.; Smaller Hop Sedge. Frequent. Wet depressions in fields and roadside ditches. #133 Hancock.*

pedunculata Willd.; Longstalk Sedge. Very rare. Several scattered individuals along a wooded trail near the river. #14 Grainger.

rosea Willd.; Roseate Sedge. Occasional. Mesic woods along the river. #107 Grainger.

sparganioides Willd. var. aggregata (Mack.) Gleason; Sedge. Occasional. Rich wooded slopes. [*C. aggregata* Mack.]. #120 Hancock.*

vulpinoidea Michx.; Fox Sedge. Occasional. Stream margins, ditches, and other wet depressions. #217 Hancock.*

Cyperus

lancastriensis Porter; Umbrella Sedge. Scarce. Gravel bars and sandy clearings along the river. #345 Grainger.*

strigosus L.; Umbrella Sedge. Common. Wet areas in fields and along roadsides. #299, #426 Claiborne, Grainger.*

Eleocharis erythropoda Steud.; Spike Rush. Occasional. Along banks of the river and other wet areas. #306 Hancock.*

Scirpus

americanus Pers.; Bulrush. Infrequent. Islands and gravel bars along the river. Mostly in shallow water areas. #222 Claiborne.*

atrovirens Willd.; Black Bulrush. Occasional. Creeks and wet depressions. #169 Hancock.*

pendulus Muhl.; Bulrush. Scarce. Wet depressions in open areas. [*S. lineatus* sensu auctt., non Michx.]. #170 Hancock.

polyphyllus Vahl; Many-leaved Bulrush. Occasional. Islands, gravel bars, and other wet depressions. #510 Claiborne.*

DIOSCOREACEAE

Dioscorea villosa L.; Wild Yam. Common. Subxeric - mesic woodlands throughout the study area. [*D. quaternata* (Walter) J. F. Gmel.]. #79, #270 Grainger, Hancock.*

HYDROCHARITACEAE

Vallisneria americana Michx.; Eelgrass. Occasional. Submerged aquatic in shallow areas of the river. #303 Hancock.

IRIDACEAE

Belamcanda chinensis (L.) DC.; Blackberry Lily. Scarce. Dry roadsides and fencerows along ridge tops. Native to East Asia. #365 Hancock.*

Iris cristata Sol.; Dwarf Crested Iris. Frequent. Rich mesic woods. Often along trails and on roadside banks. #32 Hancock.*

Sisyrinchium

angustifolium Mill.; Blue-eyed Grass. Frequent. Woodlands, along trails and roadsides. #103 Grainger.*

atlanticum E. P. Bicknell; Blue-eyed Grass. Occasional. Roadsides and clearings along the river. [*S. nashii* E. P. Bicknell, *S. mucronatum* Michx. var. *atlanticum* (E. P. Bicknell) H. E. Ahles]. #152 Hancock.*

JUNCACEAE

Juncus

dudleyi Wiegand; Rush. Scarce. Along open streams and wet areas. #216 Hancock.*

effusus L.; Soft Rush. Occasional. Muddy banks and wet areas along the river. #513 Claiborne.*

tenuis Willd.; Path Rush. Frequent. Road margins, trails, and other disturbed areas. [*J. anthelatus* (F. J. Herm.) R. E. Brooks; *J. macer* Gray]. #137, #151 Claiborne, Grainger.*

LILIACEAE

Allium canadense L.; Wild Onion. Occasional. Fields and open disturbed areas. #77 Grainger.

Chamaelirium luteum (L.) A. Gray; Devil's Bit. Frequent. Rich mesic woods throughout the study area. #70 Grainger.*

Disporum

lanuginosum (Michx.) G. Nicholson; Yellow Mandarin. Frequent. Rich mesic woods on north-facing slopes. #53 Grainger.

maculatum (Buckley) Britton; Spotted Mandarin. Infrequent. Rich mesic woods on north-facing slopes. Often in rocky areas. #55 Grainger.

Erythronium americanum KerGawl.; Trout Lily, Dog-tooth Violet. Occasional. Rich woods, often on talus slopes near the river. [E. americanum KerGawl. ssp. harperi (W. Wolf) C. R. Parks & Hardin.]. #31 Hancock.

Hemerocallis fulva (L.) L.; Day Lily. Very Rare. A couple of small populations found along a dirt road at First Bend. Native to Eurasia. #173 Grainger.*

Lilium canadense L.; Canada Lily, Wild Yellow Lily. Very Rare. Only a few individuals found in rich mesic woods along Lawson Bend Road. #242 Hancock.*

Ornithogalum umbellatum L.; Star-of-Bethlehem. Occasional. Muddy areas along banks of the river. Native to Europe. #86 Grainger.*

Polygonatum

biflorum (Walter) Elliott; Solomon's Seal. Common. Rich woods throughout the study area. [*P. canaliculatum* (Muhl.) Pursh; *P. commutatum* (Schult.f.) A. Dietr.]. #76 Grainger.

pubescens (Willd.) Pursh; Solomon's Seal. Occasional. Rich mesic woods. #61 Hancock.*

Smilacina racemosa (L.) Desf.; False Solomon's Seal. Common. Rich woods throughout the study area. [*Maianthemum racemosum* (L.) Link]. #83 Grainger.

Trillium

erectum L.; Red Trillium, Stinking Benjamin, Wake Robin. Common. Rich mesic woods along the river. Both red and white color forms believed to be present. #56 Grainger.*

grandiflorum (Michx.) salisb.; Large-flowered Trillium, White Wake Robin. Frequent. Rich mesic wooded slopes along the river. #23 Hancock.*

luteum (Muhl.) Harb.; Yellow Trillium. Common. Rich woods along the river. Often on talus slopes. #24 Grainger.

sulcatum T. S. Patrick; Southern Red Trillium, Barksdale's Trillium. Occasional. Rich mesic wooded slopes along the river. #25 Hancock.

Uvularia grandiflora Smith; Bellwort. Frequent. Rich woods along the river. Often on talus slopes. #32 Hancock.

ORCHIDACEAE

Goodyera pubescens (Willd.) R. Br.; Rattlesnake Plantain. Occasional. Dry open woodlands. #400 Grainger.*

Tipularia discolor (Pursh) Nutt.; Crane-fly Orchid. Occasional. Open woodlands along the river. #364 Grainger.*

POACEAE

Agrostis

gigantea Roth; Common Redtop. Infrequent. Fields and other disturbed areas along the river. Native to Europe. [*A. alba* L.; *A. stolonifera* L. var. *major* (Gandin) Farw.]. #281 Hancock.

perennans (Walter) Tuck.; Upland Bent Grass. Occasional. Woodland margins along the banks of the river. #300 Grainger.

Andropogon virginicus L.; Broomstraw, Broomsedge. common. Fields, roadsides, and other disturbed areas along the river. #303 Grainger.

Arthraxon hispidus (Thunb.) Makino; Frequent. Wet woods along the river. Native to Southeast Asia. [*A. hispidus* (Thunb.) Makino var. *cryptantherus* (Hack.) Honda]. #256, #483 Claiborne, Grainger.*

Arundinaria gigantea (Walter) Muhl.; Cane. Common. Wet woods and river banks. #158 Hancock.*

Brachyelytrum erectum (Schreb.) P. Beauv.; Occasional. Rich wooded slopes and woodland margins along the river. #280, #326 Grainger, Hancock.*

Bromus commutatus Schrad.; Brome Grass. Occasional. Roadsides and other disturbed areas near the river. Native to Europe. [*B. racemosus* L.]. #197 Grainger.

Chasmanthium latifolium (Michx.) H. O. Yates; River Oats. Common. Rich woods along the river. [*Uniola latifolia* Michx.]. #349 Grainger.*

Cinna arundinacea L.; Wood Reed. Frequent. Small islands, gravel bars, and clearings near moist woods. #247 Hancock.*

Dactylis glomerata L.; Orchard Grass. Common. Fields and roadsides throughout the study area. Native to Europe. #210 Grainger.*

Echinochloa crusgalli (L.) P. Beauv.; Barnyard Grass. Frequent. Muddy banks along the river. Native to Eurasia. #287 Grainger.*

Eleusine indica (L.) Gaertn.; Goose Grass. Common. Fields, margins, and banks of the river. Old World Native. #258, #302 Claiborne, Grainger.*

Elymus

hystrix L.; Bottlebrush Grass. Frequent. Forest margins especially along roadsides. [*Hystrix patula* Moench]. #268 Hancock.*

riparius Wiegand; Wild Rye. Infrequent. Moist woods along the river. #346 Grainger.*

villosus Muhl. ex Willd.; Wild Rye. Occasional. Woodland margins and roadsides along the river. #260, #266 Claiborne, Hancock.

virginicus L.; Wild Rye. Occasional. Wet woods and banks along the river. [*E. hirsutiglumis* Scribn.; *E. jejunus* (Ramaley) Rydb.]. #202, #348 Claiborne, Grainger.*

Erianthus alopecuroides (L.) Elliott; Beard Grass. Occasional. Fields and roadsides near wet woodland margins. #333, #473 Claiborne, Grainger.*

Festuca pratensis Huds.; Fescue. Frequent. Fields and pastures along the river. Native to Europe. [*F. elatior* L.]. #63, #257 Claiborne, Hancock.*

Glyceria striata (Lam.) Hitchc.; Manna Grass. Frequent. Fields and roadside ditches. #62, #264 Claiborne, Hancock.*

Leersia virginica Willd.; Cut Grass. Occasional. Low areas along the river and wet roadside ditches. #262 Claiborne.

Microstegium vimineum (Trin.) A. Camus; Occasional. Low wet areas along the river. Native to Tropical Asia. [*Eulalia viminea* (Trin.) Kuntze]. #301 Grainger.

Panicum

anceps Michx.; Panic Grass. Frequent. Roadsides and open areas near the river. #325 Grainger.

boscii Poir.; Panic Grass. Frequent. Dry woods upslope. Often along trails. [*P. boscii* var. *molle* (Vasey) Hitchc. & Chase; *Dicanthelium boscii* (Poir.) Gould & Clark]. #127 Hancock.

capillare L.; Panic Grass. Occasional. Banks of the river. #296 Grainger.

dichotomum L. var. yadkinense (Ashe) Lelong; Panic Grass. Rare. Wetlands along the river. [*P. yadkinense* Ashe; *Dicanthelium dichotomum* (L.) Gould var. *dichotomum*]. #211 Grainger.*

flexile (Gatt.) Scribn.; Panic Grass. Scarce. Rock outcrops and upland pastures. #266 Grainger.*

Phalaris arundinacea L.; Reed Canary Grass. Occasional. Islands, gravel bars, and banks of the river. #199 Claiborne.*

Phleum pratense L.; Timothy. Frequent. Pastures and fields throughout the study area. Native to Europe. #146 Claiborne.*

Poa

cuspidata Nutt.; Woodland Blue Grass. Occasional. Rich wooded slopes along the river. #20 Grainger.

sylvestris A. Gray; Woodland Blue Grass. Frequent. Banks of the river. Also, along wooded trails and roadsides. #106 Grainger.

Schizachyrium scoparium (Michx.) Nash; Little Bluestem. Frequent. dry woods and fields. Partial to trails and woodland margins. [*Andropogon scoparius* Michx.]. #277 Hancock.*

Secale cereale L.; Rye. Scarce. Bottomland fields. Probably escaped from cultivation. Native to Europe. #230 Claiborne.*

Setaria pumila (Poir.) Roem. & Schult.; Foxtail Grass. Frequent. Roadsides, fields, and margins. Native to Europe. [*S. glauca* (L.) P. Beauv.; *S. lutescens* (Weigel) F. T. Hubb.]. #269, #315 Claiborne, Hancock.*

Sorghastrum nutans (L.) Nash; Indian Grass. Occasional. Margins and trails near dry woodlands. #478 Grainger.*

Tridens flavus (L.) A. S. Hitchc.; Purpletop. Common. Roadsides, fields, and other openings. [*Triodia flava* (L.) Smyth]. #465 Grainger.*

PONTEDERIACEAE

Heteranthera dubia (Jacq.) Macmill.; Water Star Grass. Occasional. Submersed aquatic plant. Partial to shallow riffle areas of the river. #215, #301 Claiborne, Hancock.*

POTAMOGETONACEAE

Potamogeton

nodosus Poir.; American Pondweed. Frequent. Submersed aquatic plant in varying depths of water in the river. #212, #299 Claiborne, Hancock.*

pectinatus L.; Sago Pondweed. Infrequent. Submersed aquatic plant of shallow to mid-level depths of the river. #302 Hancock.

SMILACACEAE

Smilax

bona-nox L.; Catbrier, Greenbrier. Frequent. Disturbed woods and roadsides. #50 Grainger.

ecirrata (Engelm. ex Kunth) S. Watson var. hugeri (Small) H. E. Ahles; Catbrier, Greenbrier. Infrequent. Rich woods along the river. [*S. hugeri* (Small) Norton ex Pennell]. #113 Hancock.*

glauca Walter; Catbrier, Greenbrier. Common. Woodland margins and fields. #49 Grainger.

TYPHACEAE

Typha latifolia L.; Cat-tail. Scarce. Wet roadside ditches and seeps. #254 Claiborne.*

ANGIOSPERMAE (DICOTS)

ACANTHACEAE

Justicia americana (L.) Vahl; Water Willow. Common. River banks, islands, and gravel bars. #295 Hancock.*

Ruellia strepens L.; Wild Petunia. Occasional. Roadsides and trails near dry woods. #215, #376 Grainger, Hancock.*

ACERACEAE

Acer

negundo L.; Box Elder. Common. Rich forests along the river. #168 Hancock.*

rubrum L.; Red Maple. Common. Low woods and banks of the river. #122 Hancock.*

saccharinum L.; Silver Maple. Occasional. Flood plains and banks of the river. #251 Hancock.*

saccharum Marshall; Sugar Maple. Common. Rich woods along the river. #28, #523 Grainger, Hancock.*

spicatum Lam.; Mountain Maple. Very Rare. Less than ten individuals found in low rocky woods at Posey Bend. Probably disjunct from the Blue Ridge province. #148 Claiborne.

AMARANTHACEAE

Amaranthus spinosus L.; Thorny Pigweed. Frequent. Open areas near the river, gravel bars, and muddy banks. Native to Tropical America. A Pantropical weed. #334 Grainger.*

ANACARDIACEAE

Rhus

aromatica Aiton; Fragrant Sumac. Occasional. Rock outcrops in upland fields. #268 Hancock.

glabra L.; Smooth Sumac. Common. Fields and woodland margins. #253, #343 Claiborne, Grainger.*

ANNONACEAE

Asimina triloba (L.) Dunal; Pawpaw. Common. Rich woods along the river. #66 Grainger.

APIACEAE

Chaerophyllum tainturieri Hook.; Wild Chervil. Frequent. Roadsides and fields. #114 Hancock.*

Cicuta maculata L.; Water Hemlock. River and stream banks, islands, and gravel bars. #214, #424 Claiborne, Hancock.*

Cryptotaenia canadensis (L.) DC.; Honewort. Frequent. Wet woods along the river. #170 Hancock.*

Daucus carota L.; Wild Carrot, Queen Anne's Lace. Common. Fields, roadsides, and other waste places. Native to Eurasia. #148 Claiborne.

Osmorhiza claytonii (Michx.) C. B. Clarke; Sweet Cicely. Rich woods often along streams. #125 Hancock.*

Sanicula

canadensis L.; Snakeroot. Common. Rich woods, often along trails. #458 Hancock.*

odorata (Raf.) Pryer & Phillippe; Snakeroot. Frequent. Low woods along the river. [S. gregaria E. P. Bicknell]. #99 Grainger.*

Taenidia integerrima (L.) Drude; Yellow Pimpernel. Occasional. Roadsides and dry woodland trails. #130 Hancock.*

Thaspium barbinode (Michx.) Nutt.; Meadow Parsnip. Common. Rich woods along the river. #124 Hancock.*

APOCYNACEAE

Apocynum cannabinum L.; Indian Hemp. Occasional. Dry gravel bars and open woods. #211 Claiborne.

Vinca minor L.; Periwinkle. Infrequent. Roadside banks and other disturbed areas. #92 Claiborne.*

ARALIACEAE

Panax quinquefolius L.; Ginseng, Sang. Very Rare. Only a couple of plants found along a rich wooded slope at Lawson Bend. #115 Hancock.*

ARISTOLOCHIACEAE

Aristolochia macrophylla Lam.; Dutchman's Pipe. Frequent. Rich woods along the river. [*A. durior* Hill]. #73 Grainger.*

Asarum canadense L.; Wild Ginger. Occasional. Rich woods. Often on talus slopes. #128 Hancock.

Hexastylis arifolia (Michx.) Small var. ruthii (Ashe) H. L. Blomq.; Little Brown Jug. Frequent. Woodlands along the river from low to mid-slope. #64 Grainger.

ASCLEPIADACEAE

Asclepias

quadrifolia Jacq.; Whorled Milkweed. Occasional. Woods along the river. #119 Hancock.

syriaca L.; Milkweed. Frequent. Fields, roadsides, and other open disturbed areas. #212 Hancock.*

tuberosa L.; Butterfly Weed. Frequent. Roadsides and fields. #199 Grainger.

Cynanchum laeve (Michx.) Pers.; Swallow-wort. Occasional. Islands, gravel bars, and other disturbed sites. [*Ampelamus albidus* (Nutt.) Britton]. #207 Claiborne.

ASTERACEAE

Ageritina altissima (L.) R. M. King & H. Rob.; White Snakeroot. Common. Rich woods along the river. [*Eupatorium rugosum* Houttuyn; *E. roanense* Small]. #371, #414, #520 Claiborne, Grainger, Hancock.

Ambrosia

artemisiifolia L.; Common Ragweed. Common. Fields and other disturbed sites. #489 Grainger.

trifida L.; Giant Ragweed. Common. Fields and other disturbed sites. #390 Grainger.

Antennaria plantaginifolia (L.) Richardson; Pussy-toes, Ladies'-tobacco. Occasional. Dry open woods and roadsides. #36 Hancock.*

Artemisia annua L.; Sweet Wormwood. Occasional. Fields and other disturbed sites. Native to Asia and Eastern Europe. #290 Grainger.*

Aster

divaricatus L.; White Wood Aster. Common. Woodlands along the river. #419, #527 Grainger, Hancock.*

lanceolatus Willd.; Aster. Frequent. Roadsides and other open disturbed areas. [*A. simplex* Willd.]. #519 Grainger.

lateriflorus (L.) Britton; Calico Aster. Common. Open disturbed sites, roadsides, and trails. #259, #321 Claiborne, Grainger.

novae-angliae L.; New England Aster. Occasional. Trails and roads through wet woods along the river. [*Virgulus novae-angliae* (L.) Reveal & Keener]. #533 Hancock.

ontarionis Wiegand; Bottomland Aster. Infrequent. Open river banks near wet woods. #322 Grainger.

urophyllus Lindl.; Aster. Occasional. Rich woods along trails. [*A. sagittifolius* Willd.]. #274, #328 Hancock.*

Bidens

bipinnata L.; Spanish Needles. Common. Open woods and roadsides along the river. #272 Hancock.

cernua L.; Beggar's Ticks. Infrequent. Muddy banks of the river. #534 Grainger.

frondosa L.; Beggar's Ticks. Frequent. Wet seeps and gravel bars. #267, #477 Grainger, Hancock.*

polylepis S. F. Blake; Beggar's Ticks. Infrequent. Gravel bars near wet woods. #488 Grainger.*

Cacalia muhlenbergii (Sch. Bip.) Fernald; Great Indian Plantain. Infrequent. Roadsides near rich woods. #289 Claiborne.*

Centaurea maculosa Lam.; Spotted Knapweed. Frequent. Fields and other open disturbed sites. Native to Europe. #189 Grainger.

Chrysanthemum leucanthemum L.; Ox-eye Daisy. Common. Fields and roadsides. Native to Eurasia. [*Leucanthemum vulgare* Lan.]. #137 Grainger.

Cichorium intybus L.; Chicory. Common. Fields, roadsides, and other open disturbed sites. Native to Europe. #247 Grainger.*

Cirsium

discolor (Muhl. ex Willd.) Spreng.; Thistle. Occasional. Fields and open woods along the river. [*Carduus discolor* Muhl. ex Willd.]. #398 Grainger.

vulgare (Savi) Ten.; Bull Thistle. Frequent. Fields and other open disturbed sites. Native to Eurasia. #232 Claiborne.*

Conoclinum coelestinum (L.) DC.; Mistflower. Occasional. Wet meadows and openings along the river. [*Eupatorium coelestinum* L.] #381 Grainger.*

Conyza canadensis (L.) Cronquist; Horseweed. Frequent. Fields, roadsides, and other open disturbed sites. [*Erigeron canadensis* L.]. #396 Grainger.

Coreopsis major Walter; Tickseed Sunflower. Frequent. Roadsides, fields, and dry open woods. #146, #231 Claiborne, Hancock.*

Doellingeria infirma (Michx.) Greene; Aster. Common. Rich woods along the river. Often on trails. [*Aster infirmus* Michx.]. #329 Grainger.*

Eclipta prostrata (L.) L.; Infrequent. Muddy banks along the river. New World Native. Now Pantropical Weed. [*E. alba* (L.) Hassk.]. #328 Grainger.*

Elephantopus

carolinianus Raeusch.; Elephant's Foot. Frequent. Woods along the river. Often near openings and trails. #392 Grainger.

tomentosus L.; Elephant's Foot. Infrequent. Dry woodland margins. #230 Grainger.

Erigeron

annuus (L.) Pers.; Daisy Fleabane. Common. Roadsides and fields throughout the study area. #195, #278 Grainger, Hancock.

philadelphicus L.; Daisy Fleabane. Infrequent. Fields and roads along the river. #75 Grainger.*

pulchellus Michx.; Robin's Plantain. Occasional. Trails along rich wooded slopes. #131 Hancock.

strigosus Muhl. ex Willd.; Daisy Fleabane. Common. Roads, fields, and other disturbed places. #261 Hancock.*

Eupatorium

album L. var. vaseyi (Porter) Cronquist; White Thoroughwort. Occasional. Dry upland woods and fields. #344 Grainger.

hyssopifolium L.; Hyssop-leaved Thoroughwort. Infrequent. Dry fields and open areas. [*E. hyssopifolium* L. var. *laciniatum* A. Gray]. #476 Grainger.*

perfoliatum L.; Boneset. Occasional. Open wet areas near seeps and streams. #511 Claiborne.*

purpureum L.; Joe-pye-weed. Common. Rich wooded slopes. [*Eupatoriadelphus purpureus* (L.) R. M. King & H. Rob.]. #262, #330 Grainger, Hancock.*

sessilifolium L.; Upland Boneset. Occasional. Dry woodland margins. #460 Grainger.*

Galinsoga quadriradiata Ruiz & Pav.; Peruvian Daisy. Clearings along the river. Native to Central & South America. [*G. ciliata* (Raf.) Blake]. #294, #361 Grainger, Hancock.*

Helenium autumnale L.; Sneezeweed. Occasional. River banks and open wet areas. #240, #514 Claiborne, Hancock.

Helianthus

decapetalus L.; Sunflower. Occasional. Fields and woodland margins near the river. #242 Hancock.*

microcephalus Torr. & A. Gray; Sunflower. Frequent. Fields, dry woodland trails, and roadside banks. #441, #452 Claiborne, Hancock.*

tuberosus L.; Jerusalem Artichoke. Occasional. Fields, roadsides, and other open areas. #245, #309 Claiborne, Hancock.*

Hieracium gronovii L.; Hawkweed. Occasional. Dry fields and roadsides. #389 Grainger.

Iva annua L.; Marsh Elder. Infrequent. Gravel bars and open disturbed sites along the river. May not be native to North America. #463 Grainger.*

Krigia biflora (Walter) S. F. Blake; Dwarf Dandelion. Occasional. Fields and roadsides along woodland borders. #53, #106 Claiborne, Hancock.*

Lactuca

canadensis L.; Wild Lettuce. Common. Fields and roadsides. #316 Claiborne.

floridana (L.) Gaertn.; Woodland Lettuce. Occasional. Fields and roads near forest margins. #393, #430 Claiborne, Gainger.*

serriola L.; Prickly Lettuce. Common. Fields and other open disturbed sites. Native to Europe. [*L. scariola* L.]. #383 Grainger.

Liatris squarrosa (L.) Michx.; Blazing Star, Gay Feather. Infrequent. Dry fields and openings along the river. #341 Grainger.*

Polymnia

canadensis L.; Leaf Cup. Frequent. Wet woods along roadsides. #190 Grainger.

uvedalia L.; Bearsfoot. Common. Woods and fields near the river. Often along trails and roadsides. #145, #384 Claiborne, Grainger.

Prenanthes altissima L.; Rattlesnake Root. Frequent. Woods along the river. #279, #499 Grainger, Hancock.*

Rudbeckia

fulgida Aiton; Orange Coneflower. Infrequent. Open areas along the river. #356 Grainger.

hirta L.; Black-eyed Susan. Common. Fields and roadsides throughout the study area. #213 Hancock.*

laciniata L.; Coneflower. Occasional. River banks and wet fields. #225 Grainger.

triloba L.; Thin-leaved Coneflower. Occasional. Woodland borders and fields along the river. #237, #357 Claiborne, Grainger.*

Senecio

anonymus A. W. Wood; Squaw-weed. Common. Fields and other open areas. [*S. smallii* Britton]. #59, #226 Claiborne, Hancock.*

aureus L.; Golden Groundsel. Infrequent. Wet woods along the river. #34, #85 Grainger, Hancock.

obovatus Muhl. ex Willd.; Groundsel, Ragwort. Occasional. Rocky wooded slopes. #10 Grainger.

Silphium

perfoliatum L.; Cup Leaf. Occasional. Wet woods along the river. #316 Grainger.*

trifoliatum L.; Rosin Weed. Infrequent. Woodland borders and fields along the river. #197 Hancock.*

Solidago

arguta Aiton var. caroliniana A. Gray; Goldenrod. Frequent. Fields, roadsides, and dry open woods. #331 Grainger.*

canadensis L.; Goldenrod. Common. Fields and other open places. [*S. altissima* L.]. #373 Hancock.*

curtisii Torr. & A. Gray; Goldenrod. Occasional. Rich woods along the river. #320 Grainger.*

flexicaulis L.; Goldenrod. Occasional. Rich woods along the river. #297, #508 Claiborne, Grainger.*

gigantea Aiton; Goldenrod. Common. Fields and roadsides. #399, #423 Grainger, Hancock.*

nemoralis Aiton; Goldenrod. Frequent. Dry woods and fields. #462 Grainger.*

rugosa Aiton ssp. aspera (Aiton) Cronquist; Goldenrod. Frequent. Fields and woodland borders. [*S. rugosa* var. *aspera* (Aiton) Fernald]. 3459 Grainger.*

ulmifolia Muhl.; Goldenrod. Roadsides along dry woodlands. #422 Hancock.*

Sonchus asper (L.) Hill; Prickly Sow Thistle. Frequent. Disturbed areas along the river. Native to Europe. #244 Hancock.*

Taraxacum officinale Weber; Common Dandelion. Common. Pastures and other disturbed areas. Native to Eurasia. #33 Hancock.*

Tussilago farfara L.; Coltsfoot. Scarce. Upland trails and clearings. Native to Eurasia. #194 Hancock.

Verbesina

alternifolia (L.) Britton; Flatseed Sunflower. Frequent. Openings along the river. #263, #494 Claiborne, Grainger.*

occidentalis (L.) Walter; Yellow Crown-beard. Frequent. Fields, woodland margins, and other disturbed sites. #464 Grainger.*

virginica L.; Flatseed Sunflower. Occasional. Fields and clearings along the river. #406, #505 Claiborne, Grainger.*

Vernonia gigantea (Walt.) Trel. ex Branner & Coville; Ironweed. Occasional. Fields and roadsides near wet woods. [*V. altissima* Nutt.]. #413 Claiborne.*

Xanthium strumarium L.; Common Cocklebur. Frequent. Gravel bars and open disturbed sites along the river. New World Native. #491 Grainger.

BALSAMINACEAE

Impatiens

capensis Meerb.; Spotted Touch-me-not. Common. Rich woods along roads and trails. #405 Claiborne.

pallida Nutt.; Pale Touch-me-not. Common. Rich woods along roads and trails. #160 Hancock.

BERBERIDACEAE

Caulophyllum thalictroides (L.) Michx.; Blue Cohosh. Common. Rich woods along the river. #52 Grainger.

Jeffersonia diphylla (L.) Pers.; Twinleaf. Rich woods along the river. Often on talus slopes. #35 Hancock.

Podophyllum peltatum L.; May Apple. Rich woods along the river. Also, persisting in some fields and pastures. #72 Grainger.

BETULACEAE

Betula alleghaniensis Britton; Yellow Birch. Rich woods close to the river. [*B. lutea* F. Michx.]. #145 Hancock.*

Carpinus caroliniana Walter; Blue Beech, Ironwood. Common. Low woods along the river. [*C. caroliniana* Walter ssp. *virginiana* (Marshall) Furlow]. #84 Grainger.

Ostrya virginiana (Mill.) K. Koch; Hop Hornbeam. Common. Rich woods along the river. #9 Grainger.*

BIGNONIACEAE

Bignonia capreolata L.; Cross Vine. Common. Open woods and forest margins. [*Anisostichus capreolata* (L.) Bureau]. #88, #238 Claiborne, Grainger.*

Campsis radicans (L.) Seem. ex Bureau; Trumpet Creeper. Common. Roadsides, fencerows, and thickets. #186, #237 Claiborne, Grainger.*

BORAGINACEAE

Cynoglossum virginianum L.; Wild Comfrey. Occasional. Woodland trails and other clearings. #117 Hancock.*

Lithospermum canescens (Michx.) Lehm.; Hoary Puccoon. Scarce. Dry roadside embankments. #57 Hancock.*

Mertensia virginica (L.) Pers. ex Link; Virginia Bluebells. Scarce. Flood plains near rich woods. #21 Hancock.*

Myosotis macrosperma Engelm.; Scorpion Grass. Clearings and trails along the river. #81 Grainger.

BRASSICACEAE

Alliaria petiolata (M. Bieb.) Cavara & Grande; Garlic Mustard. Occasional. Roadside banks and other disturbed areas. [*A. officinalis* Andrz.]. #13, #235 Claiborne, Grainger.*

Arabis laevigata (Muhl.) Poir.; Smooth Rock Cress. Frequent. Rich woods along the river. Often on rocky ledges. #37, #63 Grainger, Hancock.

Barbarea vulgaris R. Br.; Winter Cress. Frequent. Fields and other open disturbed sites. Native to Eurasia. #38 Grainger.*

Brassica nigra (L.) W. D. J. Koch; Black Mustard. Infrequent. Fields, roadsides, and other open disturbed sites. Native to Europe. #185, #305 Grainger, Hancock.*

Cardamine rhomboidea (Pers.) DC.; Bitter Cress. Occasional. Mesic woods along the river. Often on talus slopes. [*C. bulbosa* (Shreb.) Britton, Sterns & Poggenb.]. #55 Hancock.*

Dentaria
heterophylla Nutt.; Toothwort. Frequent. Rich woods along the river. [*Cardamine angustata* O. E. Schulz]. #41 Grainger.

laciniata Muhl. ex Willd.; Toothwort. Frequent. Rich woods along the river. [*Cardamine concatenata* (Michx.) H. E. Ahles; *C. laciniata* (Muhl. ex Willd.) A. W. Wood]. #4 Grainger.

Nasturtium officinale R. Br.; Water Cress. Occasional. Wet roadside ditches, streams, and margins of the river. Native to Eurasia. [*Rorippa nasturtium-aquaticum* (L.) Hayek]. #56 Hancock.*

Rorippa palustris (L.) Besser ssp. fernaldiana (Butters & Abbe) Jonsell; Yellow Cress. Occasional. Wet banks of the river. [*R. islandica*, misapplied]. #311 Hancock.*

Thlaspi perfoliatum L.; Penny Cress. Frequent. Fields and other open disturbed sites. Native to Eurasia. #16 Grainger.

CALYCANTHACEAE

Calycanthus

floridus L. var. floridus; Sweetshrub. Frequent. Banks of the river near rich woods. #159 Grainger.*

floridus L. var. glaucus (Willd.) Torr. & A. Gray; Sweetshrub. Frequent. Banks of the river near rich woods. [*C. floridus* L. var. *laevigatus* (Willd.) Torr. & A. Gray; *C. floridus* L. var. *oblongifolius* (Nutt.) Boufford & Spongberg]. #160 Grainger.

CAMPANULACEAE

Campanula

americana L.; Tall Bellflower. Common. Mesic woods along the river. Partial to roadsides. #251 Claiborne.*

divaricata Michx.; Southern Harebell. Occasional. Roadcuts and rocky ledges near woodlands. #449 Hancock.*

Lobelia

cardinalis L.; Cardinal Flower. Common. Low woods along the river's edge. #497 Grainger.*

inflata L.; Indian Tobacco. Occasional. Open woods and river banks. #208, #337 Claiborne, Grainger.*

siphilitica L.; Great Blue Lobelia. Frequent. Mesic woods, often on roadsides. #402 Grainger.

spicata Lam.; Occasional. Low woodland borders along the river. #284 Hancock.*

Triodanis perfoliata (L.) Nieuwl.; Venus' Looking Glass. Frequent. Fields and other disturbed sites along the river. [*Specularia perfoliata* (L.) DC.]. #81 Grainger.*

CAPRIFOLIACEAE

Lonicera japonica Thunb.; Japanese Honeysuckle. Common. Roadsides, fields, and other disturbed areas. Native to East Asia. #159 Hancock.*

Sambucus canadensis L.; Common Elderberry. Common. Woodland margins and fields along the river. #220, #258 Claiborne, Hancock.*

Symphoricarpos orbiculatus Moench; Coral Berry. Occasional. Open woods along roadsides. #507 Claiborne.

Viburnum

acerifolium L.; Maple-leaf Arrowwood. Frequent. Rich woods along the river. #467 Grainger.

prunifolium L.; Black Haw. Frequent. Rich woods along the river. #97, #310 Claiborne, Grainger.

CARYOPHYLLACEAE

Cerastium semidecandrum L.; Mouse-ear Chickweed. Occasional. Open disturbed sites next to the river. Native to Eurasia. #335 Grainger.

Dianthus armeria L.; Deptford Pink. Frequent. Fields and roadsides. Native to Europe. #232 Claiborne.

Saponaria officinalis L.; Bouncing Bet. Occasional. Fields and other disturbed sites near the river. Old World Native. #221 Claiborne.

Silene

stellata (L.) W. T. Aiton; Starry Campion. Occasional. Clearings near low woods along the river. #354 Grainger.

virginica L.; Fire Pink. Frequent. Woodlands along the river. Often on roadsides. #48, #156 Grainger, Hancock.*

Stellaria

corei Shinners; Tennessee Chickweed. Occasional. Low woods along the river. Often on trails. [*S. tennesseensis* (C. Mohr) Strausb. & Core]. #62 Grainger.*

media (L.) Vill.; Chickweed. Common. Open disturbed areas near the river. Old World Native. #38 Hancock.*

CELASTRACEAE

Celastrus scandens L.; Bittersweet. Occasional. Old fields and woodland margins. #78 Grainger.

Euonymus americanus L.; Strawberry Bush, Hearts-a-bustin'. Common. Open woods along the river. #161 Grainger.

CHENOPODIACEAE

Chenopodium ambrosioides L.; Mexican Tea. Frequent. Muddy banks of the river. Native to Tropical America. #289 Grainger.*

CLUSIACEAE

Hypericum

perforatum L.; St. John's-wort. Frequent. Fields and roadsides throughout the study area. Native to Europe. #223 Claiborne.*

prolificum L.; St. John's-wort. Occasional. Fields and banks of the river. #216 Grainger.*

punctatum Lam.; St. John's-wort. Common. Fields, roadsides, and woodland borders. #192 Grainger.

CONVOLVULACEAE

Calystegia sepium (L.) R. Br.; Hedge Bindweed. Frequent. Fields and open banks of the river. #318 Hancock.*

Cuscuta gronovii Willd.; Dodder, Love Vine. Frequent. River banks, small islands, and mesic gravel bars. #322, #401 Grainger, Hancock.*

Ipomoea

pandurata (L.) G. Mey.; Man Root. Frequent. Roadsides and other disturbed sites. #292, #293 Grainger, Hancock.*

purpurea (L.) Roth; Common Morning Glory. Frequent. Roadsides and other disturbed sites. Native to Tropical America. #415, #453 Claiborne, Grainger.

CORNACEAE

Cornus

alternifolia L. f.; Alternate-leaved Dogwood. Frequent. Rich woods along the river. #132, #219 Claiborne, Hancock.*

amomum Mill.; Silky Cornel. Frequent. Banks of the river. #205 Grainger.

florida L.; Flowering Dogwood. Common. Woodlands, fields, and roadsides throughout the study area. #45 Grainger.

CRASSULACEAE

Sedum ternatum Michx.; Stonecrop. Common. Mesic rocky woods along the river. #44 Grainger.

CUCURBITACEAE

Sicyos angulatus L.; Bur Cucumber. Occasional. Clearings along the river. #446 Claiborne.

DIPSACACEAE

Dipsacus fullonum L.; Wild Teasel. Occasional. Roadsides and fields. Native to Europe. [*D. sylvestris* Huds.]. #251 Grainger.*

ERICACEAE

Chimaphila maculata (L.) Pursh; Spotted Wintergreen, Pipsissewa. Common. Dry upland woods. #67 Grainger.*

Oxydendrum arboreum (L.) DC.; Sourwood. Common. Dry to mesic woods. #129, #157 Grainger, Hancock.*

Vaccinium

corymbosum L.; Highbush Blueberry. Frequent. Dry woodlands and roadsides. [*V. constablaei* A. Gray; *V. simulatum* Small]. #456 Claiborne.*

fuscatum Aiton; Blueberry. Occasional. Mesic woods in upslope locations. [*V. atrococcum* (A. Gray) A. Heller]. #304 Grainger.*

pallidum Aiton; Lowbush Blueberry. Common. Dry upland woods. [*V. vacillans* Kalm ex Torr.]. #163, #329 Claiborne, Grainger.

stamineum L.; Squaw Huckleberry, Deerberry. Common. Dry upland woods. #283 Grainger.

EUPHORBIACEAE

Acalypha virginica L.; Three-seeded Mercury. Frequent. Disturbed areas along the river. #484 Grainger.

Croton monanthogynus Michx.; Occasional. Clearings and other open areas. #386 Grainger.

Euphorbia

corollata L.; Flowering Spurge. Common. Woodland margins and clearings. #336, #374 Grainger, Hancock.

maculata L.; Wartweed, Milk Purslane. Common. Banks of the river, roadsides, and other open disturbed sites. #286 Grainger.*

nutans Lag.; Occasional. Roadsides and other disturbed areas. [*E. preslii* Guss.; *Chamaesyce nutans* (Lag.) Small]. #451 Hancock.*

FABACEAE

Albizia julibrissin Durazz.; Mimosa. Occasional. Roadsides and clearings. Native to Tropical Asia. #529 Grainger.*

Amorpha fruticosa L.; Occasional. River banks and wet woods. #198 Claiborne.*

Amphicarpaea bracteata (L.) Fernald; Hog Peanut. Occasional. Roadsides near woodland borders. #429 Claiborne.

Apios americana Medik.; Groudnut. Occasional. Fields along the river. #244 Hancock.*

Astragalus canadensis L.; Canada Milk Vetch. Occasional. Roadsides and woodland borders along the river. #410 Claiborne.*

Cercis canadensis L.; Redbud. Common. Woodlands throughout the study area. #11 Grainger.

Chamaecrista nictitans (L.) Moench; Wild Sensitive Plant. Common. Roadsides, fields, and other disturbed areas. [Cassia nictitans L.]. #388 Grainger.

Desmodium

cuspidatum (Muhl. ex Willd.) Loudon; Beggar's Lice, Tick Trefoil. Occasional. Woodland trails along the river. #443 Hancock.*

glutinosum (Muhl. ex Willd.) A. W. Wood; Beggar's Lice, Tick Trefoil. Frequent. Rich woods along the river. #288 Hancock.*

laevigatum (Nutt.) DC.; Beggar's Lice, Tick Trefoil. Frequent. Fields, roadsides, and clearings along the river. #385 Grainger.*

nudiflorum (L.) DC.; Beggar's Lice, Tick Trefoil. Frequent. Rich woods along the river. Often on trails. #342 Grainger.

paniculatum (L.) DC.; Beggar's Lice, Tick Trefoil. Common. Woodlands throughout the study area. #195, #420 Claiborne, Hancock.*

pauciflorum (Nutt.) DC.; Beggar's Lice, Tick Trefoil. Occasional. Rich woods along the river. #355, #428 Claiborne, Grainger.*

Galactia volubilis (L.) Britton; Milk Pea. Infrequent. Open disturbed sites near the river. #417 Claiborne.

Lathyrus latifolius L.; Everlasting Pea. Frequent. Fields and other disturbed areas along the river. Native to Southern Europe. #236 Claiborne.

Lespedeza

cuneata (Dum. Cours.) G. Don; Yellow Bush Clover. Common. Fields, roadsides, and waste areas. Native to East Asia. #378 Grainger.*

procumbens Michx.; Low Bush Clover. Scarce. Upland rock outcrops. #270 Hancock.*

virginica (L.) Britton; Bush Clover. Frequent. Roadsides, fields, and other disturbed sites. #416 Claiborne.*

Medicago lupulina L.; Black Medic. Common. Fields, roadsides, and waste areas. Native to Eurasia. #155 Hancock.*

Melilotus

alba Medik.; White Sweet Clover. Common. Fields and roadsides. Native to Eurasia. #144, #264 Grainger, Hancock.*

officinalis (L.) Pall.; Yellow Sweet Clover. Common. Fields and roadsides. Native to Eurasia. #150 Hancock.*

Pueraria lobata (Willd.) Ohwi; Kudzu. Common. Fields and roadsides. Native to Japan. #435 Claiborne.

Robinia

hispida L.; Bristly Locust. Occasional. Roadsides and other disturbed areas. #108 Claiborne.

pseudoacacia L.; Black Locust. Frequent. Rich woods, rock outcrops, roadsides, and field margins. #8, #109 Claiborne, Grainger.*

Senna

hebecarpa (Fernald) H. S. Irwin & Barneby; Wild Senna. Frequent. Low fields and banks of the river. [*Cassia hebecarpa* Fernald]. #307 Hancock.*

marilandica (L.) Link; Wild Senna. Occasional. Roadsides, fields, and woodland margins. [*Cassia marilandica* L.]. #409 Claiborne.*

Stylosanthes biflora (L.) Britton, Sterns & Poggenb.; Pencil Flower. Scarce. Roadsides in upland areas. [*S. riparia* Kearney]. #421 Hancock.*

Trifolium

pratense L.; Red Clover. Common. Fields, pastures, and other open disturbed areas. Native to Europe. #154 Hancock.*

repens L.; White Clover. Common. Fields, pastures, and other open disturbed areas. Native to Eurasia. #143 Grainger.

Vicia

sativa L. ssp. nigra (L.) Ehrend.; Narrow-leaved Vetch. Frequent. Roadsides, fields, and waste places. Native to Southern Europe. [*V. angustifolia* L.]. #39 Grainger.

villosa Roth; Hairy Vetch. Occasional. Roadsides, fields, and other disturbed sites. Native to Europe. #153 Hancock.*

FAGACEAE

Castanea

dentata (Marshall) Borkh.; American Chestnut. Infrequent. Only present as stump sprouts in mesic woods. #461 Grainger.

pumila (L.) Mill.; Allegheny Chinquapin. Frequent. Dry upland woods. #284 Grainger.

Fagus grandifolia Ehrend.; American Beech. Common. Rich mesic woods. [*F. grandifolia* Ehrend. var. *caroliniana* (London) Fernald & Rehder]. #438 Claiborne.*

Quercus

alba L.; White Oak. Common. Woodlands throughout the study area. #88 Grainger.

falcata Michx.; Southern Red Oak. Common. Dry upland forests and river bluffs. #46 Grainger.

montana Willd.; chestnut Oak. Common. Dry upland forests. [*Q. prinus* L.]. #84, #112 Claiborne, Grainger.*

muhlenbergii Engelm.; Chinquapin Oak. Frequent. River bluffs and dry upland forests. #48 Grainger.

rubra L.; Northern Red Oak. Common. Rich woods along the river. #82, #108 Claiborne, Grainger.*

shumardii Buckley; Shumard Oak. Frequent. River bluffs and rich woods along the river. #107, #125 Claiborne, Hancock.*

FUMARIACEAE

Dicentra

canadensis (Goldie) Walp.; Squirrel Corn. Frequent. Rich woods along the river. Often on talus slopes. #20 Hancock.*

cucullaria (L.) Bernh.; Dutchman's Breeches. Frequent. Rich woods along the river. Often on talus slopes. #40 Hancock.*

GENTIANACEAE

Sabatia angularis (L.) Pursh; Rose Pink. Occasional. Low woods along the river. #229 Grainger.

GERANIACEAE

Geranium

columbinum L.; Dovesfoot Cranesbill. Infrequent. Rock outcrops in upland fields. Native to Europe. #178 Grainger.*

maculatum L.; Wild Geranium. Common. Rich woods along the river. #42, #149 Grainger, Hancock.*

HAMAMELIDACEAE

Hamamelis virginiana L.; With Hazel. Frequent. Woodlands along the river. #51 Hancock.

Liquidambar styraciflua L.; Sweet Gum. Common. Low woods along the river. #184 Grainger.

HIPPOCASTANACEAE

Aesculus flava Sol.; Yellow Buckeye. Common. Rich mesic woods along the river. [*A. octandra* Marshall]. #29, #109 Claiborne, Hancock.*

HYDROPHYLLACEAE

Hydrophyllum

canadense L.; Waterleaf. Frequent. Low mesic woods along the river. #273 Hancock.*

macrophyllum Nutt.; Waterleaf. Occasional. Low mesic woods along the river. #121 Hancock.*

Phacelia bipinnatifida Michx.; Common. Rich woods along the river. Often on talus slopes. #51 Grainger.

JUGLANDACEAE

Carya

cordiformis (Wangenh.) K. Koch; Bitternut Hickory. Frequent. Dry woods on middle to upper slopes. #183 Hancock.*

glabra (Mill.) Sweet; Pignut Hickory. Frequent. Dry upland woods. #164, #184 Grainger, Hancock.*

ovata (Mill.) K. Koch; Shagbark Hickory. Frequent. Rich woodlands. Usually found mid-slope. #179 Hancock.*

tomentosa (Poir.) Nutt.; Mockernut Hickory. Common. Dry upland woods. #83, #185 Grainger, Hancock.*

Juglans

cinerea L.; Butternut, White Walnut. Infrequent. Rich woods along the river. Large stand of mature fruit-bearing trees near Posey Bend. [*Wallia cinerea* (L.) Alef.]. #2, #147 Claiborne, Grainger.*

nigra L.; Black Walnut. Common. Rich woods along the river. [*Wallia nigra* (L.) Alef.] #369 Hancock.*

LAMIACEAE

Blephilia hirsuta (Pursh) Benth.; Wood Mint. Occasional. Mesic woods. Often along roadsides. #272 Hancock.*

Calamintha nepeta (L.) Savi; Scarce. Rock outcrops in upland fields. Native to Europe. [*Satureja calamintha* (L.) scheele; *S. nepeta* (L.) Scheele]. #269 Hancock.*

Collinsonia canadensis L.; Stoneroot. Occasional. Low mesic woods. #466 Grainger.*

Cunila origanoides (L.) Britton; Stone Mint. Scarce. Dry rocky woods and roadcuts. #450 Hancock.*

Glechoma hederacea L.; Ground Ivy. Frequent. Roadsides and open disturbed areas. Native to Eurasia. #10, #162 Grainger, Hancock.*

Lamium purpureum L.; Dead-nettle. Common. Open disturbed sites. Native to Eurasia. #17, #39 Grainger, Hancock.*

Meehania cordata (Nutt.) Britton; Rare. Rich mesic woods. Only seen in a couple of locations. #179 Hancock.

Mentha x piperita L.; Peppermint. Occasional. roadsides near wet woods. Also, found near seeps in upland rock outcrops. Native to Europe. #444, #509 Claiborne, Hancock.

Monarda
clinopodia L.; Horsemint, Bee Balm. Roadsides and woodland margins. #140, #271 Grainger, Hancock.

fistulosa L.; Wild Bergamot. Occasional. Roadsides and open woods. #260 Hancock.*

Physostegia virginiana (L.) Benth. subsp. praemorsa (Shinners) P. D. Cantino; Obedient Plant. Occasional. River banks and mesic gravel bars. [*P. praemorsa* Shinners; *Dracocephalum virginianum* L.]. #319 Hancock.*

Prunella vulgaris L.; Self Heal. Common. Disturbed sites along the river. Cosmopolitan weed native to Europe. #175 Hancock.*

Pycnanthemum incanum (L.) Michx. ssp. loomisii (Nutt.) Hamer comb. nov., ined.; Mountain Mint. Infrequent. Dry upland woods along roadsides. [*P. loomisii* Nutt.]. #377 Hancock.

Salvia lyrata L.; Lyre-leaved Sage. Common. Disturbed sites along the river. #76, #82 Grainger, Hancock.*

Satureja vulgaris (L.) Fritsch; Infrequent. Moist woodland borders and roadsides. #368 Hancock.

Scutellaria
elliptica Muhl. var. hirsuta (Short & Peter) Fernald; Skullcap. Occasional. Mesic woods along roadsides. #143 Hancock.*

lateriflora L.; Skullcap. Scarce. Mesic woods on talus slopes near the river. #250 Hancock.*

serrata Andr.; Skullcap. Very Rare. Only a couple of individuals seen above a waterfall in a rich wooded area at Lawson Bend. More common in the Blue Ridge province. #113 Hancock.*

Stachys nuttallii Shuttlew. ex Benth.; Hedge Nettle. Occasional. Mesic woodland borders. [S. riddellii House]. #224 Claiborne.*

Teucrium canadense L.; Common. Wet woods and roadsides. #162, #313 Grainger, Hancock.*

LAURACEAE

Lindera benzoin (L.) Blume; Spicebush. Common. Low mesic woods along the river. #5, #85 Grainger, Hancock.*

Sassafras albidum (Nutt.) Nees; Sassafras. Common. Fields and other open disturbed areas. #275 Hancock.*

LOGANIACEAE

Spigelia marilandica L.; Indian Pink. Occasional. Rich woods along the river. #182 Hancock.*

LYTHRACEAE

Cuphea viscosissima Jacq.; Blue Waxweed. Infrequent. Upland rock outcrops. [*C. petiolata* (L.) Koehne]. #271 Hancock.

Lythrum salicaria L.; Purple Loosestrife. Infrequent. Muddy banks of the river. An invasive wetland species. Native to Eurasia. #249 Hancock.*

MAGNOLIACEAE

Liriodendron tulipifera L.; Tulip Poplar. Common. Rich woods. Also a successional species in fields and other open areas. #133 Grainger.

Magnolia

acuminata (L.) L.; Cucumber Tree. Common. Rich woods along the river. #94, #177 Claiborne, Hancock.*

macrophylla Michx.; Bigleaf Magnolia. Occasional. Low mesic woods near the river. #532 Grainger.

tripetala L.; Umbrella Magnolia. Occasional. Rich woods along the river. #243 Hancock.

MENISPERMACEAE

Cocculus carolinus (L.) DC.; Coralbeads. Occasional. Roadsides near woodland margins. #238 Claiborne.*

Menispermum canadense L.; Moonseed. Common. Low woods along the river. Often on trails. #94, #167 Grainger, Hancock.*

MORACEAE

Maclura pomifera (Raf.) C. K. Schneid.; Osage Orange. Occasional. Fields and open banks along the river. #506 Grainger.

Morus rubra L.; Red Mulberry. Common. Low rich woods along the river. #200 Grainger.

NYSSACEAE

Nyssa sylvatica Marshall; Black Gum. Common. Woodlands along the river. #156 Grainger.

OLEACEAE

Forsythia viridissima Lindl.; Golden Bells. Scarce. Roadsides and waste areas. Escaped from cultivation. Native to Eurasia. #36 Hancock.

Fraxinus

americana L.; White Ash. Common. Rich woods along the river. [*F. americana* var. *biltmoreana* (Beadle) J. W. Wright ex Fernald]. #75, #187 Grainger, Hancock.

pennsylvanica Marshall; Green Ash. Common. Flood plains and banks of the river. [*F. pennsylvanica* Marshall var. *subintegerrima* (Vahl) Fernald]. #203 Claiborne.

quadrangulata Michx.; Blue Ash. Occasional. Rich woods along the river. #104 Grainger.

Ligustrum sinense Lour.; Privet. Scarce. Disturbed sites, roadsides, and old homesteads. Old World Native. #167 Hancock.*

ONAGRACEAE

Circaea lutetiana (L.) Asch. & Magnus ssp. canadensis (L.) Asch. & Magnus; Enchanter's Nightshade. Frequent. Rich woodlands. #287, #290 Claiborne, Hancock.*

Ludwigia decurrens Walter; Occasional. Muddy banks of the river. [*Jussiaea decurrens* (Walter) DC.]. #294 Grainger.

Oenothera biennis L.; Evening Primrose. Common. Roadsides and other disturbed sites. #411 Claiborne.

OROBANCHACEAE

Conopholis americana (L.) Wallr.; Cancer Root, Squaw Root. Occasional. Dry upland woods. Primarily a root parasite on oaks. #71 Grainger.*

Epifagus virginiana (L.) Barton; Beech Drops. Common. Rich woods. Parasitic on beech tree roots. #472 Grainger.

OXALIDACEAE

Oxalis

florida Salisb.; Wood Sorrel. Common. Fields and other open disturbed areas. [*O. dillenii* Jacq. var. *florida* (Salisb.) DC.]. #102, #326 Grainger, Hancock.*

fontana Bunge; Wood Sorrel. Frequent. Fields, woodland margins, and other disturbed places. [*O. stricta* sensu auctt., non L.]. #434 Claiborne.*

violaceae L.; Violet Wood Sorrel. Occasional. Rich woods along the river. #74 Grainger.

PAPAVERACEAE

Papaver dubium L.; Poppy. Very Rare. Only one small population scattered along the roadside at the U. S. Highway 25E bridge. Native to Europe. #43 Grainger.*

Sanguinaria canadensis L.; Bloodroot. Common. Rich woods along the river. #2 Grainger.

Stylophorum diphyllum (Michx.) Nutt.; Celandine Poppy. Occasional. Rich woods along the river. #19 Hancock.

PASSIFLORACEAE

Passiflora lutea L.; Yellow Passion Flower. Occasional. Woodland margins and disturbed sites along the river. #327 Grainger.

PHRYMACEAE

Phryma leptostachya L.; Lopseed. Common. Mesic woods along the river. #265 Hancock.

PHYTOLACCACEAE

Phytolacca americana L.; Pokeweed. Common. Fields and open disturbed sites. #198 Grainger.

PLANTAGINACEAE

Plantago

rugelli Decne.; Broadleaved Plantain. Common. Roadsides, fields, and other waste areas. #193, #305, #439 Claiborne, Grainger, Hancock.*

virginica L.; Plantain. Common. Roadsides, fields, and other waste areas. #136 Grainger.

PLATANACEAE

Platanus occidentalis L.; Sycamore. Common. Flood plains, river banks, islands, and gravel bars. #176, #203 Grainger, Hancock.*

POLEMONIACEAE

Phlox

amplifolia Britton; Occasional. Mesic woods, often on roadsides. #408 Claiborne.*

divaricata L.; Blue Phlox. Frequent. Woodlands along the river. Often on talus slopes. [*P. divaricata* L. ssp. *laphamii* (A. W. Wood) Wherry]. #58 Grainger.

ovata L.; Frequent. Rich mesic woods along the river. #134 Hancock.

paniculata L.; Occasional. River banks and mesic gravel bars. #223 Claiborne.*

POLYGONACEAE

Polygonum

caespitosum Blume var. longisetum (Bruijn) A. N. Steward; Smartweed, Knotweed. Frequent. Wet clearings along the river. Native to Southeast Asia. #433, #492 Claiborne, Grainger.*

cuspidatum Siebold & Zucc.; Mexican Bamboo. Very Rare. Only a single individual found along an upland roadside near woods. Native to Japan. Escaped from cultivation. #448 Hancock.*

pensylvanicum (L.) Small; Smartweed, Knotweed. Common. Disturbed areas along the river. #447, #471 Grainger, Hancock.*

punctatum Elliott; Smartweed, Knotweed. Common. Wet areas along the river. #432, #445 Claiborne, Hancock.*

scandens L.; Smartweed, Knotweed. Common. Fields and open disturbed sites along the river. [*P. cristatum* Engelm. & A. Gray]. #427 Grainger.

virginianum L.; Jumpseed. Frequent. Mesic woods along the river. [*Antenoron virginiana* (L.) Roberty & Vautier; *Tovara virginiana* (L.) Raf.]. #431 Claiborne.

Rumex

conglomeratus Murray; Dock. Occasional. Open rocky woods along the river. Native to Europe. #153 Claiborne.*

crispus L.; Curly Dock. Common. Roadsides, fields, and other disturbed areas. #169 Hancock.*

PORTULACACEAE

Claytonia

caroliniana Michx.; Spring Beauty. Common. Rich woods along the river. #18 Hancock.*

virginica L.; Spring Beauty. Common. Rich woods along the river. #33 Hancock.*

PRIMULACEAE

Lysimachia

ciliata L.; Loosestrife. Common. Mesic woods along the river. #233, #315, #362 Claiborne, Grainger, Hancock.

nummularia L.; Moneywort. Frequent. Streams, roadside ditches, and margins of the river. Native to Europe. #317 Hancock.*

tonsa (A. W. Wood) R. Knuth; Smooth Loosestrife. Infrequent. Rocky woods along the river. #196 Hancock.*

Samolus parviflorus Raf.; Brookweed. Occasional. Wet banks of the river. [*S. valerandi* L. ssp. *parviflorus* (Raf.) Hulten]. #339 Grainger.

RANUNCULACEAE

Anemone virginiana L.; Thimbleweed. Common. Rich woods. Often along roadsides. #166 Hancock.*

Aquilegia canadensis L.; Columbine. Frequent. Rich wooded slopes on cliffs and rocks. #26 Grainger.

Cimicifuga

racemosa (L.) Nutt.; Black Cohosh. Occasional. Rich rocky woods along the river. #154, #161 Claiborne, Hancock.

rubifolia Kearney; Black Cohosh. Very Rare. Only a few individuals found along a rocky slope at Posey Bend. #218 Claiborne.

Clematis

viorna L.; Leatherflower. Common. Open woods along the river. #118 Hancock.

virginiana L.; Virgin's Bower. Common. Low woods along the river. #248, #382 Grainger, Hancock.*

Delphinium tricorne Michx.; Dwarf Larkspur. Occasional. Rich woods along the river. Often on talus slopes. #115 Hancock.

Hepatica

acutiloba DC.; Liverleaf. Common. Rich rocky woods. [*H. nobilis* Mill. var. *acuta* (Pursh) Steyerm.]. #7 Grainger.*

americana (DC.) Ker Gawl.; Liverleaf. Occasional. Rich woods along the river. [*H. nobilis* Mill. var. *obtusa* (Pursh) Steyerm.]. #144 Hancock.*

Ranunculus

abortivus L.; Crowfoot. Common. Woodland borders and roadsides. #12, #69 Grainger, Hancock.*

bulbosus L.; Bulbous Buttercup. Frequent. Low fields and pastures near the river. Native to Europe. #64 Hancock.*

fascicularis Muhl. ex Bigelow; Northern Swamp Buttercup. Infrequent. Fields and roadsides along the river. #257 Hancock.

recurvatus Poir.; Hooked Buttercup. Common. Rich woods along the river. #70, #95 Grainger, Hancock.*

Thalictrum

dioicum L.; Early Meadow Rue. Frequent. River banks in rich woods. #28 Grainger.*

pubescens Pursh; Meadow Rue. Frequent. Low woods along the river. Often on trails. [*T. polygalum* Muhl.]. #363 Grainger.*

thalictroides (L.) Eames & Boivin; Rue Anemone. Common. Rich woods along the river. [*Anemonella thalictroides* (L.) Spach]. #46 Grainger.

RHAMNACEAE

Rhamnus caroliniana Walter; Carolina Buckthorn. Frequent. Rich wooded slopes. #503 Grainger.

ROSACEAE

Agrimonia
pubescens Wallr.; Agrimony. Frequent. Dry fields and roadsides. #332, #404 Claiborne, Grainger.

rostellata Wallr.; Beaked Agrimony. Occasional. Clearings along the river. #359 Grainger.*

Amelanchier arborea (F. Michx.) Fernald; Serviceberry, Shadbush. Frequent. Woods on middle to upper slopes. [*A. arborea* (F. Michx.) Fernald var. *austromontana* (Ashe) H. E. Ahles]. #13 Grainger.

Chaenomeles lagenaria (Loisel.) Koidz.; Japanese Quince. Very Rare. Only a couple of individuals found along a fence row on Manning Ferry Road. Escaped from cultivation. Native to China. #35 Hancock.

Duchesnea indica (Andr.) Focke.; Indian Strawberry. Common. Disturbed areas along the river. Native to Asia. #11, #191 Claiborne, Grainger.

Geum canadense Jacq.; White Avens. Frequent. Mesic woods along the river. Often on roadsides. #209, #280 Claiborne, Hancock.*

Physocarpus opulifolius (L.) Maxim.; Ninebark. Frequent. Banks of the river. #320 Hancock.*

Potentilla
canadensis L.; Cinquefoil, Five Finger. Common. Open disturbed sites. #69 Grainger.

recta L.; Sulphur Cinquefoil. Frequent. Roadsides and other disturbed areas. Native to Europe. #225, #248 Claiborne, Grainger.*

Prunus serotina Ehrend.; Wild Black Cherry. Common. Fields and woodlands throughout the study area. #139 Grainger.

Rosa
multiflora Thunb. ex Murray; Multiflora Rose. Occasional. Roadsides along the river. Native to East Asia. 3151 Hancock.*

setigera Michx.; Prairie Rose. Infrequent. Roadsides along the river. #147 Claiborne.*

Rubus
flagellaris Wild.; Northern Dewberry. Common. Fields, roadsides, and other disturbed sites. [*R. enslenii* Tratt.]. #112 Claiborne.*

occidentalis L.; Black Raspberry. Common. Fields, roadsides, and other disturbed sites. #40 Grainger.

phoenicolasius Maxim.; Wineberry. Occasional. Disturbed areas along the river. Native to East Asia. #111, #324 Claiborne, Grainger.*

Waldsteinia fragarioides (Michx.) Tratt.; Barren Strawberry. Frequent. Dry Woodlands. [*W. donniana* Tratt.; *W. parviflora* Small]. #54 Grainger.

RUBIACEAE

Cephalanthus occidentalis L.; Button Bush. Common. River banks, islands, and gravel bars. #299 Hancock.*

Diodia virginiana L.; Buttonweed. Frequent. Wet areas along the river. #310 Hancock.*

Galium

aparine L.; Bedstraw. Common. Roadsides and other disturbed areas. #100, #171 Grainger, Hancock.*

lanceolatum Torr.; Bedstraw. Very Rare. Only a few individuals seen in rich woods at Lawson Bend. #121 Hancock.*

triflorum Michx.; Bedstraw. Occasional. Roadsides near mesic woods. #291 Claiborne.*

Hedyotis purpurea (L.) Torr. & A. Gray; Occasional. Rich woods along the river. [*Houstonia purpurea* L.]. #180 Hancock.*

SALICACEAE

Salix

caroliniana Michx.; Swamp Willow. Occasional. River banks, islands, and gravel bars. #206 Claiborne.*

nigra Marshall; Black Willow. Common. River banks, islands, and gravel bars. #347 Grainger.*

SANTALACEAE

Pyrularia pubera Michx.; Buffalo Nut. Frequent. Woodlands along the river. #482 Grainger.*

SAURURACEAE

Saururus cernuus L.; Lizard's Tail. Common. Shorelines of the river. #296 Hancock.*

SAXIFRAGACEAE

Astilbe biternata (Vent.) Britton; False Goatsbeard. Occasional. Rich woods. Often on rocky ledges. #183 Hancock.

Heuchera

americana L.; Alumroot. Occasional. Rich woods, often on roadsides. [*H. americana* L. var. *hispida* (Pursh) Wells]. #102 Grainger.

villosa Michx.; Alumroot. Frequent. Rich rocky woods along the river. #285 Hancock.

Hydrangea arborescens L.; Common. Rich wooded slopes. Often along trails and roadsides. #367 Hancock.

Mitella diphylla L.; Bishop's Cap, Miterwort. Frequent. Mesic woods along the river. #16 Grainger.

Philadelphus hirsutus Nutt.; Mock Orange. Occasional. Banks of the river. [*P. sharpianus* S. Y. Hu]. #300 Hancock.*

Ribes cynosbati L.; Gooseberry. Occasional. River banks near rich woods. #217 Grainger.*

Tiarella cordifolia L.; Foamflower. Common. Rich woods along the river. Often on talus slopes. [*T. wherryi* Lakela]. #30 Hancock.*

SCROPHULARIACEAE

Aureolaria virginica (L.) Pennell; Downy False Foxglove. Infrequent. Open woodlands. [*Gerardia virginica* (L.) Britton, Sterns & Poggenb.]. #375 Claiborne.*

Dasystoma macrophylla (Nutt.) Raf.; Mullein Foxglove. Infrequent. Rich woods near the river. Often along roadsides. [*Seymeria macrophylla* Nutt.]. #233 Claiborne.*

Mimulus alatus Aiton; Monkey Flower. Occasional. River banks and mesic gravel bars. #294 Hancock.*

Pauwlonia tomentosa (Thunb.) Steud.; Princess Tree, Empress Tree. Occasional. Roadsides and other disturbed sites. Native to East Asia. #252 Claiborne.

Penstemon

canescens (Britton) Britton; Beard Tongue. Occasional. Woodland margins and roadsides. [*P. brevisepalus* Pennell; *P. brittonorum* Pennell]. #256 Hancock.*

laevigatus (L.) Aiton; Beard Tongue. Occasional. Mesic woods along the river. #119 Hancock.*

Scrophularia marilandica L.; Figwort. Occasional. Roadsides near rich woods. #437 Claiborne.

Verbascum

blattaria L.; Moth Mullein. Common. Roadsides and other disturbed sites. Native to Eurasia. #135 Grainger.*

thapsus L.; Woolly Mullein. Common. Roadsides and other disturbed sites. #234 Claiborne.*

Veronica persica Poir.; Speedwell. Frequent. Disturbed areas along the river. Native to Southwest Asia. #37 Hancock.*

SOLANACEAE

Solanum carolinense L.; Horse Nettle. Frequent. Fields, roadsides, and other waste areas. #193 Grainger.

STAPHYLEACEAE

Staphylea trifolia L.; Bladdernut. Frequent. Rich woods along the river. #50, #132 Grainger, Hancock.*

THYMELAEACEAE

Dirca palustris L.; Leatherwood. Occasional. Rich woods along the river. #103 Grainger.*

TILIACEAE

Tilia heterophylla Vent.; Basswood. Common. Rich woods along the river. #52 Hancock.*

ULMACEAE

Celtis

laevigata Willd.; Sugarberry. Infrequent. Wet fields and banks of the river. #54 Hancock.*

occidentalis L.; Hackberry. Occasional. Low wet woods along the river. #307 Grainger.

tenuifolia Nutt.; Georgia Hackberry. Infrequent. Open woods along the river. [*C. georgiana* Small]. #98 Grainger.

Ulmus

alata Michx.; Winged Elm. Occasional. Roadsides, fields, and dry woods. #501 Grainger.

americana L.; American Elm. frequent. Mesic woods along the river. #31 Hancock.*

rubra Muhl.; Slippery Elm. Common. Banks of the river. #74, #321 Claiborne, Hancock.*

URTICACEAE

Boehmeria cylindrica (L.) Sw.; False Nettle. Common. Low woods along the river. Often on roadsides. #236 Claiborne.*

Laportea canadensis (L.) Wedd.; Wood Nettle. Common. Rich woods along the river. #267 Hancock.*

Parietaria pensylvanica Muhl. ex Willd.; Pennsylvania Pellitory. Infrequent. Gravel bars and other open disturbed areas. #214 Claiborne.*

Pilea pumila (L.) A. Gray; Clearweed. Frequent. Low mesic woods along the river. #517 Hancock.

VALERIANACEAE

Valerianella radiata (L.) Dufr.; Corn Salad. Occasional. Open disturbed sites along the river. #100, #110 Claiborne, Grainger.*

VERBENACEAE

Phyla lanceolata (Michx.) Greene; Fog Fruit. Occasional. Open river banks and gravel bars. [*Lippia lanceolata* Michx.]. #309, #333 Grainger, Hancock.*

Verbena

simplex Lehm.; Verbain. Common. Roadsides and other open disturbed sites. #259 Hancock.*

urticifolia L.; White Verbain. frequent. Low fields and banks of the river. [*V. urticifolia* L. var. *leiocarpa* L. M. Perry & Fernald]. #210, #308 Claiborne, Hancock.*

VIOLACEAE

Hybanthus concolor (T. F. Forst.) Spreng.; Green Violet. Occasional. Rich woods along the river. #275 Hancock.*

Viola

canadensis L.; Canada Violet. Occasional. Low mesic woodlands. #123 Hancock.*

cucullata Aiton; Bog Violet, Blue Marsh Violet. Occasional. Flood plains and other wet areas near the river. #30 Grainger.

palmata L.; Three-lobed Violet. Frequent. Rich wooded slopes. [*V. triloba* Schwein.]. #58, #60 Grainger, Hancock.*

pubescens Aiton; Downy Yellow Violet. Occasional. Low mesic woods. [*V. eriocarpa* Schwein.; *V. pensylvanica* Michx.; *V. pubescens* Aiton var. *leiocarpa* (Fernald & Wiegand) B. Boivin]. #61 Grainger.

rafinesquii Greene; Wild Pansy. Common. Open disturbed areas along the river. [*V. kitaibeliana* Roem. & Schult. var. *rafinesquii* (Greene) Fernald]. #3, #116 Grainger, Hancock.*

rostrata Pursh; Long Spurred Violet. Occasional. Rich wooded slopes. #3 Grainger.*

sororia Willd.; Woolly Blue Violet. Common. Open disturbed sites along the river. [*V. papilionaceae* Pursh]. #4 Grainger.

striata Aiton; Pale Violet. Frequent. Low mesic woods. Often along trails and muddy areas. #15, #117 Grainger, Hancock.*

VITACEAE

Ampelopsis cordata (Michx.); Pepper Vine. Occasional. Low woods along the river. Also on Grissom Island. #205, #243 Claiborne, Hancock.*

Parthenocissus quinquefolia (L.) Planch.; Virginia Creeper. Common. Woods and disturbed areas along the river. #79 Grainger.

Vitis

aestivalis Michx.; Summer Grape. Common. Low woods along the river. #78 Grainger.

cinerea (Engelm. in A. Gray) Engelm. ex Millardet var. baileyana (Munson) Comeaux; Winter Grape. Occasional. Open woods along the river. [*V. baileyana* Munson]. #86 Grainger.

rotundifolia Michx.; Muscadine. Occasional. Low mesic woods. #139 Grainger.

vulpina L.; Frost Grape. Common. Mesic woods along the river. #150 Claiborne.

APPENDIX B.

RARE PLANT STATUS REPORTS

STATUS REPORT FOR *Carex gravida* L. H. Bailey

I. Classification and Nomenclature

A. Species or Intraspecific Taxon

1. Scientific Name

a. Binomial

Carex gravida L. H. Bailey

b. Full Bibliographic Citation

Mem. Torrey Bot. Club, i. (1889) 5. - Am. bor.

2. Pertinent Synonmy

(None)

3. Common Name(s)

Heavy Sedge

B. Family Name

Cyperaceae (Sedge Family)

II. Present Legal or Other Formal Status

A. Global

Listed as G5.

B. Federal

(None)

C. State

Listed as Special Concern by the Tennessee Department of Environment and Conservation (1997).

III. Geographic Distribution

A. Geographic Range

Heavy sedge occurs from Ohio and SW. Ontario to Minnesota, South Dakota, and Wyoming, south to Kentucky and Texas. The taxon has been documented in only one other county in Tennessee, Hardeman.

B. Precise Occurrences in the UCR Study Area

1. Populations currently known extant:

a. Site One: Howard Quarter Quadrangle (36°24'00"N 83°26'25"W)

Description: Site one is the only known location for this taxon in the study area. It was found along the river bank in Grainger County at the end of a gravel drive just before the U. S. Highway 25E bridge. The sedge was in an open area near the woods not far from the water's edge. Associated taxa consisted mostly of various grasses and other sedges.

Population Vigor: Only a couple of plants were found and were not seen again the following year.

Evidence of Threats to Survival: Flooding is a possible threat to this taxon. Also, human disturbance is likely as many people fish along the banks of the river at this site. There is a chance that the two individuals have already been extirpated.

STATUS REPORT FOR *Cimicifuga rubifolia* Kearney

I. Classification and Nomenclature

A. Species or Intraspecific Taxon

1. Scientific Name

a. Binomial

Cimicifuga rubifolia Kearney

b. Full Bibliographic Citation

Bull. Torr. Bot. Club, 1897, 561. - Am. bor.

2. Pertinent Synonymy

(None)

3. Common Name(s)

Appalachian Bugbane

B. Family Name

Ranunculaceae (Buttercup Family)

II. Present Legal or Other Formal Status

A. Global

Listed as G3.

B. Federal

(None)

C. State

Listed as Threatened by the Tennessee Department of Environment and Conservation (1997).

III. Geographic Distribution

A. Geographic Range

Appalachcian bugbane occurs in cool mountain woods from SW. Virginia to North Carolina and Tennessee. It is known as a disjunct

in W. Kentucky and S. Illinois. The taxon has been documented in sixteen counties in Tennessee, including Claiborne, Grainger, and Hancock Counties.

B. Precise Occurrences in the UCR Study Area

1. Populations currently known extant:

a. Site One: Howard Quarter Quadrangle (36°24'45"N 83°26'25"W)
Description: Site one is the only known location for this taxon in the study area. The plants were found along a low, rocky wooded slope facing northeast at Posey Bend in Claiborne County. Overstory taxa include: *Acer saccharum, Fagus grandifolia, Carpinus caroliniana,* and *Platanus occidentalis.* Also, *Acer spicatum* was found nearby.

Population Vigor: Only a few scattered plants were found, but all appeared to be healthy. Likewise, all of the plants were flowering.

Evidence of Threats to Survival: The plants appear to be secure in their location. However, a private dirt road passes above the plants upslope. Potential threats could come from such access in the future.

STATUS REPORT FOR *Juglans cinerea* L.

I. Classification and Nomenclature

A. Species or Intraspecific Taxon

1. Scientific Name

a. Binomial

Juglans cinerea L.

b. Full Bibliographic Citation

Linn. Syst. ed. x., 1272. - Am. bor.

2. Pertinent Synonymy

a. *Wallia cinerea* (L.) Alef.

3. Common Name(s)

Butternut, White Walnut

B. Family Name

Juglandaceae (Walnut Family)

II. Present Legal or Other Formal Status

A. Global

Listed as G3, G4.

B. Federal

(None)

C. State

Listed as Threatened by the Tennessee Department of Environment and Conservation (1997).

III. Geographic Distribution

A. Geographic Range

Butternut occurs from New Brunswick to Minnesota, south to South Carolina, Georgia, and Arkansas. The taxon has been collected in 30

counties throughout Tennessee, including Hancock County.

B. Precise Occurrences in the UCR Study Area

1. Populations currently known extant:

a. Site One: Howard Quarter Quadrangle (36°25'05"N 83°24'35"W)
Description: The trees were found clustered in a low open field close to the river just before Posey Bend in Claiborne County. The only associated taxon in close proximity is black walnut, *J. nigra*.

Population Vigor: Approximately 10 mature trees were discovered. All appeared to be healthy, and several were bearing fruit.

Evidence of Threats to Survival: The trees seem to be secure in this location. However, their proximity to the river may make them susceptible to flooding. Also, the trees are located near a field which increases the likelihood for human disturbance.

b. Site Two: Howard Quarter Quadrangle (36°24'05"N 83°26'20"W)
Description: The trees were found at the base of a rocky slope in rich woods almost at mid-point of First Bend in Grainger County. Associated overstory taxa include *Fagus grandifolia*, *Acer saccharum*, and *Fraxinus americana*.

Population Vigor: Only a couple of juvenile trees were found. Both were approximately 10 feet tall and appeared to be healthy and growing.

Evidence of Threats to Survival: Competition from other trees appear to be the only threat to the survival of these saplings. The location is remote and rugged.

STATUS REPORT FOR *Lilium canadense* L.

I. Classification and Nomenclature

A. Species or Intraspecific Taxon

1. Scientific Name

a. Binomial

Lilium canadense L.

b. Full Bibliographic Citation

Linn. Sp. Pl. 303. - Am. bor.

2. Pertinent Synonymy

(None)

3. Common Name(s)

Canada Lily, Wild Yellow Lily

B. Family Name

Liliaceae (Lily Family)

II. Present Legal or Other Formal Status

A. Global

Listed as G5.

B. Federal

(None)

C. State

Listed as Threatened by the Tennessee Department of Environment and Conservation (1997).

III. Geographic Distribution

A. Geographic Range

Canada lily occurs from Quebec and Maine to Maryland, in the mountains to Virginia, west to Ohio, Kentucky, southern Indiana,

and Alabama. The taxon has been documented in 18 counties in Middle and East Tennessee including Claiborne County.

B. Precise Occurrences in the UCR Study Area

1. Populations currently known extant:

a. Site One: Swan Island Quadrangle (36°28'05"N 83°16'50"W)
Description: Site one is the only known location for this taxon. The taxon occurs in rich woods midslope on a roadside bank on Lawson Bend Road in Hancock County.

Population Vigor: Only a few plants were found at this location. Two of the plants were in flower, with the third being immature. All of the plants were located again during the second growing season as well.

Evidence of Threats to Survival: There is a strong possibility that these plants may be extirpated given their proximity along a roadside. While Lawson Bend Road is seldom traveled, it is mowed and maintained by the county. The plants were not mowed during the two years of this study, but may be in the near future.

STATUS REPORT FOR *Meehania cordata* Britton

I. Classification and Nomenclature

A. Species or Intraspecific Taxon

1. Scientific Name

a. Binomial

Meehania cordata Britton

b. Full Bibliographic Citation

Meehania, Britton ex Small & Vail, in Mem. Torrey Bot. Club, iv. (1893) 147; et in Bull. Torrey Bot. Club, xxi. (1894) 32 t. 173 = Cedronella, Riv. (Labiat.).
cordata, Britton, ll. cc. = *C. cordata*, Benth.

2. Pertinent Synonymy

Cedronella cordata Benth.

3. Common Name(s)

Heartleaf Meehania

B. Family Name

Lamiaceae (Mint Family)

II. Present Legal or Other Formal Status

A. Global

Listed as G5.

B. Federal

(None)

C. State

Listed as Threatened by the Tennessee Department of Environment and Conservation (1997).

III. Geographic Distribution

A. Geographic Range

Heartleaf Meehania occurs in rich mountain woods from SW. Pennsylvania and S. Ohio to Tennessee and North Carolina. It is also reported from Illinois. The taxon has been documented in only five counties in Tennessee. All of these counties are in East Tennessee and include Claiborne, Grainger, and Hancock Counties.

B. Precise Occurrences in the UCR Study Area

1. Populations currently known extant:

a. Site One: Swan Island Quadrangle (36°28'00"N 83°17'30"W)
Description: Site one is located near the end of Lawson Bend Road at the base of a waterfall on a trail close to the river in Hancock County. Overstory taxa include *Tilia heterophylla*, *Acer saccharum*, *Fagus grandifolia*, and *Aesculus flava*. Other associated taxa include: *Trillium grandiflorum*, *Smilacina racemosa*, *Polygonatum biflorum*, *Adiantum pedatum*, *Mitella diphylla* and *Geranium maculatum*.

Population Vigor: Approximately 50 plants were found scattered along the trail. Many of the plants were flowering.

Evidence of Threats to Survival: Many of these plants are in danger of being trampled, as they are located along a popular trail that leads to a waterfall. People often camp and fish in this area and climb the trail.

b. Site Two: Howard Quarter Quadrangle (36°24'40"N 83°25'00"W)
Description: Site two is located in low rich woods near the river in the deepest part of Posey Bend in Grainger County. Overstory taxa consist entirely of a grove of hemlock, *Tsuga canadensis*.

Population Vigor: Fewer than 10 plants were found scattered on the ground under the hemlock. Only a few were flowering.

Evidence of Threats to Survival: The location of these plants is very remote. The only threat is flooding of the low ground.

STATUS REPORT FOR *Panax quinquefolius* L.

I. Classification and Nomenclature

A. Species or Intraspecific Taxon

1. Scientific Name

a. Binomial

Panax quinquefolius L.

b. Full Bibliographic Citation

Linn. Sp. Pl. (1753). 1058 = *Aralia quinquefolia*

2. Pertinent Synonymy

a. *Panax quinquefolia* Decaisne & Planchon

b. *Ginseng quinquefolium* Wood

c. *Panax americanum* Raf.

d. *Panax quinquefolium* L.

3. Common Name(s)

Ginseng, Sang

B. Family Name

Araliaceae (Cashew Family)

II. Present Legal or Other Formal Status

A. Global

Listed as G4.

B. Federal

(None)

C. State

Listed by the Tennessee Department of Environment and Conservation (1997) as Special Concern due to Commercial Exploitation.

III. Geographic Distribution

A. Geographic Range

Ginseng occurs in rich woods from Quebec to Minnesota and South Dakota, south to Georgia, Louisiana, and Oklahoma. The taxon has been documented in 47 counties throughout Tennessee.

B. Precise Occurrences in the UCR Study Area

1. Populations currently known extant:

a. Site One: Swan Island Quadrangle (36°27'45"N 83°17'15"W)
Description: Site one is the only known location for this taxon. The taxon occurs in rich woods about midslope at Lawson Bend in Hancock County. The site can be reached easily from an abandoned road that is now a trail which splits from Lawson Bend Road. Associated taxa include many small saplings of buckeye, *Aesculus flava.*

Population Vigor: Only a couple of plants were found at this location. Both plants were in flower and appeared healthy.

Evidence of Threats to Survival: There is some chance that these plants could be gathered by collectors, as they occur close to a large trail.

VITA

Bobby Christopher Bullington was born to Bobby and Jane Bullington in Lafayette, Tennessee on September 18, 1967. He attended both elementary school and high school in the county of his birth. In 1985, he was accepted into Vanderbilt University in Nashville, Tennessee. Four years later, he received a Bachelor of Arts Degree in Economics.

After a brief stay in graduate school at the University of Tennessee, he left to work in Japan in 1990. For two and a half years, Chris taught English as a foreign language at a junior college in Tokyo. Time away from school led to the realization that a change of study was in order.

In 1993, he was accepted into the Master's Program in Botany at the University of Tennessee, Knoxville, and embarked upon a course of study in field botany. He received a Graduate Teaching Assistantship in 1994. In 1996, the Botany Department awarded him the Graduate Student Teaching Award.

Currently, he is married with one son. His many hobbies include karate, hiking, gardening, and canoeing. In the future, he hopes to continue the study of plants, and to work in some capacity as a botanist.