

2008

Vascular Flora of the Totuskey Creek Watershed, Richmond County, Virginia

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<https://dx.doi.org/doi:10.21220/s2-b6a3-6q47>

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Vascular Flora of the Totuskey Creek Watershed, Richmond County, Virginia

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South Burlington, Vermont

Bachelor of Science, University of New Hampshire, 2005

A thesis presented to the Graduate Faculty
of the College of William and Mary in candidacy for the degree of
Master of Science

Department of Biology

The College of William and Mary
August, 2008

APPROVAL PAGE

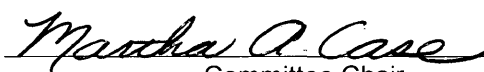
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Master of Science



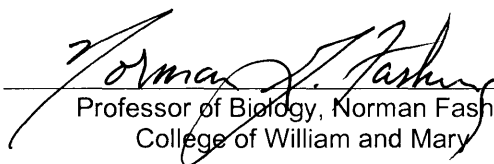
Christopher W. Johnstone

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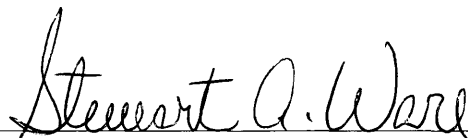


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ABSTRACT PAGE

The vascular flora of the lower Totuskey Creek watershed in Richmond County, Virginia was surveyed from 2005 to 2007. Richmond County is one of five which form the Northern Neck Peninsula, the northernmost peninsula on the coastal plain of Virginia. Forty-eight trips were made to the study site encompassing 50 square miles in the eastern portion of Richmond County. Differences in physiography, vegetation, topography, and other elements suggested 14 apparently distinct habitats which comprised lowland habitats (sandy river banks, brackish and freshwater marshes, ponds, stream banks and floodplains, and ravines); upland habitats (mixed hardwood and pine/mixed hardwood forests, and successional pine stands); and disturbed habitats (roadsides, fields and field margins, cut-over areas, powerline cuts, and flooded tire ruts).

A total of 675 species representing 676 taxa, 125 families, and 400 genera were collected during the course of this study. One hundred fifty-four taxa are new records to Richmond County while 16 of these are new records to the Northern Neck. A phytogeographic analysis indicates nearly half (47.9%) of the flora is native to North America ranging west beyond the Mississippi River but not to the Pacific Coast. Another 21.2% of the flora is non-native. Voucher specimens were collected for nearly all species and are held by the herbarium of the College of William and Mary (WILLI).

A regional floristic analysis incorporating all floristic information to date from the Virginia Peninsulas and the coastal plain of Maryland is also discussed. Sørensen's similarity indicates that the Northern Neck is the most distinct among the three Virginia peninsulas, and Maryland is the most distinct among all areas analyzed. The results of a phytogeographic analysis suggest that the element of the southern flora may not play as large a role in the gradual change in floristic similarity across the region as suggested by data in a previous study. In addition, a significant change in the southern flora between the peninsulas of Virginia and the coastal plain of Maryland suggests that Maryland may be a better northern boundary for the southern flora than any of the Virginia Peninsulas.

“A practical botanist will distinguish at the first glance the plants of the different quarters of the globe and yet will be at a loss to tell you by which marks he detects them.”

- Carl von Linné

To my family who has always encouraged me to follow my heart

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ACKNOWLEDGMENTS

I owe a great deal of thanks to many people who helped make this project a success. My advising committee, Dr. Martha Case, Dr. Norman Fashing, and Dr. Stewart Ware provided invaluable feedback, guidance, and encouragement during the course of the study and my stay at William and Mary. Herbarium curators Holly Grubbs and Beth Chambers provided much insight and assistance with database management and accession of voucher specimens. Herbarium interns provided many hours of help in the field and in the herbarium managing specimens. I am also grateful for the friendly service of Chris Jett and members of the Richmond County Administration Office who helped with acquiring landownership information. Ellis Squires also helped a great deal with field work and donated many valuable specimens.

My most sincere gratitude goes out to my loyal field assistants, Zach Bradford and Melissa Gerben, for enduring encounters with ticks, snakes, and punishingly hot and humid weather for the benefit of this study. Their dedication and enthusiasm was inspiring and I am convinced these two both await careers as extraordinary botanists.

I also wish to thank my wife, Sarah, for her love and support, and for tolerating bags, dirt, trowels, plants, and all other blessings that come with a botanist in the house. The remaining members of my family have also offered continuous support and encouragement during the course of this study.

Finally, I would like to thank The Northern Neck Audubon Society for recognizing the importance of floristic research and providing the majority of the funding for this project. My thanks also go out to the Graduate College of Arts and Sciences for providing additional funding.

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**THE VASCULAR FLORA OF THE TOTUSKEY CREEK WATERSHED
RICHMOND COUNTY, VIRGINIA**

INTRODUCTION

History of Botanical Collection on the Northern Neck Peninsula

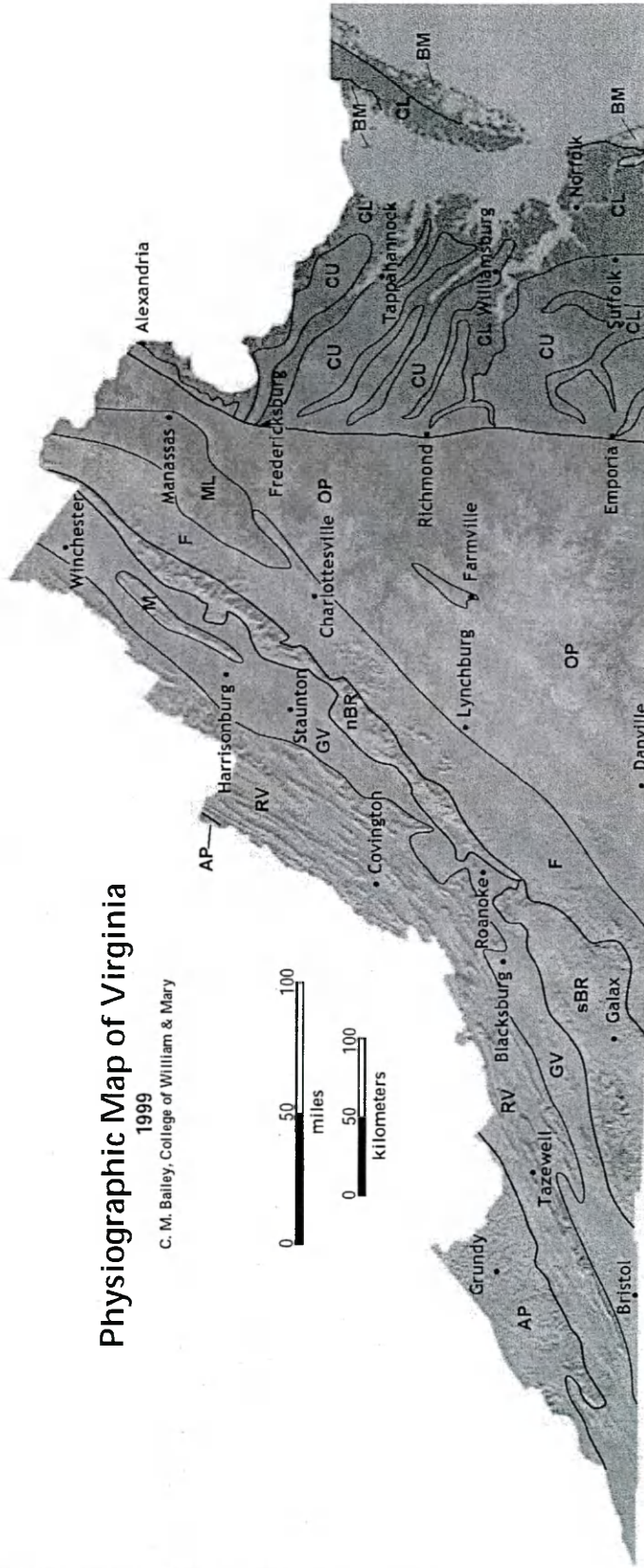
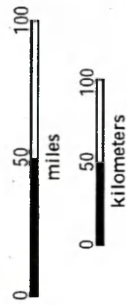
On the western shore of the Chesapeake Bay, the land of Virginia has been shaped into three large peninsulas, or necks. The northernmost peninsula lies between the Potomac and Rappahannock rivers. This stretch of land was referred to as “ye Northerne Neck” by the first English settlers traveling the Chesapeake Bay from Jamestown (Haynie, 1959). The Northern Neck is 25 miles across at its widest point along the shore of the Chesapeake Bay. The peninsula extends inward about 100 miles and gradually narrows as the two rivers begin to converge near Fredericksburg. The peninsula is located entirely within the Coastal Plain province of Virginia (Fig. 1). The extent of the peninsula is largely defined by King George, Westmoreland, Richmond, Northumberland, and Lancaster counties (Fig 2).

Exploration in Virginia and scientific documentation of its native plants have histories dating back to colonial times although there are surprisingly few historical accounts of studies conducted on the Northern Neck. For example, colonial botanist John Clayton collected many plant specimens in Virginia while serving as Clerk to the County Court of Gloucester County from 1723 until his death in 1773. Most of his specimens were shipped to Europe and later ended up in the hands of Swedish naturalist Carolus Linnaeus. Although Clayton’s specimens likely served as the principal source of knowledge for the plants of North America in Linnaeus’ *Species Plantarum* (1753) (Harvill *et al.*, 1992), Clayton left no published records of his own findings. Therefore, it

Physiographic Map of Virginia

1999

C. M. Bailey, College of William & Mary



Appalachian Plateau province

AP- Rugged, well-dissected landscape with dendritic drainage pattern. Elevation- 1000'-3000' with High Knob rising to over 4000'.

Valley & Ridge province

RV- Ridge & Valley subprovince: long linear ridges separated by linear valleys with trellis drainage pattern. Elevation- 1000'-4500'.

GV- Great Valley subprovince: broad valley with low to moderate slopes underlain by carbonate rocks. Elevation- 500'-1500' north of Roanoke, 1200'-2300' south of Roanoke

M- Massanutten Mountain: Series of long linear ridges that rise to 3000' above the Great Valley

Blue Ridge province

nBR- northern Blue Ridge subprovince: rugged region with steep slopes narrow ridges, broad mountains, and high relief. Elevation 1500'-4200'.

sBR- southern Blue Ridge subprovince: broad upland plateau with moderate slopes. Elevation 2400'- 3000' with higher peaks rising above upland, including 5729' Mt. Rogers.

Piedmont province

F- Foothills subprovince: region with broad rolling hills and moderate slopes. Elevation 400'-1000' with peaks rising to 1500'-2500'.

ML- Mesozoic lowlands subprovince: region with modest relief and low slopes underlain by Mesozoic sedimentary and igneous rocks. Elevation 200'-400'.

OP- Outer Piedmont subprovince: broad upland with low to moderate slopes. Elevation 600'-1000' in west gradually diminishing to 250'- 300' in east.

Coastal Plain province

CU- Upland subprovince: broad upland with low slopes and gentle drainage divides. Steep slopes develop where dissected by stream erosion. Elevation- 60'-250'.

CL- Lowland subprovince: flat, low-relief region along major rivers and near the Chesapeake Bay. Elevation- 0-60'.

BM- Barrier Islands & Salt Marshes: low, open areas covered with sediment and vegetation in direct proximity to the Chesapeake Bay and Atlantic Ocean. Elevation 0'-15'.

Figure 1. Map of the physiographic provinces of Virginia.

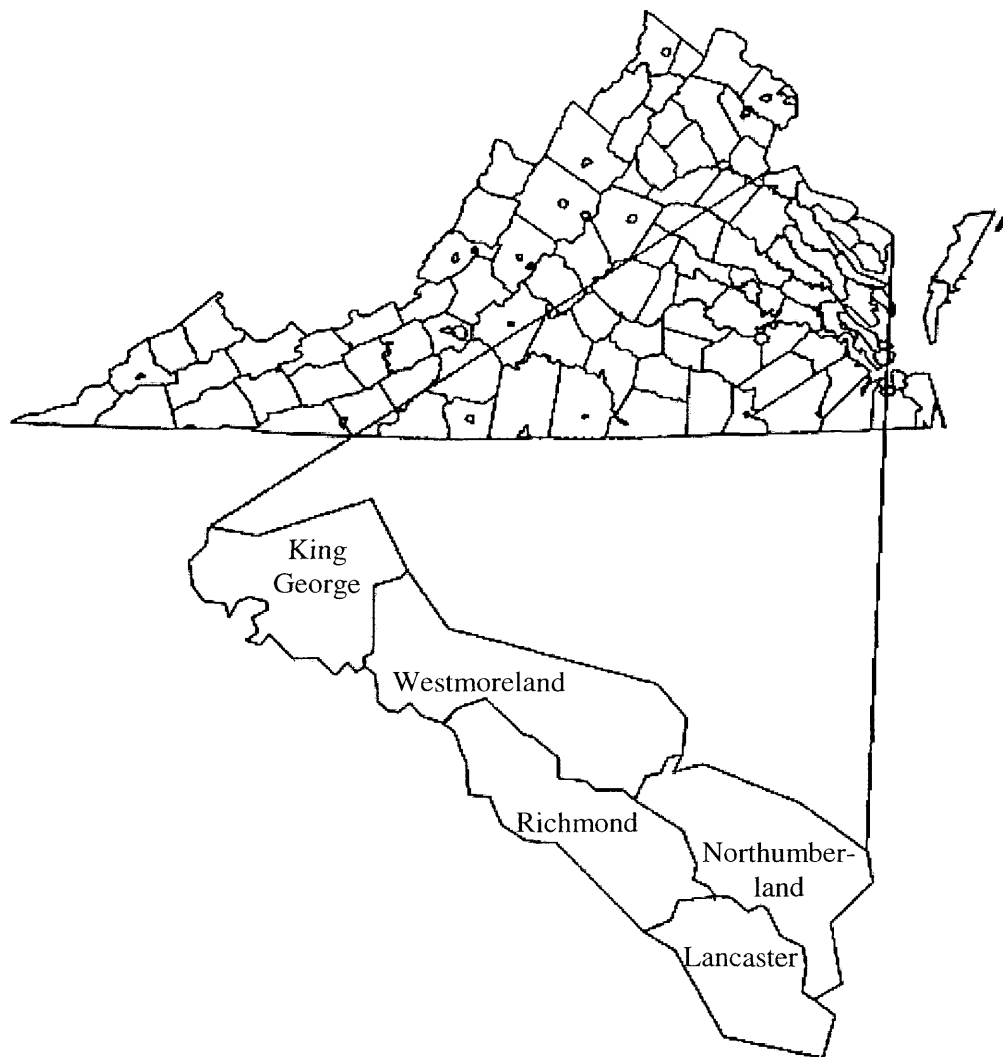


Figure 2. Map of Virginia indicating counties of the Northern Neck peninsula.

is unclear whether he visited the Northern Neck of Virginia (Harvill *et al.*, 1992). During the 1800's, botanists such as William Canby, Frederick Pursh, and Nathaniel Britton explored many areas of Virginia, but most of their work was focused in the southwestern mountain region and southeastern tidewater region (Harvill *et al.*, 1992). Starting in 1933, M. L. Fernald of the Gray Herbarium at Harvard spent 14 years botanizing in Virginia, mainly in areas south of the James River (Rollins, 1951). As with Clayton, it is unclear if these later botanists ever explored northward to the Northern Neck (Harvill *et al.*, 1992). The only account of the flora of this region that was found published prior to the 1970's is a checklist of ferns and fern allies collected by Clyde F. Reed. Reed collected 20 species and varieties of ferns and five species of fern allies throughout all five counties of the Northern Neck (Reed, 1959).

In modern times, more attention has been devoted to the Northern Neck. Researchers from the College of William and Mary and George Mason University began to focus attention on the flora of the Northern Neck starting in the late 1970's. Since then, knowledge of the floristic composition of areas of the peninsula has accrued at a regular rate. Ted Bradley and others from George Mason University contributed many records to the flora of Lancaster County (Bradley *et al.*, 1976). The flora of Caledon State Park (currently known as Caledon Natural Area) in King George County was surveyed by Donna Ware of the College of William and Mary (Ware, 1984). Later, researchers from the University of Richmond conducted a floristic study of an area adjacent to Caledon State Park (Simmons *et al.* 1995). In 1995, Troy Weldy, a graduate student from the College of William and Mary, added copious records to the flora of Lancaster County while collecting and analyzing the flora of the Corrotoman River

watershed (Weldy, 1995). In 2000, John Dodge of George Mason University conducted a floristic study of a portion of the Potomac River watershed in Westmoreland County (Dodge, 2000). A total of 918 species were collected during the studies in King George County (Ware, 1984; Simmons *et al.*, 1995) and Weldy (1995) documented 824 species in the Corrotoman River Watershed. Weldy's study revealed 204 species previously unrecorded from Lancaster County, 62 species that were new records for the Northern Neck, two coastal plain records, and *Cypripedium kentuckiense* Reed (species' authorities will be omitted from the text from this point forward for ease of reading but can be found in the Annotated Checklist), a species never before documented in Virginia and considerably out of its natural range (Weldy *et al.*, 1996). Although the Westmoreland survey (Dodge, 2000) included collections from only a 25 square mile area (less than a third of that included in the study by Weldy, 1995), an impressive 628 species were identified, including 96 county records, and an additional 14 Northern Neck records. These studies contributed to the floras of three of the five counties on the Northern Neck, leaving both Richmond and Northumberland counties without comprehensive floristic studies conducted anywhere in their respective counties.

Research prior to the start of collections for the current study revealed that some information on the flora of Richmond County was available from surveys conducted by amateur botanists and members of the United States Fish and Wildlife Service. Ellis Squires, amateur botanist and resident of Richmond County, has been active in collecting and identifying specimens while walking, biking, and kayaking in the county since the 1970's (Ellis Squires, pers. comm.). In addition to Mr. Squires, several small tracts of land belonging to or managed by the Rappahannock River National Wildlife Refuge

(RRVNWR) are surveyed at least annually (Rebecka Wilson, pers. comm.). These surveys are conducted by refuge staff, often with the help of local amateur botanists, many of whom belong to the Northern Neck Chapter of the Virginia Native Plant Society. The efforts by the RRVNWR, however, rarely include collection of voucher specimens and are often primarily focused on rare species or rare plant communities known from their own tracts.

Previous Study of Phyto geography and Floristic Similarity

The peninsular regions on the Coastal Plain of Virginia provide a unique geographical and perhaps climatic condition with implications for the geographic distribution of the flora of this region. Of particular interest in previous studies has been the element of the southern flora among the Lower, Middle, and Upper peninsulas as well as the overall floristic similarity among these areas (the term Upper Peninsula will be used here in place of Northern Neck for easy reference to previous studies). These previous studies and observations have revealed that a large number of species are at or near their northern range limit on the coastal plain peninsulas of Virginia (Harvill, 1966; North, 1983). Many of these characteristically southern species are not found north of the York River, with a subset of the remainder not reaching north of the Rappahannock, and still a smaller number not extending beyond the Potomac River. It is clear that large bodies of water such as the rivers may be significant barriers to the dispersal and range expansion of species, especially since these plants have likely moved northward or are moving northward along the coast due to the relatively mild climate caused in large part by the effects of the waters of the Chesapeake Bay (North, 1983). There is also convincing evidence that the decrease in the representation of southern species as one

moves northward is not independent of other climatic shifts across the three peninsulas (e.g., number of frost free growing days) (North, 1983).

North (1983) provided an analysis of the floristic similarities among the Virginia peninsulas. The results revealed that while the three peninsulas shared nearly three-quarters of the same taxa, the Lower and Middle Peninsulas appeared most alike in floristic composition (Sørensen's Coefficient of Similarity (CS) = 0.845). The Upper Peninsula shared fewer taxa with both the Lower Peninsula (CS = 0.722), and the Middle Peninsula (CS = 0.778). North (1983) concluded from a subsequent range analysis that most of the difference in the floras could be attributed to an assemblage of southern species that the Lower and Middle peninsulas shared between one another and not with the Upper Peninsula. These results suggest that the Upper Peninsula is distinct from the other two peninsulas in its floristic composition; however, due to the relative lack of collection efforts in areas on the Upper Peninsula preceding the analysis, North advised that the results should be considered with caution.

Research Objectives

This study has three primary objectives: (1) conduct the first detailed floristic analysis of a watershed in Richmond County on the Northern Neck, (2) provide observations on each habitat sampled in the study area by describing the plant communities and physical attributes of those habitats and (3) use updated floristic information for an analysis of the floristic patterns across the geographic areas of the Virginia Peninsulas and coastal plain of Maryland. A central question to be addressed is whether the incorporation of new floristic information, particularly from studies on the

Northern Neck peninsula, will support the regional floristic and phytogeographic patterns identified by North (1983).

METHODS

Study Site Selection

Prior to the year 2000, Drs. Donna Ware and Martha Case evaluated areas on the Northern Neck that were in need of floristic study. Richmond County was chosen because no comprehensive documentation of the county's flora existed and it still contained many undeveloped forested areas. During 2000, two undergraduate students from the College of William and Mary (Adrian Duehl and Nicholas Hollingshead) were recruited to evaluate aerial photographs and USGS topographic maps for potential study sites. The watershed of Totuskey Creek was identified as a possible site for this study because of the presence of a diversity of lowland and upland habitats, relatively low incidence of anthropogenic disturbance, and areas of geologic diversity. Dr. Ware, A. Duehl, and N. Hollingshead confirmed these assessments during field trips to the watershed in 2000. Plant specimens collected during these trips were identified and compared to records in the Atlas of the Virginia Flora III (Harvill *et al.*, 1992). Six of the eighteen species were, at the time of collection, previously unrecorded from Richmond County. These results reflected the lack of botanical research in Richmond County. As a result of these findings, an area totaling 50 square miles encompassing the watershed of the Totuskey Creek (in the eastern half of Richmond County) was selected as the study site. Field work commenced during the summer of 2005.

Study Site Description

Richmond County lies on the southern side of the Northern Neck, bordering the Rappahannock River. The county is roughly 191 square miles in area, with a population of approximately 9100 (a 30% increase from 6,000 in 1970) (US Census Bureau, 2005). A large portion of the residents live in or nearby the town of Warsaw, the geographic, political, and commercial center for the county. Farming dominates the economy in Richmond County and the harvesting and sale of crabs and fish are also important.

The county is dissected by many creeks and streams. The largest as well as the most historically and economically important, are the waterways of Farnham Creek, Cat Pointe Creek, and Totuskey Creek. The areas surrounding the Totuskey Creek were centers for Native American communities, and the waterways were used in colonial times for transportation of cut timber and other goods. They also provided waterpower to grain and lumber mills (Hammack, 1976; Richmond County Board of Supervisors, 1976).

The Totuskey Creek watershed is located southeast of present-day Warsaw and the land from which water runoff enters the creek encompasses roughly one-quarter of the county's area. The main branch of Totuskey Creek includes the drainage from the areas south of Route 360 and north of Route 3 (Fig. 3). The Little Totuskey branch flows from areas northeast of Warsaw, continues south under Route 360, and converges with the main branch at the Route 3 Bridge. The creek flows south from the bridge where it can reach as much as 300 meters wide, and finally flows into the Rappahannock River. Tidal fluctuations are visible in all but the smallest streams in the uppermost reaches of the creek, but the wetland flora along the creek indicates that portions upstream from the Route 3 Bridge are mostly void of salt water (pers. obs.).

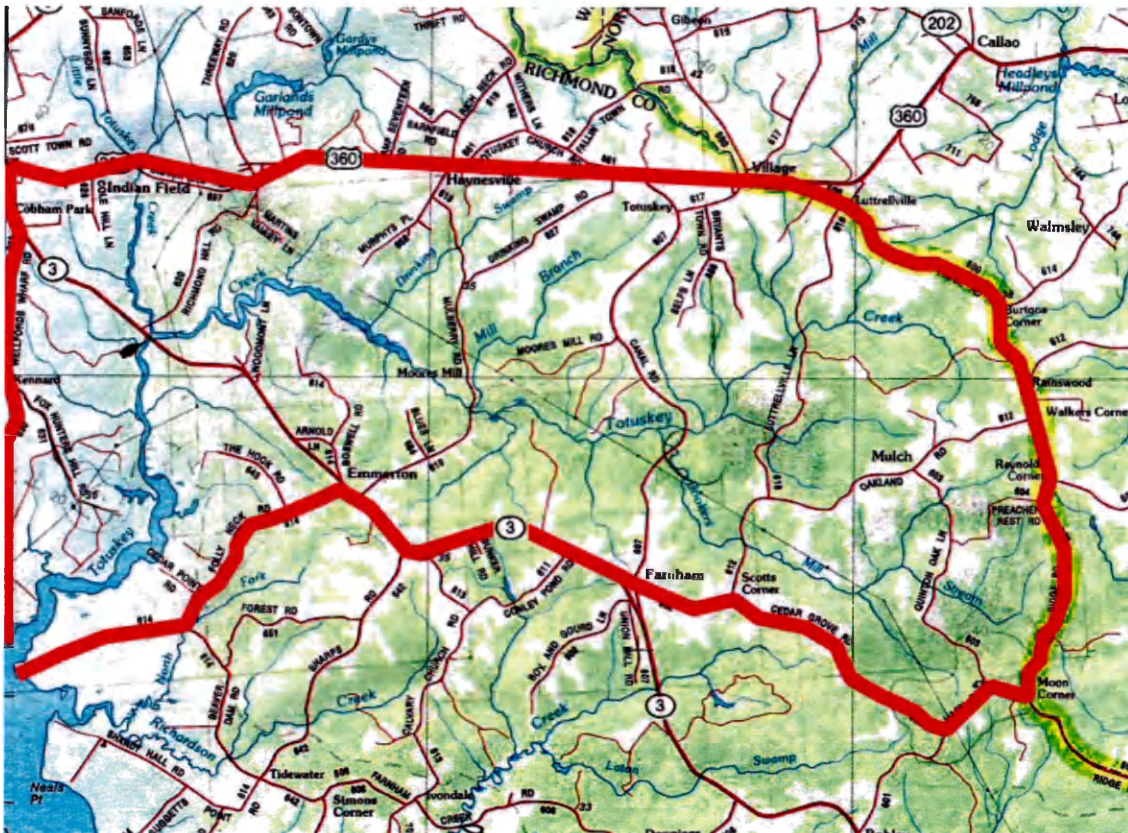


Figure 3. Map of principle towns, roads, and waterways of the Totuskey Creek watershed. Floristic study boundaries shown in red.

A variety of developed and natural areas can be found within the watershed. The majority of land near the town of Warsaw at the intersection of Route 360 and Route 3 is commercial, residential, or otherwise developed. A large portion of the level, upland areas in the watershed, especially near roads, is under cultivation. The dominant crops are wheat, corn, and soybean. Forested areas of pine and mixed hardwoods, or areas consisting entirely of mixed hardwoods are found throughout the study area. Aerial photographs show that the majority of forested areas can be found along the slopes and wet floodplains near Totuskey Creek and its drainage streams. This is understandable

since most of these sloping and wet areas are unsuitable for development or farming. Areas recently cut for timber are scattered throughout the study area; however, active logging efforts during the course of this study were observed at only a single location along the northeast boundary of the study site along Ridge Road. Wetlands occur intermittently between free-flowing portions of the smaller streams and offer a refuge for a diversity of wildlife. Avian species are particularly noticeable and include blue heron, osprey, and bald eagle. Wetland areas are also found immediately adjacent to the wider, main branches of the creek.

The land surrounding the creek below Route 360 is the area that was chosen for this floristic study. Although technically not including the entire watershed, the study site will be referred to as the Totuskey Creek watershed. Public 2- and 4-lane paved roads are situated on upland ridges separating the majority of the Totuskey Creek watershed from other watersheds. The following roads were chosen as official boundaries for the study area: Wellford's Wharf Road from the mouth of Totuskey Creek north to the Route 3, Route 3 north to Route 360, Route 360 east to Route 600 (Ridge Road), Ridge Road south to Moan Road, Moan Road south to Cedar Grove Road, Cedar Grove Road west to Route 3, Route 3 north to Folly Neck Road, and finally Folly Neck Road south to the mouth of the Creek (Fig. 3).

A USGS survey indicates geologic formations of most recent origin found within the study site include those typical of the Inner Coastal Plain. These formations include strata of alluvial sands, terrace gravels, and marine clay and silt (Mixon *et al.*, 1989). The survey also indicates the presence of the older Chesapeake Group formations, recognized most readily by deposits of fossilized shells made visible following soil

erosion along stream banks and ravines. Fossilized shells were not observed in the Totuskey Creek watershed during the current study, despite visits to many ravine sites.

Soils in the watershed can be divided into two main categories, upland and lowland soils. The upland soils consist of moderately to excessively well-drained loam with varying amounts of sand, silt, and clay. The lowland soils along creek and stream floodplains and in wetlands are comprised of fine sandy loam, silt loam, and often a layer of “muck” made of recent alluvial sediment and organic material. Portions of lowland loamy areas exhibiting moderate drainage are often exploited for crop cultivation (Soil Conservation Service, 1982).

The climate on the Northern Neck is not unlike the majority of Tidewater Virginia. The region’s climate is officially classified as humid and subtropical (Hayden and Michaels in UVA Climatology Office [website], 2007). Hot, humid summers with moderate rainfall are followed by mild winters with relatively less precipitation, regular frosts, and occasional snowfall. Temperature and precipitation data are available through August 2007 from the National Climatic Data Station ‘Warsaw 2N’, located approximately two miles from the study site. Long term data averages are also available and include data sampled between 1951 and 2005. The average temperature for the field season of 2006, 60.2 °F, was only 2.4° above the long-term average; however, sharp departures from the normals can be seen in January 2006 (+8.8 °F), and an extended heat wave in August 2006 (+3.3 °F). The running average temperature through August 2007 (60.8 °F) is also higher than the long-term average for the same time period (59.4 °F). The study area experienced a wetter-than-normal year in 2006 (+7.44 inches). In

contrast, the area experienced a considerable drought during the 2007 season (-6.96 inches precipitation, through August 2007).

Floristic Collection and Analysis

Collecting trips were made on forty-eight days during the periods of March 20 to November 4, 2006, and February 17 to August 1, 2007. A cumulative total of 195 hours were spent in the field during these periods, with daily trips lasting between two and eight hours. The trips were conducted at an average frequency of twice per week during the first season, and once every two weeks during the second season. Topographic maps served to locate various habitats and access routes. As different habitats or distinct plant communities were encountered, a conscious effort was made to revisit the areas several times during the growing season. An effort was also made to visit representatives of these habitat types in several locations throughout the range of the study area. Access to nearly all areas was by foot, with the exception of several wetlands along the watercourse of the creek which were accessed by kayak.

In order to identify habitats (and associated species) that may have been overlooked during the 2006 collecting season, the Atlas of Virginia Flora III (Harvill *et al.*, 1992) was consulted to produce a list of species that were likely to be present in the study site but were not yet collected in the present study. Species whose occurrences were assumed likely were those that fit one or more of the following criteria: (1) they had previously been collected from Richmond County, (2) they had been collected from at least one of the neighboring counties on the Northern Neck, or (3) they had been collected from the majority of counties on the Coastal Plain. This investigation was performed only for the *Poaceae* and *Cyperaceae*, two of the largest families represented

in the flora and consisting of species found in a variety of habitats. After the identification of species not yet collected in the Totuskey Creek flora, their associated habitats, as described in Radford et al. (1968), were recorded. The predominant habitats of the uncollected species included wetlands (both fresh and brackish) and a variety of disturbed areas (roadsides, field margins, etc.). Accordingly, these particular habitats were emphasized during the field season of 2007.

Voucher specimens were collected in triplicate when local abundance was suitable; otherwise fewer were collected. Photographs were used to document specimens out of normal reach (e.g., *Phoradendron leucarpum*), when an extremely low population size was present at a locality, or when only one individual was found. These photographs are included in Appendix B. Collections normally included flowering or fruiting material suitable for identification purposes; however, specimens lacking these structures, but for which a primary identification in the field was possible, were also collected. Notes made in the field included descriptions of the specific location (including GPS coordinates when available), habitat, and conspicuous morphological features for each set of voucher specimens. Each specimen and its duplicates were also assigned a unique collection number. All specimens were transported to the College of William and Mary and properly pressed and dried. Identification of unknowns generally commenced with dried specimens except for particularly delicate specimens which were often identified at least to the level of genus before pressing. A number of pressed voucher specimens were also donated from Ellis Squires and verified prior to inclusion with this study.

Manuals used to identify most specimens included: Manual of the Vascular Flora of the Carolinas (Radford *et al.*, 1968), Manual of Vascular Plants of Northeastern United

States (Gleason and Cronquist, 1991), Flora of the Carolinas, Virginia, Georgia, and surrounding areas (Weakley, working draft 2006), and select volumes of Flora North America (Flora of North America Editorial Committee, 1993+). In addition, Hitchcock (1950) and Smith (1975) were used to supplement the above manuals for identification of *Poaceae*, Sullivan (2004) was used for *Physalis*, and Holmgren *et al.* (1998) was used as a supplement for a variety of taxa. Occasionally, field guides such as Newcomb (1977) and Clemants and Gracie (2006) were consulted. Most specimens were compared with those held in the William and Mary Herbarium, especially those for which identification with the manuals alone was particularly difficult. Donna M.E. Ware, curator emeritus of the William and Mary Herbarium, was employed to verify the identification of specimens included in this study. Identification reassignments are indicated in the checklist and Dr. Ware's annotations accompany the specimen label.

Nomenclature of the flora checklist follows that of the Digital Atlas of the Virginia Flora [website] (Virginia Botanical Assoc., 2007). The digital atlas incorporates much of the nomenclature found in Flora North America (Flora North America Editorial Committee, 1993+) as well as that of the Angiosperm Phylogeny Group (APG2) (The Angiosperm Phylogeny Group, 2003). The digital atlas differs from many other sources in that it retains a small number of species names no longer in current use by some organizations due to discrepancies in morphology or habitat specificity within Virginia (e.g., *Viola affinis* of the *V. palmatum* complex). The digital atlas also retains more traditional names of taxa for which nomenclatural changes are in a state of flux (i.e., *Myrica*).

An analysis of the geographic distribution, or phytogeography, of the plants of the Totuskey Creek watershed was conducted by assigning each species to one of several predetermined geographic range categories. The proportions of species in each category were compared between the flora of the Totuskey Creek watershed and the flora of the Corrotoman River watershed in neighboring Lancaster County (Weldy, 1995). Each species was assigned to a single phytogeographic category that best described its natural geographic range. The range categories follow those used by North (1983) and Weldy (1995) for similar analyses and are outlined in Table 1. Sources for the phytogeographic information included Gleason and Cronquist (1991), Flora North America Editorial Committee (1993+), and USDA, NRCS (2007). The broadest range given by all sources combined was used for the analysis. It is important to note that the range assignments of species of the Corrotoman River watershed were taken directly from the dataset provided by Weldy (1995), and that due to updated phytogeographic information, several species documented in the Totuskey Creek watershed were assigned to categories that differ slightly from those assigned to the same species in the flora of the Corrotoman River watershed (Weldy, 1995). Adjustments to the data provided in the previous study were not completed before the current analysis because it was the opinion of the author that the comparisons would not be significantly compromised because of the low number of adjustments.

Table 1. Range categories for phytogeographic analysis.

<u>Range 1:</u>	Circumboreal
<u>Range 2:</u>	Native to North America and eastern Asia
<u>Range 3:</u>	Ranging west to the Pacific Coast
<u>Range 3a:</u>	Uninterrupted distribution from eastern North America to the Pacific Coast
<u>Range 3b:</u>	Interrupted distribution from eastern North America west beyond the Mississippi to the Pacific Coast
<u>Range 4:</u>	Ranging south beyond the United States to the New World Tropics
<u>Range 5:</u>	Ranges extending from eastern North America west beyond the Mississippi River, but not to the Pacific Coast
<u>Range 5a:</u>	Generally distributed north and south
<u>Range 5b:</u>	Generally northern in distribution
<u>Range 5c:</u>	Generally southern in distribution
<u>Range 5d:</u>	Generally distributed along the Coastal Plain and Mississippi Valley, extending west beyond the Mississippi in the north
<u>Range 5e:</u>	Generally distributed along the Coastal Plain and Mississippi Valley, extending west beyond the Mississippi in the south
<u>Range 6:</u>	Ranges limited to North America east of the Mississippi River
<u>Range 6a:</u>	Generally distributed north and south
<u>Range 6a1:</u>	Extending widely beyond the Coastal Plain
<u>Range 6a2:</u>	Mostly limited to the Coastal Plain
<u>Range 6b:</u>	Generally northern in distribution
<u>Range 6c:</u>	Generally southern in distribution
<u>Range 7:</u>	Introduced species
<u>Range 8:</u>	Cosmopolitan and nearly cosmopolitan species

Habitat and Plant Community Descriptions

The habitat descriptions are a synthesis of cumulative observations in each habitat throughout the course of this study. Habitats are grouped by local physiography (e.g., lowlands and uplands), and are described in terms of vegetation type (e.g., hardwood forest, pine forest), general topography (e.g., sloping forest, flat-ground forest), and additional a-biotic factors (e.g., fresh/brackish water). Generally, the most conspicuous and abundant species are indicated for the plant communities found in the habitats. Occasionally the community description will include other species that were only found in a single habitat or are otherwise noteworthy as county or peninsula records.

Regional Floristic Comparisons

This analysis incorporates the floras of the Lower Peninsula, Middle Peninsula, and Upper Peninsula of Virginia, as well as the flora of the coastal plain of Maryland. All species published in the Atlas of the Virginia Flora III (Harvill *et al.*, 1992) for these regions were used in the analysis; however, updates to the analysis were required. These comprised numerous new records of plant species added to the flora of the Upper Peninsula (Northern Neck) since the publication of the third edition of the Atlas. These records were found in the floras completed by Simmons *et al.* (1995), Weldy (1995), and Dodge (2000), as well as those taxa newly recorded in the current study. It is also important to mention that records for the Lower and Middle peninsula floras obtained after the analysis by North (1983) were already included in the third edition of the Atlas, and are also incorporated in the current analysis. Although floristic research is a

continuous effort to some extent on all three peninsulas, the Atlas provides the most concise and comprehensive treatment of ranges in Virginia.

The geographical areas comprising the Virginia peninsulas incorporate all land east of the Fall Line, excluding the Delmarva Peninsula. Specific counties and cities included are as follows:

- | | |
|------------------------|---|
| Lower Peninsula (LP): | Charles City, New Kent, James City, and York counties, and the cities of Williamsburg, Newport News, Poquoson, and Hampton. |
| Middle Peninsula (MP): | Essex, King and Queen, King William, Middlesex, Gloucester, and Mathews counties. |
| Upper Peninsula (UP): | King George, Westmoreland, Richmond, Northumberland, and Lancaster counties. |

Taxa of the Maryland coastal plain flora were found available in floristic studies conducted in the areas of Calvert County (Steury, 2002), Anne Arundel County (Stieber, 1967), Prince Georges County, and Charles County (Steury and Davis, 2003). The former two counties border the Potomac River, while the latter two border the northern stem of the Chesapeake Bay. All four of these counties are located north of the Upper Peninsula of Virginia, entirely within the Atlantic Coastal Plain geographic province, and combined they constitute a convenient entity for floristic comparison with areas of the Virginia coastal plain. To avoid inadvertent comparison of the same taxon twice, efforts were made to eliminate the inclusion of plant synonyms. Synonyms would be especially problematic while incorporating nomenclature of significant age (*e.g.*, Stieber, 1967). The plant names follow that of the Atlas of the Virginia Flora III (Harvill *et al.*, 1992) for consistency among data sets.

Flora checklists for each Virginia peninsula and the Maryland coastal plain were assembled into a spreadsheet including all taxa documented from any of the areas of interest. The execution of specific data filters allowed for the generation of lists of taxa held in common between any two floras.

Many introduced taxa commonly used as ornamentals or persisting from gardens and homesites (e.g., *Acer palmatum*, *Ginkgo biloba*, *Gladiolus* spp.) were omitted from both the Virginia and Maryland checklists because of one or more of the following reasons: (1) there was sufficient evidence from the separate annotated checklists that they were present because of localized human introduction, (2) there was insufficient evidence of satisfactory naturalization in the region of interest, and (3) the Atlas of the Virginia Flora III lacked adequate distributional information (the most common reason).

The floras were analyzed in pairwise fashion using Sørensen's Coefficient of Similarity, defined as: $CS = 2a / (b+c)$, where 'a' is the number of taxa in common between the two floras of the pairwise comparison, 'b' is the total number of taxa in flora number one, and 'c' is the total number of taxa in flora number two. The statistic ranges from zero, when no species are in common, to one when all species are in common. To summarize similarities, the resulting similarity values were clustered using Unweighted Pairgroup Methods Analysis using Arithmetic Averages (UPGMA).

Following the similarity analysis, an analysis of the phytogeography of the regional floras was conducted by following the same methods utilized for the phytogeographic analysis of the flora of the Totuskey Creek watershed. The numbers of taxa in each phytogeographic category were tallied for the Lower, Middle, and Upper peninsulas of Virginia as well as the Maryland coastal plain. For each phytogeographic

category, 4 x 2 G-tests (Sokal and Rohlf, 1994) evaluated the independence of the geographic region with the frequency of taxa in the category. Some phytogeographic categories were also combined and analyzed following the protocol from a previous study by North (1983). Categories 5c and 6c were combined in order to form a new category encompassing the majority of the “southern flora.” Similarly, a category encompassing the majority of the “northern flora” was created by combining range categories 5b and 6b. Categories where independence was rejected ($P < 0.05$), were subjected to further G-tests evaluating pairwise combinations of geographic areas in 2 x 2 tests. Significance values were adjusted to compensate for all multiple comparisons in a 4 x 2 table (Sokal & Rohlf, 1994).

RESULTS

Floristic Composition

During the course of two growing seasons, a total of 675 vascular plant species in 399 genera and 125 families were collected and identified from the Totuskey Creek watershed (Table 2). Two varieties of one species were also determined, bringing the total number of taxa to 676. All documented taxa, including those for which photographs replaced pressed specimens, are listed in the Annotated Checklist (Appendix A). The collections contributed 154 taxa (22.7%) that are new records from Richmond County, sixteen of which (2.4%) are new records to the Northern Neck peninsula. The new records are marked as such in the Annotated Checklist.

Table 2. Taxonomic summary of collected taxa.

Division	Families	Genera	Species	var./ssp.
<i>Lycopodiophyta</i>	1	3	3	
<i>Pteridophyta</i>	9	13	16	
<i>Pinophyta</i>	3	4	5	
<i>Magnoliophyta</i>				
Monocotyledons	17	94	167	
Magnoliid Dicotyledons	6	10	10	
Eudicotyledons	89	275	475	1
TOTALS	125	400	675	1

The frequency of taxa in each phytogeographic category for the floras of the Totuskey Creek watershed and Corrotoman River watershed are illustrated in Figure 4 (a complete list of the taxa of the Totuskey Creek watershed flora in each phytogeographic range can be found in Appendix C). The phytogeographic categories for each flora follow essentially the same trend. The range category with the largest frequency of taxa from the Totuskey Creek watershed is Range 5a, ranging beyond the Mississippi River, generally north and south (40.0%). The second largest range category is Range 7, introduced plants (21.2%). These categories also contain the largest proportions of taxa from the Corrotoman River watershed. The two categories also exhibit the largest differences in same-category comparisons between the Totuskey Creek watershed flora and the Corrotoman River watershed flora (3.1% and 3.3% difference respectively); however, G-tests indicate these differences are not significant.

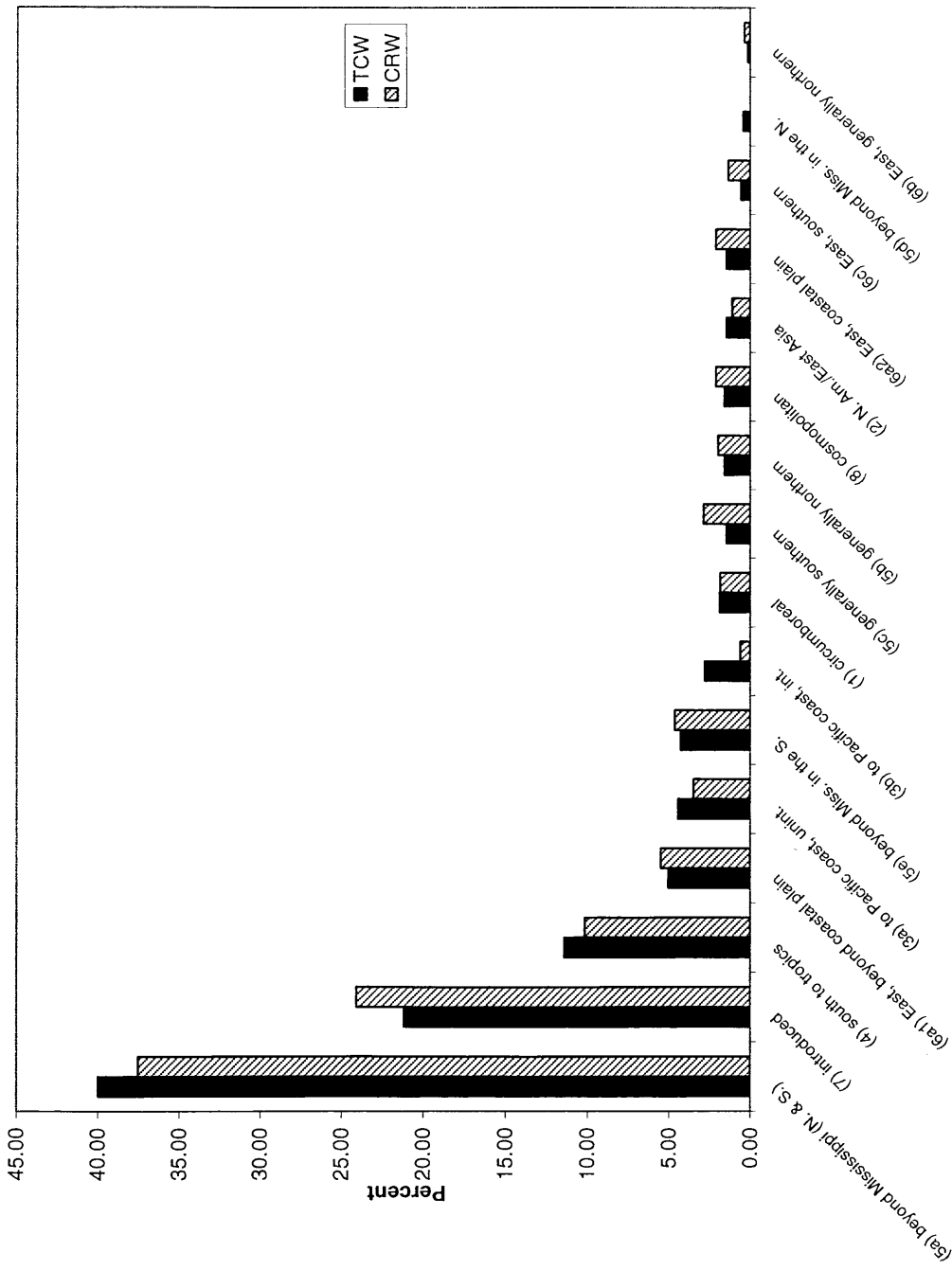


Figure 4. Percentage of taxa in each phytogeographic range category for the Totuskey Creek watershed (TCW) and the Corrotoman River watershed (CRW). CRW ranges assigned by Weldy (1995).

Habitat and Community Descriptions

Differences in physiography, vegetation, topography, and other elements suggested 14 apparently distinct habitats in all. Three main groups of habitats were evident: lowlands, uplands, and disturbed habitats. The descriptions of the habitats and plant communities are presented in the Discussion section.

Regional Floristic Comparisons

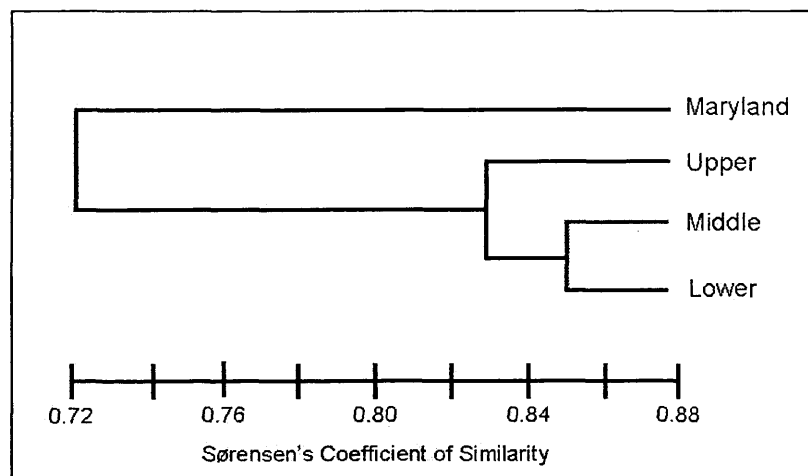
The collection of floras from the Lower Peninsula to the Maryland Coastal Plain resulted in sample sizes ranging from 1,157 taxa (in Maryland) to 1,609 taxa (on the Lower Peninsula) for analysis (Table 3). Sample sizes on each peninsula are greater than those used by North (1983), who did not analyze any floristic data from Maryland. The data generated in the similarity analysis are shown in Table 4. The overall floristic patterns depicted by the similarity analysis are the same as those indicated in the analysis by North (1983). The Lower and Middle peninsulas are the most similar ($CS = 0.854$), while the similarities between both the Lower and Upper peninsulas and the Middle and Upper peninsulas are relatively lower (0.829 and 0.845 respectively). The least similar in all comparisons is the flora of the coastal plain of Maryland. The relationships of similarity among the floras are illustrated in the UPGMA cluster diagram (Fig. 5). While the floristic patterns are the same to those previously identified by North (1983), it is important to note that all coefficients among the comparisons of the Virginia floras in the current analysis are relatively higher than those generated in the previous analysis. This is particularly noticeable in the similarity comparisons with the Upper Peninsula.

Table 3. Numbers of taxa in flora checklists.

	Total Number of Taxa	Total Number of Taxa (North, 1983)
Lower Peninsula	1609	1508
Middle Peninsula	1367	1274
Upper Peninsula	1331	946
Maryland Coastal Plain	1157	n/a

Table 4. Numbers of shared taxa and coefficients of similarity.

Comparison	Shared Taxa	Coefficient of Similarity (this study)	Coefficient of Similarity (North, 1983)
Lower to:			
Middle	1271	0.854	0.845
Upper	1218	0.829	0.722
Maryland CP	978	0.707	n/a
Middle to:			
Upper	1140	0.845	0.778
Maryland CP	904	0.716	n/a
Upper to:			
Maryland CP	943	0.758	n/a

**Figure 5. Cluster analysis (UPGMA) of floristic similarities among floras.**

The phytogeographic similarity identified between the Corrotoman River watershed flora and the Totuskey Creek watershed flora is also consistent across the floras of the Virginia Peninsulas and coastal plain of Maryland (Table 5), with only two of the 16 range categories exhibiting significant heterogeneity. Only the categories representing the majority of the southern flora (categories 5c and 6c) showed significant heterogeneity across the regions ($P < 0.001$, Table 5). Subsequent analysis of pairwise geographic comparisons of the southern flora element indicate significant heterogeneity in all comparisons with the Maryland flora (Table 6) but no significant heterogeneity between any pairs of the Virginia peninsulas (Table 6).

Table 5. Number and percentage of taxa (out of total species) in each phytogeographic range category. G-tests report the overall independence of geographic region and phytogeographic composition. Each row was a 4 x 2 test of independence.

Range	Significance	Virginia Peninsulas				Maryland Coastal Plain	
		Lower	Middle	Upper		# of taxa	% of total
(1) circumboreal	ns	26	26	25	22	1.62	1.90
(2) N. Am./East Asia	ns	11	11	11	11	0.68	0.83
(3a) to Pacific coast, uninterrupted	ns	91	84	75	86	5.66	5.63
(3b) to Pacific coast, interrupted	ns	69	53	56	54	4.29	4.21
(4) south to tropics	ns	106	103	101	81	6.59	7.59
(5a) beyond Mississippi (N. & S.)	ns	644	536	517	489	40.02	38.84
(5b) generally northern	ns	29	21	25	27	1.80	1.88
(5c) generally southern	$P < 0.001$	62	48	35	14	3.85	2.63
(5d) beyond Miss. in the North	ns	3	3	3	3	0.19	0.23
(5e) beyond Miss. in the South	ns	83	73	67	43	5.16	5.03
(6a1) East, beyond coastal plain	ns	69	60	60	46	4.29	3.98
(6a2) East, coastal plain	ns	38	29	26	17	2.36	1.95
(6b) East, generally northern	ns	8	4	6	4	0.50	0.45
(6c) East, generally southern	$P < 0.001$	30	21	13	2	1.86	0.98
(7) introduced	ns	317	273	287	238	19.70	21.56
(8) cosmopolitan	ns	21	22	22	19	1.31	1.65
5b + 6b (northern)	ns	37	25	31	31	2.30	2.33
5c + 6c (southern)	$P < 0.001$	92	69	48	16	5.71	3.61

Table 6. Comparison of southern taxa (ranges 5c + 6c) between pairs of floras. G-tests report the overall independence of geographic region and phytogeographic composition. Each row was a 2 x 2 test of independence.

Comparison	G-value	Significance
Lower to:		
Middle	0.66	ns
Upper	7.3	ns
Maryland	38.3	$P < 0.01$
Middle to:		
Upper	3.4	ns
Maryland	28.2	$P < 0.01$
Upper to:		
Maryland	12.9	$P < 0.05$

DISCUSSION

Floristic Collection

Given the time allotted for collection efforts and the area of the study site, the collection of 676 taxa (Table 2) is consistent with the totals from floristic studies of other areas on the Northern Neck conducted in similar time frames. Weldy (1995) collected 824 taxa in his study area in Lancaster County and Simmons *et al.* (1995) collected 918 taxa in their study area in King George County; however, these collection efforts took place over larger land areas, 85 and 160 square miles respectively. Along the same trend, Dodge (2000) collected fewer taxa (629) in Westmoreland County from a smaller land area than surveyed for the current study. Regardless of this trend, the number of taxa collected in floristic studies cannot be solely attributed to the time spent collecting nor the area of the study site. The prowess and biases of the collector also affect the number of taxa collected. Perhaps the most important factor in comparing numbers of taxa between two study areas is the diversity of habitats found in each area. While accounts of the habitats in each of the studies mentioned above overlap considerably with the current study of the Totuskey Creek watershed, there are a few habitats that are described from one or two of the studies and not from the study of the Totuskey Creek watershed [e.g., steep river bluffs (Weldy, 1995; Dodge, 2000) and salt meadows, pocket marshes, and sphagnous headwaters (Weldy, 1995)]. The Atlas of the Virginia Flora III (Harvill *et al.*, 1992), following updates from this and relatively recent studies, indicates at least 1331 taxa grow on the Northern Neck. If the distribution of these plants on the Northern Neck

is assumed to be relatively even across the whole peninsula, then the current study has documented roughly 50% of species theoretically growing in the Totuskey Creek watershed.

It is clear from the number of county records (154) and peninsula records (16) that the previous knowledge of the flora of Richmond County was inadequate, lacking many records of the vascular plant species, including some considered to be quite common (*e.g.*, *Phragmites australis*, *Aralia spinosa*, and *Quercus velutina*). No records of state or federally listed rare species were collected in the Totuskey Creek watershed. This is in contrast to collections by Weldy (1995) in the Corrotoman River watershed which included 12 plant species listed as rare by the Virginia Natural Heritage (Townsend, 2007). This is interesting since the habitats similar to those from which Weldy documented some of these rare species in the Corrotoman River watershed (*e.g.*, ravine bottoms and wet “swamps”) were also surveyed in the Totuskey Creek watershed. Habitats harboring additional rare species in the Corrotoman River watershed include salt meadows and pocket marshes. According to Weldy’s descriptions, these wetlands are distinct from the brackish marsh habitats of the Totuskey Creek watershed due to their relatively higher salinity.

A considerable number of species collected in the Totuskey Creek watershed (143 spp., 21.2% of the flora) are introduced (phytogeographic Range 7). This is a slightly lower, but comparable figure to study areas in other counties on the Northern Neck: King George County (21.7%), Westmoreland County (26.3%), and Lancaster County (24.1%). This data indicates that at least one of every five species growing on the Northern Neck is not native to this region.

Two exotic species (*Ranunculus ficaria* L. and *Pseudognaphalium stramineum* (Kunth) W.A. Weber) are documented from the Northern Neck for the first time and are uncommon-to-rare among exotics known from Virginia. The lesser celandine, *Ranunculus ficaria*, is a European introduction and is most common to cool, swampy areas and gardens of the northern United States (Flora North America Editorial Committee, 1993+). *Ranunculus ficaria* is documented from the Totuskey Creek watershed persisting in a compost pile and spreading to a nearby forest margin in the vicinity of a residence alongside the north end of Canal Road. It is known only from three other Virginia counties (Fairfax Co., Albermarle Co., and Chesapeake Co.) (Harvill *et al.*, 1992). *Pseudognaphalium stramineum* is native to South America and western North America, and is documented in this study from a dry, sandy clear-cut area east of Luttrellville Lane. Previously, this species was only documented from Suffolk, Northampton, and Accomack counties (Harvill *et al.*, 1992). The introduction of both of these exotics appears extremely localized. Each was only found in one area and in low numbers. Only two plants of *P. stramineum* were found. There was no evidence at either site that these plants pose an immediate threat to surrounding plant communities.

Among the native species of the Totuskey Creek watershed, the dominant affinity is in phytogeographic Range 5. That is, 47.9% of the flora has a distribution in North America ranging from the Atlantic coast west beyond the Mississippi River, but not to the Pacific Coast. The majority of these species (40.0% of the flora) can be found in range 5a; generally distributed north and south (Fig. 5). There are nearly equal numbers of species in Range 5b, generally northern in distribution (11 spp.), and Range 5c, generally southern in distribution (10 spp.). Even though many more species fit Range

5e, ranging beyond the Mississippi in the South (29 spp.), than in Range 5d (3 spp.), ranging beyond the Mississippi in the North, the collective implication of the numbers in Range 5 illustrate that the flora of the Totuskey Creek watershed is neither decidedly northern nor decidedly southern, but rather includes species with broader distributions.

The next largest proportion of taxa (11.4%) belong to Range 4, ranging south beyond the United States to the New World tropics. Groups of these species have ranges that extend into the Caribbean Islands, Mexico, and in a few cases Central and South America. Some of these species can also be found in northern North America (*e.g.*, *Potamogeton foliosus*, *Eclipta prostrata*, and *Bidens laevis*) providing some of the longest and most continuous ranges among all species in the flora.

Forty-nine species fit into Range 6 (7.3% of the flora), and have ranges restricted to eastern North America, east of the Mississippi River. Forty-four of these species are distributed north and south (Range 6a), providing further evidence that the flora is not chiefly comprised of characteristically northern or characteristically southern plants. While the study site is contained within the Atlantic Coastal Plain, many species in the flora have eastern ranges that extend widely outside the coastal plain (subrange 6a1, 34 spp.). The remaining species in Range 6a are exclusive inhabitants of the Coastal Plain (subrange 6a2, 10 spp.). Only one species, *Carex platyphylla*, is generally northern in distribution east of the Mississippi (Range 6b). This species on the coastal plain is disjunct from its more regular range in the mountains of Virginia. Finally, four species fit most accurately into Range 6c, generally southern in distribution: *Hexastylis virginica*, *Helianthus atrorubens*, *Hibiscus moscheutos*, and *Yucca filamentosa*.

Forty-nine species have either interrupted or uninterrupted ranges across North America including the Pacific Coast (Range 3). Thirty of these species (4.4% of the flora) have an uninterrupted distribution (Range 3a), and include many grasses, while 19 species (2.8% of the flora) have various interrupted distributions (Range 3b), and include only one species of grass.

Thirteen plants (1.9% of the flora) have circumboreal ranges (Range 1). These plant with large ranges are distributed about the high latitudes of the northern hemisphere. Interestingly, with the exclusion of *Osmunda regalis* and *Ophioglossum vulgatum*, all of the species in this range are among the most common and abundant of those species occurring in their respective typical habitats. Several of these plants are common to a number of habitats (e.g., *Galium aparine*, *Eleocharis obtusa*, *Calystegia sepium*, and *Prunella vulgaris*).

The nine species native to both North America and Eastern Asia (Range 2, 1.5% of the flora) are among the most interesting species, phytogeographically. The similarities between North American and East Asian floras have been studied by many scientists such as Soviet-Armenian botanist Armen Takhtajan (Takhtajan, 1986) and Chinese botanist Hui-Lin Li (Li, 1977). The assemblage of plants currently shared by the two continents may be the remainder of what was once a much larger group of shared taxa due to continental land bridges and the wide extent of the northern temperate forests during the Tertiary Period (Wen, 1999). The majority of the species from the Totuskey Creek watershed that fit in this range category include several that are typical of mesic woodlands: *Adiantum pedatum*, *Dendrolycopodium obscurum*, *Huperzia lucidula*, *Liparis liliifolia*, *Monotropa uniflora*, and *Phryma leptostachya*. The remaining species in this

category grow in more wet, lowland woods and streambanks: *Symplocarpus foetidus*, *Persicaria virginiana*, *Onoclea sensibilis*, and *Penthorum sedoides*.

The final range, Range 8, includes 11 cosmopolitan species (1.6% of the flora). These species can be found in areas all over the world, or nearly so. Seven of these are restricted to wetland habitats and include the conspicuous and familiar reed (*Phragmites australis*) and cattails (*Typha* spp.). A few exhibit considerable morphological variation across large distances (*Schoenoplectus tabernaemontani* and *Cyperus esculentus*) or regular infrageneric hybridization (*Typha* spp.) (Flora North America Editorial Committee, 1993+). Due to this hybridization and variation among specimens, systematists around the world support various classifications of these taxa.

The taxa in the range categories from the Totuskey Creek watershed and the Corrotoman River watershed (Weldy, 1995) follow a strikingly similar pattern. The differences in proportions of taxa in pairwise comparisons of the range categories are not statistically significant. This similarity is understandable since the two study sites are less than 25 miles apart and are related in many aspects including elevation, physiography, and habitat composition.

Habitat and Plant Community Descriptions

The physiography of the study area can be easily divided into two zones: lowlands and uplands. The lowlands literally encompass habitats found in the lowest elevations, to and below sea-level. Naturally, water drains to these areas forming small streams, flood plains, and other wetlands that eventually drain into Totuskey Creek. Lowland habitats such as pools and ponds can also be found surrounded by upland areas.

The uplands consist of areas at relatively higher elevations and include the land along the higher slopes and ridges of the watershed.

Disturbed habitats can be found in both lowlands and uplands, but are described in a separate group. Generally, it is easy to predict the plant communities associated with these human-altered habitats; however, a few of these habitats harbor plant communities that can be highly variable. Presented below are the fourteen natural and disturbed habitats encountered in the Totuskey Creek watershed and their associated plant communities.

Lowland Habitats:

Sandy River Bank

Narrow bands of sandy soil and pure sand can be found along the edge of Totuskey Creek and adjacent Rappahannock River. This xeric habitat supports a depauperate flora. Nonetheless, a few species were found here and nowhere else during this study. These uncommon species include *Cenchrus tribuloides* often growing in the pure sand, and *Portulaca oleracea*, *Opuntia humifusa* and *Quercus stellata* found growing further from the water's edge. Other, more common plants growing here include *Pinus virginiana*, *Atriplex patula*, *Eragrostis curvula*, *Hordeum pusillum*, and *Smilax bona-nox*.

Brackish Marsh

Aerial photographs and maps of the region indicated that marshes occupy nearly all non-developed margins of Totuskey Creek. This habitat forms at the boundary of the deep water and transitions gradually to surrounding uplands. Dense wetland vegetation is

dissected by meandering, shallow, tidal streams, some of which form part of the upland drainage. The waters of the Rappahannock at the mouth of the Totuskey Creek are partly saline, and this brackish water has an influence on the marsh vegetation as far inland as the Route 3 bridge. *Spartina alterniflora*, *S. cynosuroides*, and *Typha angustifolia* dominate these wetlands. *Schoenoplectus robustus* and *S. americanus* are also abundant as emergents and on tussocks along the margin of the water. *Phragmites australis* is uncommon, but when present, often forms dense patches. Other conspicuous species include *Kosteletzkya virginica*, *Hibiscus moscheutos*, and *Iva frutescens*. In moist soil or still, shallow water along the margin near surrounding uplands are less conspicuous species such as *Pluchea odorata*, *Hydrocotyle verticillata*, and *Symphytotrichum subulataum*. *Baccharis halimifolia*, *Quercus phellos*, and *Ilex opaca* are found on the uplands adjacent to the marshes. A single individual of *Quercus laurifolia* was found at the margin of a brackish marsh at the end of Wellford's Wharf Road. This is the only specimen found during the study, and is the only known location of this tree species on the Northern Neck.

Freshwater Marsh

Freshwater marshes are located further upstream from the brackish marshes; however, a small tidal fluctuation is still visible. Freshwater fish such as longnose gar (*Lepisosteus osseus*) and carp (*Cyprinus carpio*) are often visible in the clear shallow water. One of the largest and most accessible examples of a freshwater marsh is located on the Little Totuskey Creek branch just south of Indianfield Road in Warsaw. The first conspicuous change from brackish to freshwater marsh is the presence of *Nuphar advena* which can form large masses that often span the width of the creek or stream. *Spartina*

cynosuroides and *Peltandra virginica* are also often abundant. In midsummer, an array of showy flowers is regularly visible including the blooms of *Pontederia cordata*, *Lilium superbum*, *Thalictrum pubescens*, *Cephalanthus occidentalis*, *Mimulus ringens*, and *Rosa palustris*. *Alnus serrulata*, *Carex comosa* and *C. lurida* are common in the transition zone to the surrounding uplands. These marshes are often flanked by mixed hardwood slopes, so a variety of trees grow at the margins; *Fraxinus pennsylvanica*, *Acer rubrum*, and *Nyssa sylvatica* are the most common. The ash and maple are often hosts to *Phoradendron leucarpum*, which is only clearly visible in the leafless branches in late autumn.

Ponds

There are several millponds along the northern reaches of the Totuskey Creek above VA Route 360; however, the area defined for this study included only two man-made ponds along Wellford's Wharf Road and the occasional pool at the headwaters of small streams. The man-made ponds retain a relatively constant water level throughout the growing season; however, headwater ponds exhibit a significant drop in water level towards the end of the summer. Even with the differences in hydrology, these two types of ponds have a considerable overlap in species composition. The calm pond waters support large colonies of *Nuphar advena* and a white form of *Nymphaea odorata* ssp. *odorata*. Also present are smaller aquatics such as *Lemna valdiviana*, *Callitriche heterophylla*, and *Hydrocotyle ranunculoides*. *Utricularia gibba* is found on the water surface near the pond margin and on floating masses of organic material. *Potomogenton foliosus* was found in an algae-infested stormwater pool. The muddy edges of ponds support a variety of *Carex* spp. as well as *Gratiola virginiana*, *Ludwigia palustris*, *L.*

decurrens, *Lobelia cardinalis*, and *Dulichium arundinaceum*. On the sloping banks of the ponds are *Osmunda regalis* var. *spectabilis*, *Osmunda cinnamomea*, *Woodwardia areolata*, *Juncus effusus*, *Gaylussacia frondosa*, *G. baccata*, *Clethra alnifolia*, and *Rosa multiflora*. The bank of one of the man-made ponds is the only known location of *Taxodium distichum* in the watershed.

Streambanks

The banks of the largest tributaries of Totuskey Creek support canopy trees such as *Fraxinus pennsylvanica*, *Quercus michauxii*, and occasionally *Q. alba*. Other trees such as *Liquidambar styraciflua*, *Carpinus caroliniana*, and *Acer rubrum* can also be found along the streambanks. Thickets of *Viburnum dentatum* and *V. nudum* can be found along most stream corridors. Growing amongst the *Viburnum* are twining and climbing species such as *Mikania skandens*, *Smilax rotundifolia*, *Amphicarpa bracteata*, *Apios americana*, and *Cuscuta* spp. Many showy wildflowers grow here and include *Impatiens capensis*, *Bidens laevis*, *Eupatorium fistulosum*, *Decodon verticillatus*, and *Mimulus alata*. *Persicaria* spp. and *Toxicodendron radicans* are common along disturbed parts of the streambanks.

Smaller streams often found in the upper reaches of the watershed form at the bases of ravines of various sizes and often meander through flood plains of widths several times that of the streams. These are some of the first areas to “spring to life” in the earliest part of the growing season. The narrow streambanks support numerous *Carex* spp., *Luzula echinata*, *Glyceria striata*, *Cardamine pennsylvanica*, *C. bulbosa*, *Ranunculus abortivus*, *Viola cucullata*, and *V. primulifolia*.

Stream Floodplains

Stream floodplains remain moist through all but the latest part of the season. Dense stands of *Athyrium filix-femina*, *Saururus cernuus*, and *Smilax rotundifolia* are the most constant and abundant constituents of the herbaceous flora on the flood plain. Also nearly ubiquitous is *Claytonia virginica*. *Symplocarpus foetidus*, *Caltha palustris*, *Chelone glabra*, *Collinsonia canadensis*, and *Erythronium americanum* are rare but locally abundant. Orchids such as *Galearis spectabilis*, *Platanthera clavellata*, and *P. lacera* are also occasionally found here. Some of the shrubs include *Alnus serrulata*, *Lindera benzoin*, *Cornus amomum*, and *Viburnum nudum*. *Euonymus americana* is regularly found along the margin of the floodplain as it meets the surrounding forested upland slopes. Canopy trees in the wet flood plain are *Acer rubrum*, *Liriodendron tulipifera*, *Quercus michauxii*, and occasionally *Platanus occidentalis*. Other regular tree members include *Fraxinus pennsylvanica*, and *Carpinus caroliniana*. *Asimina triloba* and *Magnolia virginiana* are found only occasionally, but often form dense stands. *Betula nigra* and *Itea virginica* are only present in floodplains and on streambanks with relatively open canopies. In more disturbed floodplains, a waist-high thicket formed by late-summer die-off of *Persicaria* spp. and various sedges and grasses, and the proliferation of *Smilax* make many of these areas nearly impassable on foot during the second half of the growing season.

Ravines

Ravines of various sizes provide small-scale topographic relief in the watershed. Steep wooded banks often lead to a wet ravine bottom or flowing stream. *Fagus grandifolia* is often the most abundant canopy tree at the top of the ravine slope and

surrounding forest. *Liriodendron tulipifera* is also present, but grows lower on the slopes and is often less abundant. Near the ravine bottom, *Carpinus caroliniana*, *Kalmia latifolia*, and *Asimina triloba* are the most abundant woody species. The shady conditions and moist humus found on the ravine slopes provide a preferable habitat for many ferns and other species amenable to such conditions. *Polystichium acrostichoides* is common, while *Adiantum pedatum* is rare, but locally abundant. Other ferns such as *Thelypteris novaboracensis*, *Osmunda cinnamomea*, and *Athyrium filix-femina* are plentiful on the ravine bottom. Ravine slopes support graminoids such as *Poa cuspidata*, *Carex platyphylla*, and *C. atlantica*, while *C. intumescens* and *C. rosea* can occasionally be found on the ravine bottom. Additional herbs such as *Hydrangea arborescens*, *Actaea pachypoda*, *Viola cucullata*, *Aristolochia serpentaria*, and *Galearis spectabilis* are present in low numbers, while *Medeola virginica* is often very abundant.

Upland Habitats:

Mixed Hardwood Forest

There is a considerable amount of forest in the watershed that is entirely mixed hardwoods, or with few pines restricted to the edges. Sloping mixed hardwoods, like those found along the lower reaches of Fox Hunter's Hill Road and the lowlands bordering the Mulberry Road bridge, are dominated by *Fagus grandifolia*, with lower, but significant proportions of *Acer rubrum* and *Liriodendron tulipifera*. Flat-ground or gradually sloping hardwood areas, such those bordering Route 603, appear to contain *Quercus alba* and *Carya pallida* in highest proportions. Additional trees such as *Quercus rubra* and other *Carya* spp. make up most of the remainder of the hardwood canopy. *Ilex*

opaca, *Cornus florida*, and *Kalmia latifolia* are the most common and abundant members of the understory. Leaf litter and soil humus are often thick in these areas and the herbaceous diversity is highly variable, but generally low. Ferns such as *Polystichium acrostichoides* and *Botrychium virginianum* can be quite abundant. *Uvularia perfoliata*, *Hexastylis virginica*, *Dioscorea villosa*, and *Tipularia discolor* are regular elements of the herb flora, while *Huperzia lucidula*, *Sphenopholis pennsylvanica*, *Monotropa uniflora*, *Aristolachia serpentaria*, *Anemone virginiana*, and *Aplectrum hyemale* are more infrequent. *Carex* species such as *C. platyphylla*, *C. laxiculmis*, and *C. amphibola* can also be found in this habitat.

Pine/Mixed Hardwood Forest

The pine/mixed hardwood habitat is likely the most common forest habitat in the watershed. *Pinus taeda* occupies a significant portion of the canopy, and *Quercus alba*, *Carya pallida*, and *Acer rubrum* are important hardwoods in this habitat. *Quercus montana* is rare to uncommon, and occupies open or “gap” areas in the forest. *Myrica cerifera* joins *Ilex opaca* and *Oxydendron arboreum* in the understory while *Gaylussacia frondosa* and *Vaccinium stamineum* are common and often very abundant on the forest floor. The type of herbaceous community appears to depend mostly on the degree of disturbance present in the forest. In relatively less disturbed areas, herbs such as *Dendrolycopodium obscurum*, *Diphasiastrum digitatum*, *Chimaphila maculata*, and *C. umbellata* can be expected. In more disturbed areas, vines are abundant and include *Toxicodendron radicans*, *Smilax* spp., and *Rubus* spp. Three orchid species were occasionally observed in this habitat. While *Liparis liliifolia* and *Malaxis unifolia* seem to be sensitive to forest disturbance, *Cypripedium acaule* appeared to persist quite well

even with considerable disturbance, and seemed to be most abundant closest to the forest margin, roadside, or other source of disturbance.

Successional Pine Stands

Although this habitat in modern times is almost always created as a result of disturbance by human activity, it is not maintained by these disturbances, and will be considered here with other wooded habitats instead of the regularly disturbed habitats in the following section. These nearly pure pine stands are rare in the Totuskey Creek watershed and those encountered did not appear to be old cultivated land, but rather areas formerly clear-cut for logging. Young individuals of *Pinus taeda* are most prevalent and grow in such high density that traversing these areas on foot is troublesome. *Pinus virginiana* is common but seems to be restricted to the forest margin, along with *Quercus falcata*, *Kalmia latifolia*, and *Toxicodendron radicans*. *Chimaphila maculata* is the most common and abundant herb in these successional pine areas. Other vegetation on the interior includes occasional groupings of *Gaylussacia frondosa* and sparse thickets of *Smilax*. *Cypripedium acuale* was rarely seen and only as small seedlings.

Disturbed Habitats

Roadsides

Immediately adjacent to roadside pavement are bands of gravel and gravelly soil. Further from the pavement, all roadsides are bordered by a shallow roadside ditch, margin of a cultivated field, or disturbed forest margin, and most roadsides are mowed at least once during the growing season. There exist a multitude of environmental conditions along roadsides, and likewise, the flora of this habitat exhibits tremendous

variation. Roadsides are a haven for introduced species, especially grasses. *Festuca arundinacea*, *Dactylis glomerata*, *Anthoxanthum odoratum*, *Eragrostis spectabilis*, and *Bromus racemosus* are very common and abundant. A more careful examination of dry roadsides would reveal more diminutive grasses such as *Aira caryophyllea*, and *A. praecox*. Moist roadsides support additional graminoids such as *Juncus tenuis*, *Cyperus esculentus*, *C. lupulina*, *C. retrorsus*, and occasionally *Kyllinga gracillima*. Introduced wildflowers such as *Echium vulgare*, *Trifolium incarnatum*, *Coronilla varia*, and *Vicia* spp. are scattered along roadsides. Showy native species include *Viola pedata*, *Penstemon laevigatus*, *Polygala mariana*, *P. curtissii*, *Lobelia puberula*, *Rhexia mariana*, *Asclepias tuberosa*, *Rosa carolina*, *Symphytotrichum* spp., and *Solidago* spp. Moist, roadside ditches appear to support a unique group of plants found nowhere else in the survey. This group includes *Ruellia caroliniensis*, *Conoclinium coelestinum*, *Hypericum perforatum*, *Anoda cristata*, and *Euphorbia cyathophora*. Shrub species regularly occurring along roadsides include *Sambucus canadensis*, *Rhododendron periclymenoides*, and *R. atlanticum*. Small trees such as *Amelanchier obovata*, *Pyrus communis*, *Malus pumila*, and *Prunus persica* can also be found here.

Fields and Field Margins

Most fields of appreciable size are used for crop cultivation at least part of the year. The fields not cultivated fall into two general groups, those recently cultivated and fallow for less than 12 months and those fields appearing uncultivated for a year or more. Recently fallow fields can occasionally contain persisting crop plants such as *Triticum aestivum* (wheat) and *Avena sativa* (oats). Additional grasses such as *Vulpia octoflora* and *Lolium perrene* are quick to colonize the bare soil. Members of the *Brassicaceae*

also colonize quickly and are perhaps the most diverse group in recently fallow fields. *Barbarea vulgaris*, *Arabidopsis thaliana*, *Lepidium* spp., *Teesdalia nudcaulis*, and *Cardamine hirsuta* are most common.

The presence of perennial and biennial plants is an indication that a field may be uncultivated for a year or more. The earliest flowering perennials include *Asclepias* spp., *Oenothera laciniata*, and *O. biennis* (biennial). Other perennials such as *Solidago* spp. and *Eupatorium* spp. persist into the late autumn if the field is left unmown. Annuals are not absent from these aged fields, however. Colorful displays of *Centaurea cyanus*, *Lamium* spp., *Vicia* spp., *Ipomoea* spp. and *Lathyrus hirsutus* are common in the spring and summer months.

The flora of the field margin mostly mimics that of the adjacent field; however there seem to be many species that prefer the conditions of this edge habitat to the occasionally cultivated soil. Regularly at the margins are *Viola* spp., *Desmodium* spp., *Cuscuta campsestris*, *Asparagus officinalis*, *Sida spinosa*, *Datura stramonium*, *Daucus carota*, and *Xanthium strumarium*. Rare, but notable species found here include *Physalis longifolia* var. *subglabrata*, *Hordeum vulgare*, *Persicaria lapathifolia*, and *Helianthus tuberosus*. Woody species are also usually confined to the margins of fields, and regularly include *Rhus glabra*, *Juniperus virginiana*, and *Celtis occidentalis*.

Cut-over Areas

This habitat is created when a tract of land is cleared of trees for logging or development. Usually, both pine and hardwood species are cut, leaving only coarse tree stumps, piles of limbs, stripped bark, and the infrequent heap of discarded timber. Oddly, sizable individuals of *Ilex opaca* and *Oxydendrum arboreum* are often left standing.

Stump sprouts of many cut species allow for the reconstruction of what the tree composition and likely herbaceous community may have looked like. This disturbed habitat provides many open areas for pioneer species such as *Erechtites hieracifolia*, *Verbascum thapsis*, *Solanum* spp., *Solidago* spp., and *Eupatorium* spp; however, the many of the species here appear to be native remnants of the previous woodland community that persist for a short time after logging. Woodland graminoids such as *Chasmanthium laxum*, *Luzula bulbosa*, *Carex pensylvanica*, and *C. albicans* var. *emmonsii* persist even without the dense tree canopy previously present. Ericaceous shrubs such as *Rhododendron periclymenoides*, *Gaylussacia baccata*, and *G. frondosa* are also common. Non-native trees such as *Paulownia tomentosa* and *Albizia julibrissin* can be observed in areas aged several years since logging.

Powerline Cuts

Powerline cuts are corridors created for the unobstructed passage of a variety of utility lines. These cleared strips, up to 50 meters in width, can be several miles long and usually connect with other powerline cuts or terminate at regional utility stations. Much like cut-over areas, powerline cuts are disturbed habitats formed by the removal of all woody vegetation, and usually occur adjacent to natural habitat with which the disturbed area was once continuous. The powerline cuts are maintained by utility personnel and are mown up to twice a year in some places (pers. obs) to inhibit the re-growth of woody species. Because of this regular disturbance, the floras of powerline cuts are often a mix between that of other regularly disturbed areas and the nearby natural habitat. In the spring, violets such as *Viola sagittata*, *V. primulifolia*, and *V. pedata* are scattered amongst additional early-blooming species such as *Rubus* spp., *Potentilla canadensis*,

Houstonia caerulea, and *Packera anonyma*. A few woodland species in refuge under persisting shrubs and the woodland border are also blooming at this time including *Hexastylis virginica* and *Hepatica americana*. Grasses and *Carex* species occur in great profusion throughout the season; the most common in dry areas are *Anthoxanthum odoratum*, *Danthonia spicata*, *Andropogon* spp., *Dichanthelium* spp., *Carex umbellata*, *C. nigromarginata*, and *C. albicans* var. *emmonsii*. Alongside the occasional stream flowing across the powerline cut and other moist areas are *Cinna arundinacea*, *Sphenopholis obtusata*, *Carex lurida*, *C. crinita*, and *C. vulpinoidea*. Legumes are another plentiful group in this habitat. Often present are *Desmodium* spp., *Lespedeza* spp., *Galactia volubilis*, and *Stylosanthes biflora*. Some woody species do persist, especially on slopes where mowing is problematic. *Kalmia latifolia* and *Elaeagnus umbellata* are common.

Flooded Tire Ruts

Large, motorized equipment used for the clearing of trails for hunting, logging, or the maintenance of powerline cuts can sometimes leave deep tire ruts in the soil. These tire ruts can be 12 inches or more in depth, several feet long, and often retain storm water for extended periods of time. The flooded tire ruts support many obligate and facultative wetland species, even though they are often far removed from any natural wetland habitat. In fact, some of the wetland species were observed exclusively in this disturbed habitat and never at other suitable, natural wetland sites. These species include *Alisma subcordatum*, *Heteranthera reniformis*, *Fimbristylis autumnalis*, and *Rotala ramosior*. Other, more widespread species such as *Scirpus atrovirens*, *Juncus effusus*, *Persicaria*

sagittata, *Bidens polylepis*, *Hypericum mutilum*, *Utricularia gibba*, *Lindernia dubia*, and *Eleocharis* spp. are also found in this disturbed habitat.

Regional Floristic Comparisons

When taxa newly recorded from the Upper Peninsula were added to the Atlas of the Virginia Flora III (Harvill *et al.*, 1992) it became apparent from simple inspection of records in the Atlas that the Upper Peninsula shares many more taxa with the Lower and Middle peninsulas than previously described by North (1983). The relatively higher similarity values in the comparative similarity analysis were, therefore, not completely unexpected. However, it is difficult to identify the exact cause of the difference in the similarity values from the previous analysis to the current analysis since new floristic information in the current analysis includes not only higher numbers of shared taxa between peninsula floras, but also higher numbers of taxa in each flora checklist. The Sørensen's Coefficient of Similarity is affected by both of these values.

Perhaps more important than the discrepancy in raw numbers from one study to the next is the similarity in the pattern of floristic similarity across this region that the data from both studies illustrate. The results obtained by North (1983) and those of the current analysis both indicate that the floras of the Lower and Middle peninsulas are the most similar among the Virginia peninsulas (current study, CS = 0.854; Table 4). Furthermore, there is a progression of decreasing similarity of adjacent peninsulas in a northern direction (Fig. 4). For example, the Middle and Upper Peninsula's similarity drops to 0.845, and the Upper Peninsula's similarity to Maryland drops to 0.758. Consistent with this pattern is the observation that the most dissimilar comparison is the

Lower Peninsula and Maryland (CS = 0.707). Although the values are very close to each other in all comparisons, they are consistent with the hypothesis proposed by North (1983) that flora gradually changes its composition in a northern/southern fashion.

Most intriguing are the noticeably lower similarity coefficients in all pairwise comparisons with the Maryland coastal plain flora (Table 4). These results make it appear that the Maryland flora is remarkably distinct from the other floras analyzed. Although this could be explained as the result of comparing floras containing very different habitats, this does not appear to be the case. The floristic studies used to populate the Maryland flora checklist indicate sampling an array of habitats that are strikingly similar to those encountered on the Northern Neck. For example, in Calvert County, Steury (2002) sampled an area including uplands comprised of, "...mixed deciduous and coniferous forest..." dominated by chestnut oak (*Quercus montana*), black oak (*Quercus velutina*), scarlet oak (*Quercus coccinea*), *Carya* spp., Virginia Pine (*Pinus virginiana*) and loblolly pine (*Pinus taeda*). The study area also borders the Chesapeake Bay and likely included fresh and brackish marsh habitats. Other wetland sites such as, "...ponds, creeks, and seeps" are also indicated as sampling sites (Steury, 2002). In Prince Georges and Charles counties along the Potomac River, Steury *et al.* (2003) sampled habitat types including, "...cultivated fields, deciduous forest, streams shores, marshes, swamps, wet thickets,...ponds, meadows, and a sand spit...". The habitats sampled in these studies are not unlike those encountered during the study of the Totuskey Creek watershed and other studies on the Northern Neck (Simmons *et al.*, 1995; Weldy, 1985; and Dodge, 2000).

Finally, another factor influencing the apparent dissimilarity of Maryland to the Virginia peninsulas may be the sample size of taxa for the analysis. The Atlas of the Virginia Flora III (Harvill *et al.*, 1992) is a synthesis of many floristic studies, published and unpublished, and well-documented records from professional and amateur collections over a time span exceeding 30 years. The Maryland checklist used for the current analysis was synthesized only from two available published works and a single graduate student thesis. Even though the county sizes (the map unit for The Atlas of the Virginia Flora) may be comparable, the Maryland studies together doubtfully cover a comparable land area to that of the Atlas, and without the multitude of unpublished information, is bound to be less complete. Additional floristic study or perhaps a more exhaustive search for unpublished records would make for a more complete checklist of Maryland plants. A more complete list in the future may uncover a large number of additional species shared with the peninsulas of Virginia, and therefore produce similarity coefficients more like those among the Virginia peninsulas.

While the results of the similarity analysis indicate the floras of this region gradually change and become less similar in a northern direction, the phytogeographic analysis indicates that the proportion of southern species in each flora may not play as large a role in this change as previously indicated by North (1983). Most phytogeographical categories show no heterogeneity across the region (Table 5). Only categories 5c and 6c, the categories representing the southern flora element, show a significant decrease toward the north across the whole region ($P < 0.01$). Also significant are all differences in the proportions of the southern flora in pairwise comparisons with the Maryland flora (Lower-Maryland: $P < 0.01$, Middle-Maryland: $P < 0.01$, Upper-

Maryland: $P < 0.05$, Table 6). Surprisingly, there is no significant difference in the proportion of the southern flora between any two of the Virginia peninsulas. This is in contrast to the results obtained by North (1983) which indicated a significant change in these range categories between the Lower and Upper peninsulas as well as the Middle and Upper peninsulas.

The significant change in proportion of southern species in a northern direction found in the previous study appeared to correlate with the decrease in floristic similarity also found in the previous study. The significant difference in the proportion of southern species in the Maryland flora found in the current study also appears to correlate with the relatively low similarity values when comparing the Maryland flora to the Virginia floras. The results of the comparisons of just the Virginia peninsulas in the current study are less congruent. While the proportion of southern species do actually decrease somewhat in a northern direction [5.7% (Lower Peninsula), 5.0% (Middle Peninsula), 3.6% (Upper Peninsula), and 1.4% (Maryland coastal plain)], this change is not statistically significant. This result indicates that the proportion of southern species may not play a large role in the gradual change in floristic similarity across the peninsulas. The collective results of the phytogeographic analysis indicate that the drop-out of a significant proportion of southern species in a northern direction may not begin to occur before crossing the Potomac River into Maryland.

After analyzing the southern flora, it became of interest to analyze the range categories that comprise the northern flora (ranges 5b & 6b). The proportions of the northern flora element do not differ significantly across these same floras or between any two them. This is a curious result since it would seem logical to infer that the conditions

causing the southern flora to decrease in proportion in a northerly direction from the Lower Peninsula to Maryland would also cause the northern flora to decrease in proportion in a southerly direction. These contrasting patterns are likely due to the different areas of the eastern US in which these plants find a limit to their range and the direction in which these plants “drop out” of the flora in Virginia. Plants considered strictly southern, those that are normally confined to the lower two-thirds of the eastern US, persist in the mild, maritime climate of the Atlantic Coastal Plain, but drop out relatively quickly in a northern direction across a region including Virginia. Plants normally confined to the northern two-thirds of the eastern US, and so called northern species, find refuge in the higher altitudes of the Appalachian range in western Virginia. The true southern limit of these northern species is likely in the mountain areas, but in areas further south than Virginia. These northern plants found in Virginia have ranges that spread eastward in the state, and just as the southern species drop out in the northern direction, the northern species drop out in an eastern direction. Because of this, the northern plants found on the coastal plain are a subset of a larger group of northern plants found in the western part of the state. They are likely widely adapted and may persist in many areas of the state, and so the proportion of these species does not change in a north-south direction like their southern counterparts (Stewart Ware, pers. comm.).

In addition to analyzing the proportions of southern species, North (1983) provides a list of species known at the time to have ranges terminating south of the Northern Neck. Of these 63 species, 10 are now known from the Northern Neck according the Digital Atlas of the Virginia Flora (Virginia Bot. Associates, 2007). These species include *Symphyotrichum grandiflora*, *Cyperus haspan*, *Carex oxylepis*, *C. viridis*,

Decumaria barbara, *Desmodium fernaldii*, *Drosera capillaris*, *Eupatorium saltuense*, *Penstemon australis*, and *Rhyncospora inexpansa* (Weldy, 1995). One of these species, *Eupatorium saltuense*, is known only from the Totuskey Creek watershed in Richmond County. The current study also includes the collection of *Quercus laurifolia* Michx., the first known location of this species on the Northern Neck. This oak is an occasional constituent among tree species on sandy flood plains and river banks from Virginia and the Carolinas south to Florida and west to Louisiana (Flora North America Editorial Committee, 1993+). On the southern boundary of Richmond County, a single tree was found growing in a wet, sandy depression at the margin of a brackish marsh near the mouth of the Totuskey Creek at the Rappahannock River. Previous to this study, the northernmost occurrence of *Q. laurifolia* was known from King William County on the Middle Peninsula (Virginia Botanical Associates, 2007). The occurrence of this decidedly southern species in Richmond County on the Northern Neck is a range extension in Virginia of approximately 25 miles northward. The documentation of species previously thought not to occur on the Northern Neck is another valuable result of this floristic study in Richmond County.

CONCLUSIONS

Without any previous floristic information specific to the Totuskey Creek watershed, it is difficult to assess how close the number of 676 taxa is to the true number of taxa in the flora of the area. It is almost a certainty that many taxa went unnoticed and undocumented in the current study; however, the collection efforts were sufficient to uncover numerous new species' records for Richmond County. These records will be submitted to the editors of the Digital Atlas of the Virginia Flora (Virginia Bot. Associates, 2007), and will provide for a more accurate account of the flora of the county for those seeking in the future. Also, new records for the Northern Neck in conjunction with results of other studies on the peninsula will provide a more accurate understanding of the flora of the peninsula as a whole as demonstrated by the comparative similarity and phytogeographic analyses included in this study.

The phytogeographic analysis of the flora of the Totuskey Creek watershed indicates that the majority of the species of the flora are not exclusive inhabitants of the coastal plain or the eastern United States, but rather have ranges that extend west beyond the Mississippi River. This trend in Richmond County is consistent with the flora of the neighboring county to the east, Lancaster County.

The analysis of regional floristic similarity provides the same characterization of the pattern of floristic similarity among the Virginia peninsulas as the analysis conducted years ago without the new records from the Northern Neck. The Northern Neck still appears the most distinct among the peninsulas; however, the similarity coefficients

generated in the current study indicate the flora may actually be more similar to the peninsulas to its south than indicated in the previous study (82% or more similar). In addition, the data illustrates that the Northern Neck flora is strikingly less similar to the nearby areas north on the coastal plain of Maryland than it is to the flora on its neighboring peninsula to the south. As mentioned previously, the relatively low similarity value may be due to inadequate records of the Maryland flora or it may be due to the significantly lower proportion of southern plant species occurring on the Maryland coastal plain when compared to the Virginia peninsulas. The lack of significant difference in proportion of southern species among the Virginia peninsulas provides little support for the hypothesis proposed by North (1983) that the southern flora steadily decreases in proportion in a northern direction across the Virginia peninsulas. A better hypothesis may be that the southern flora begins to decrease across the Virginia peninsulas, but only significantly impacts the composition of the flora in areas north of the Northern Neck.

While studies on the Northern Neck over the last 20 years have helped form a more accurate understanding of the flora, the characterization of the Northern Neck flora is not complete. Additional floristic study is highly recommended, especially within Northumberland County. This would result in detailed floras from each of the five Northern Neck counties, and as in all previous studies, would likely yield many new distributional records. An additional study of western Richmond County may also be worthwhile. The watershed of Cat Pointe Creek would be a convenient location, with a diversity of plant habitats equal to or greater than that of the Totuskey Creek watershed (pers. obs.). Also, amateur collections and observations in the areas surrounding Cat

Pointe Creek include at least one state listed rare species (*Monotropsis odorata* Schwein ex. Ell., collected by Ellis Squires). Perhaps additional rare species also occur in this large watershed.

The importance of floristic collection efforts is evident in the results of this study. Accurate information regarding plant species is available because of the continual effort of botanists surveying, contributing specimens, and documenting species' locations with the assistance of regional herbaria and public resources such as the Digital Atlas of the Virginia Flora (Virginia Bot. Associates, 2007). A checklist of the flora of an area of appreciable size is never complete. Besides likely omission of rare or uncommon species not encountered, changes in floristic composition due to natural processes, development, and the introduction of exotic species and pests necessitate ongoing analysis.

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APPENDIX A

Annotated checklist of vascular plants

The checklist of vascular plants collected in the Totuskey Creek watershed includes brief notes on each species. These notes include (in order as they appear): Latin name and authority, common name (if applicable), abundance within typical habitats, most frequent or notable habitats, and the author's collection number. Taxa printed in bold type are native to North America, while those printed in normal type are introduced. The relative abundances are estimates gathered through cumulative observations in the field. The abundance categories are Very Common, Common, Occasional, Uncommon, and Rare. Taxa occurring at nearly every site of suitable habitat, and oftentimes growing in considerable numbers in other less-typical habitats are Very Common. Taxa noted as Common occur at suitable habitat sites roughly between 75% and 100% of the time, while Those noted as Occasional can be found in suitable habitats approximately 50% of the time. Uncommon taxa occur in suitable habitats less than 10% of the time, and Rare taxa occur much less frequently, oftentimes found as single individuals at a single sites in the study area. If a relatively large population of a rare taxon was observed in at least one site, the abundance is accompanied by the abbreviation 'LA' for locally abundant.

Collection numbers preceded by 'E. Squires' are those collected by Mr. Ellis Squires of Richmond County, while numbers with no prefix are those of the author. Names of taxa newly recorded from Richmond County during the course of the study are preceded by a single asterisk (*), while those newly recorded from the Northern Neck are preceded by two asterisks (**). Specimens identified or annotated by Donna Ware have collection numbers followed by "†." Some specimens that received a change in

identification by Donna Ware may have been mistaken in the field for similar species also included in the checklist. Due to the fact that these re-assignments were made after the conclusion of field work, proper estimates of the relative abundance and typical habitats of these misidentified species are not available. Therefore, this information is not included in their respective entry in the checklist.

ANNOTATED CHECKLIST

Vascular Flora of the Totuskey Creek Watershed, Richmond County, Virginia

* Richmond County Record, ** Northern Neck Record

LYCOPODIOPHYTA - LYCOPHYTES

LYCOPODIACEAE

- * *Dendrolycopodium obscurum* (L.) A. Haines, ground-pine. Occasional: hardwood and mixed pine-hardwood forest. 34
- Diphasiastrum digitatum* (Dill. ex A. Braun) Holub., southern ground-cedar. Occasional: hardwood and mixed pine-hardwood forests. 67
- Huperzia lucidula* (Michx.) Trevisan, shining clubmoss. Uncommon: moist ravine, hardwood forest slope. 147

PTERIDOPHYTA – FERNS

ASPLENIACEAE

Asplenium platyneuron (L.) B.S.P., spleenwort. Occasional: mixed pine-hardwood forest and forest margins. 293

BLECHNACEAE

Woodwardia aereolata (L.) T. Moore., netted chain-fern. Occasional: ravines and floodplains of small streams. 162

DENNSTAEDTIACEAE

Pteridium aquilinum (L.) Kuhn, bracken fern. Uncommon: mixed pine-hardwood forest. 189

DRYOPTERIDACEAE

Athyrium filix-femina (L.) Roth ex Mert. var. *asplenioides* (Michx.) Farw., southern lady fern. Common: forest slopes, freshwater marsh margins, wet ditches. 258, 473

Onoclea sensibilis L., sensitive fern. Occasional: stream margins, pond margin, and moist hardwood forest. 332

Polystichum acrostichoides (Michx.) Schott, Christmas fern. Very Common: moist hardwood forest. 301

OPHIOGLOSSACEAE

* *Botrychium biternatum* (Sav.) Underwood, sparse-lobed grape fern. 569

Botrychium virginianum (L.) Sw., rattlesnake fern. Occasional: floodplains of small streams, stream margins, and moist hardwood forest. 165

Ophioglossum vulgatum L., adder's tongue fern. Rare: hunting trail through pine/mixed hardwood forest and wet ravine. 446, 755

OSMUNDACEAE

Osmunda cinnamomea L. var. *cinnamomea*, cinnamon fern. Occasional: ravine slopes, ravine bottoms, and wet ditches. 132

O. regalis L. var. *spectabilis* (Willd.) Gray, royal fern. Occasional: wet ditches and pond margin. 254

POLYPODIACEAE

Polypodium virginianum L., common polypody. Rare: one population on north-facing, forested bank of Totuskey Creek. 46

PTERIDACEAE

Adiantum pedatum L. northern maidenhair fern. Rare (LA): single, large population on north-facing ravine slope. 206

THELYPTERIDACEAE

Phegopteris hexagonoptera (Michx.) Fee, southern beech fern. Occasional: ravine slopes, moist hardwood forest. 444

Thelypteris noveboracensis (L.) Nieuwl., New York fern. Occasional: ravine bottoms and flood plains of small streams. 665

T. palustris Schott, marsh fern. Occasional: margins of freshwater marsh. 813

PINOPHYTA - CONIFERS

CUPPRESSACEAE

Juniperus virginiana L., eastern red cedar. Common: forest margins, powerline cuts, cut-over areas. 310, 311

Taxodium distichum (L.) Richard, bald cypress. Rare: pond margin. 260, 262

PINACEAE

Pinus taeda L., loblolly pine. Very common: pine/mixed hardwood forest, roadsides, powerline cuts, cut-over areas.

P. virginiana, Virginia pine. Common: pine/mixed hardwood forest, hunting/logging trails, pond margin. 729

TAXACEAE

Taxus baccata L., yew. Rare: escaped to wooded creek bank. E. Squires 4

MAGNOLIOPHYTA – FLOWERING PLANTS

MAGNOLIID DICOTYLEDONS

ANNONACEAE

Asimina triloba (L.) **Dunal**, paw paw. Common: moist mixed hardwoods, ravine bottoms, stream banks. 781

ARISTOLOCHIACEAE

* *Aristolachia serpentaria* L., Virginia snakeroot. Rare: moist mixed hardwood forest. 568

Hexastylis virginica (L.) **Small**, Virginia heart leaf. Common: mixed hardwood forest slopes, roadside slopes. 33

LAURACEAE

Lindera benzoin (L.) **Blume**, spicebush. Occasional: moist, hardwood forest slopes and stream flood plains. 26

Sassafras albidum (Nutt.) **Nees**, sassafras tree. Common: pine/mixed hardwood forest, roadsides, and field margins. 141

MAGNOLIACEAE

Liriodendron tulipifera L., tulip poplar. Very common: mixed hardwood forest slopes, ravines, stream flood plains, and roadsides. 786

Magnolia virginiana L., sweet bay. Occasional: stream flood plains and moist mixed hardwood slopes. 403

NYMPHACEAE

Nuphar advena (Aiton) **W.T. Aiton**, spatterdock, yellow pond lily. Common: freshwater marshes and ponds. 140

Nymphaea odorata **Aiton**, fragrant water lily. Occasional: ponds. 253

SAURURACEAE

Saururus cernuus L., lizard's tail. Common: stream flood plains and ravine bottoms. 265

EUDICOTYLEDONS

ACANTHACEAE

Ruellia caroliniensis (Gmelin) Steudel, wild petunia. Occasional: forested roadside slopes, roadside ditches. 331

ACERACEAE

* *Acer platanoides* L., Norway maple. Rare: single tree on margin of residential property and road. 596

A. rubrum L., red maple. Very common: mixed hardwoods, margins of ponds and wetlands. 24, 155

A. saccharinum L. silver maple. Rare: mixed hardwoods, forested roadsides. 181

ADOXACEAE

Sambucus canadensis L., common elder. Common: forested roadsides, stream margins. 184, 237

Viburnum acerifolium L., maple-leaved viburnum. Uncommon: mixed hardwood slopes. 168

V. prunifolium L. Uncommon: mixed hardwood forest margins, wetland margins. 69

V. nudum L., Common: stream margins, floodplains of streams, and pond margins. 60, 268

V. dentatum L., arrow-wood. Uncommon: wetland and pond margins, floodplains of streams. 169

AMARANTHACEAE

Amaranthus cannabinus (L.) J.D. Sauer, water hemp. Occasional: freshwater marshes. 541

A. hybridus L., smooth pigweed. Occasional: roadsides, cultivated field margins. 547

ANACARDIACEAE

Rhus copallinum L., dwarf sumac. Common: forest margins, powerline cuts, clearcuts. 467

R. glabra L., smooth sumac. Common: forest margins, clearcuts. 292

Toxicodendron radicans (L.) Kuntze, poison ivy. Common: open forest, trails, powerline cuts, roadside ditches. 211

APIACEAE

Angelica venenosa (Greenw.) Fern., Uncommon: hardwood forest slope above marsh. E. Squires 35

* *Chaerophyllum tainturieri* Hooker, southern chervil. Occasional: gravelly roadsides, field margins. 96

Cicuta maculata L., common water-hemlock. Uncommon: freshwater marsh, wet ditches. 474

Cryptotaenia canadensis (L.) DC., honewort. Uncommon: stream banks. 333

Daucus carota L., Queen Anne's lace. Occasional: open woods, hunting/logging trails, fields, roadsides. 304, 627

Hydrocotyle ranunculoides L. f., water pennywort. Occasional: slow-moving, shallow freshwater of open swamps and streams. 186

H. umbellata L., water pennywort. Rare: shallow pond water. 406, 578

* *H. verticillata* Thunb., water pennywort. Common: margins of brackish marshes, wet ditches. 489

Sanicula canadensis L. var. *canadensis*, Canada snakeroot. Common: mixed hardwood forest and trails through mixed hardwood forest. 295

* *S. smallii* Bicknell, southern snakeroot. Rare: trail through mixed hardwood forest. 207

APOCYNACEAE

Apocynum cannabinum L., Indian hemp. Occasional: roadsides. 278

AQUIFOLIACEAE

Ilex opaca Aiton, American holly. Common: mixed hardwoods. 508

I. verticillata (L.) Gray, winterberry. Occasional: stream banks. 660

ARALIACEAE

* *Aralia spinosa* L., devil's walking stick. Common: forest margins, forested trails, and powerline cuts. 534

Hedera helix L., English ivy. Occasional: roadsides and home sites. 613

ASCLEPIDACEAE

Asclepias amplexicaulis Smith, blunt-leaved milkweed. Rare: single population in roadside ditch. E. Squires 21

A. incarnata L. spp. *pulchra* (Erhart ex. Willd.) Pers., swamp milkweed. Uncommon: high ground in freshwater and brackish marshes. 426, 499

A. syriaca L. common milkweed. Common: roadsides and field margins. 302

A. tuberosa L., butterfly weed. Occasional: roadsides and field margins. 276

* *A. variegata* L., white milkweed. Uncommon: powerline cut, roadsides, and forested trails. 234

ASTERACEAE

Achillea millefolium L., yarrow. Common: roadsides, field margins, and powerline cuts. 170

- * *Ageratina altissima* (L.) K. & R. Uncommon: open trails through forest. 666
- Ambrosia artemisiifolia* L. ragweed. Common: roadside ditches, weedy forest margins. 607
- * *Antennaria parlinii* Fern. ssp. *fallax* (Greene) Bayer & Stebb., pussytoes. Common: forested roadside slopes and open pine/mixed hardwood forest. 65
- A. solitaria* Rydb. Uncommon: mixed hardwood forest slopes. 742
- Anthemis arvensis* L., field chamomile. Occasional: Roadsides and field margins. 95, 172
- Artemisia vulgaris* L., common mugwort. Common: roadsides and field margins. 654
- Baccharis halimifolia* L., groundsel tree. Common: margins of brackish marsh, roadside ditch. 685, 688
- Bidens aristosa* (Michx.) Britton, tickseed sunflower. Common: wet ditches, pond margins, and other moist sites. 11, 602
- B. bipinnata* L., Spanish needles. Occasional: forest margins. 570
- B. frondosa* L., beggar's ticks. Common: wet ditches, water-filled tire ruts in forest trail. 621
- B. laevis* L. BSP. Uncommon: stream banks. 693
- Centaurea cyanus* L., cornflower. Common: fallow fields and field margins. 101
- * *C. stoebe* L. ssp. *micranthos* (Gugler) Hayek, spotted knapweed. Rare: only a few plants on cultivated field margin. 524
- Chrysopsis mariana* (L.) Ell., shaggy golden aster. Common: powerline cuts, clearcuts, and forest margins. 13, 618, 634
- * *Cichorium intybus* L., chicory. Occasional: roadsides, highway median, and field margins. 339
- * *Cirsium arvense* (L.) Scop. var. *horridum* Wimmer & Brobner, Canada thistle. Rare (LA): cultivated field and field margin. 318
- C. discolor* (Muhl. ex Willd.) Spreng., field thistle. Occasional: forest margins and dry, open forest trails. 606
- Conoclinium coelestinum* (L.) DC., blue mistflower. Occasional: roadsides. 661
- Conyza canadensis* (L.) Cronq. var. *canadensis*, horseweed. Uncommon: margin of brackish marsh and roadsides. 495
- * *Coreopsis lanceolata* L., tickseed. Uncommon: roadsides. 824
- * *Eclipta prostrata* (L.) L., Yerba-de-tajo. Rare (LA): wet meadow on margin of brackish marsh. 504
- Elephantopus carolinianus* Willd., elephant's foot. Uncommon: roadsides and powerline cuts. 531
- * *E. tomentosus* L., Common: roadsides, forest margins, forested trails, and powerline cut. 676

- Erechtites hieracifolia* (L.) Raf. fireweed. Common: roadsides, powerline cuts, and clear-cuts. 561, 622
- Erigeron annuus* (L.) Pers., annual fleabane. Occasional: roadsides and forest margins. 413, 576
- E. philadelphicus* L., Philadelphia daisy. Uncommon: forest margins, and open forested trails. 180, 708
- ** *E. pulchellus* Michx., robin plantain. Rare: single population in maple-beech woods at Strawberry Bottom. E. Squires 11
- * *E. strigosus* Muhl. ex. Willd., rough fleabane. Occasional: roadsides, forest margins. 208, 321, 322, 623
- Eupatorium capillifolium* (Lam.) Small, dogfennel. Common: roadsides, forest margins, and open forest trails. 697
- E. dubium* Willd, ex. Poir., three-nerved joe-pye weed. Occasional: open forest trails and clear-cuts. 564
- E. fistulosum* Barratt, hollow-stemmed joe-pye weed. Occasional: forest margins and stream banks. 511
- E. hyssopifolium* L., hyssop-leaved joe-pye weed. Uncommon: dry, open areas, clear-cuts. 592
- E. pilosum* Walter. Occasional: powerline cuts and forest margins. 699
- * *E. purpureum* L. 630†
- E. rotundifolium* L., Common: pond margins, roadsides, and forest margins. 455
- ** *E. saltuense* Fern. Rare: single population on sandy edge of creek at Indianfield. 649
- Eurybia compacta* Nesom. slender aster. Uncommon: dry roadsides. 565
- Euthamia graminifolia* (L.) Nutt., flat-topped goldenrod. Common: margins of brackish marshes, roadsides, field margins. 625, 687, 698
- Gamochaeta purpurea* (L.) Cabrera, cudweed. Common: dry roadsides, powerline cuts, clear-cuts. 214, 572
- Helenium autumnale* L. Rare: single population along stream at trail crossing near Indianfield Road. 646
- Helianthus atrorubens* L. Uncommon: clear-cut areas, forest margins. 637
- * *H. divaricatus* L. Uncommon: moist hardwood slope above creek. E. Squires 30
- * *H. tuberosus* L., Jerusalem artichoke. Occasional: field margins and roadsides. 652
- Hieracium gronovii* L., hawkweed. Common: powerline cuts and dry forest margins. 458, 519
- H. venosum* L., rattlesnake weed. Common: dry, sandy woodland, and sandy creek bank. 125
- Hypochoeris radicata* L., cat's ear. Common: dry roadsides. 149, 257

- Iva frutescens* L., marsh elder. Common: brackish marshes. 690
- Krigia virginica* (L.) Willd., dwarf dandelion. Common: powerline cuts and dry roadsides. 86
- Lactuca canadensis* L., wild lettuce. Occasional: clearcuts and dry roadsides. 350
- Leucanthemum vulgare* Lam., oxeye daisy. Common: fields, field margins, and roadsides. 279
- Liatris graminifolia* Willd., blazing star. Common: dry roadsides. 566, 709
- Mikania skandens* (L.) Willd., climbing hempweed. Common: stream banks and wet roadside ditches. 527
- Packera anonyma* (Wood) W.A. Weber & A. Love, ragwort. Occasional: clearcuts, powerline cuts, and roadsides. 160
- Pityopsis graminifolia* (L.) Nutt. var. *latifolia* (Fern.) Semple & Bowers, grass-leaved golden aster. Occasional: powerline cuts, clearcuts, and dry roadsides. 422
- Pluchea odorata* (L.) Cass var. *odorata*, salt-marsh fleabane. Uncommon: brackish marshes. 691
- * *Prenanthes serpentaria* Pursh., lion's foot. Occasional: forest trails and forest margins. 657, 704
- Pseudognaphalium obtusifolium* (L.) Hilliard & Burt, sweet everlasting. Common: roadsides, field margins, and clearcuts. 558
- ** *P. stramineum* (Kunth) W.A. Weber. Rare: dry, open trail on ridgetop of clearcut. 414
- * *Pyrrhopappus carolinianus* (Walt.) DC., Uncommon: clearcuts and roadsides. 294
- Rudbeckia hirta* L., black-eyed Susan. Uncommon: field margins, roadsides, and fencerows. 277
- ** *Senecio vulgaris* L., groundsel. Uncommon: clearcut and roadside. 127
- Sericocarpus asteroides* (L.) Britton, Stearns, & Poggenburg, white-topped aster. Occasional: forest margins, forested trails, and dry roadside. 303, 365, 835
- S. linifolius* (L.) BSP, narrow-leaved white-topped aster. Occasional: forest margins and dry roadside. 378, 567
- ** *Silphium asteriscus* L., Southern rosin weed. Rare: moist roadside ditch. 338
- * *Solidago altissima* L., late goldenrod. Uncommon: field margins. 705
- S. bicolor* L., white goldenrod. Occasional: forested trails, forest margins, and wooded roadsides. 616a†, 656
- S. caesia* L. Uncommon: pine/mixed hardwood forest slopes. 667
- S. erecta* Pursh., slender goldenrod. Uncommon: forest margins and roadsides. 2, 616†, 679
- S. juncea* Aiton, early goldenrod. Common: roadsides, powerline cuts, and clearcuts. 291, 340, 460, 549†
- S. nemoralis* Aiton, gray goldenrod. Occasional: powerline cuts. 675, 696, 710

- S. odora* Aiton. Uncommon: clearcuts and powerline cuts (perhaps more common and often mistaken for other *Solidago* spp.) 638
- S. pinetorum* Small, Small's goldenrod. Rare: observed at a single powerline cut across Canal Rd. 594
- ** *S. puberula* Nutt., downy goldenrod. 710†
- S. rugosa* Miller, rough-stemmed goldenrod. Occasional: roadsides and powerline cuts. 10, 619, 635, 636
- S. rugosa* Mill. ssp. *aspera* (Aiton) Cronq. 700†
- * *Symphotrichum cordifolium* (L.) Nesom. Rare: moist ravine bottom. 668
- S. dumosum* (L.) Nesom., long-stalked aster. Common: powerline cuts, field margins, and roadsides. 590
- * *S. lanceolatum* (Willd.) Nesom. Uncommon: roadsides. 706
- * *S. lateriflorum* (L.) A.& D. Love. Common: moist roadside ditches. 7, 8
- S. pilosum* (Willd.) Nesom. Uncommon: roadside ditches. 653, 694
- * *S. puniceum* (L.) A.& D. Love. Occasional: open woods and roadsides. 9, 717
- * *S. racemosum* (Ell.) Nesom. Occasional: marshes and roadsides. 686
- S. subulatum* (Ell.) Nesom. Rare: edge of brackish marsh. 689
- S. undulatum* (L.) Nesom. Occasional: wooded roadside slopes. 678
- Verbesina occidentalis* (L.) Walker, Southern flatseed sunflower. Uncommon: roadsides and field margins. 529
- Vernonia glauca* (L.) Willd., ironweed. Occasional: slopes and high ridges in powerline cuts. 442
- V. novaboracensis* (L.) Michx. Occasional: freshwater marsh, moist ditches. 471, 643
- Xanthium strumarium* L., cocklebur. Uncommon: field margins. 695

BALSAMINACEAE

Impatiens capensis Meerb., jewelweed. Common: streambanks, wet roadside ditches, freshwater marsh margins. 392

BERBERIDACEAE

Podophyllum peltatum L., mayapple. Common: mixed hardwoods forest slopes, forest margins, and streambanks.

BETULACEAE

Betula nigra L., river birch. Occasional: swamps. 185

Carpinus carolinianus **Walter.**, ironwood. Common: streambanks, ravines, mixed hardwood forest, and forest margins. 224

Corylus americana **Walter.**, American hazelnut. Common: forest margins and roadsides. 235, 390, 671

BIGNONIACEAE

* *Bignonia capreolata* **L.**, cross vine. Uncommon: roadsides and forest margins. 231

Campsis radicans (**L.**) **Seeman.**, trumpet creeper. Common: roadsides, powerline cuts, clear-cuts, and forest margins. 275

BORAGINACEAE

Buglossoides arvensis (**L.**) Johnston, corn gromwell. Common: roadsides and fields. 30

Cynoglossum virginianum **L.**, wild comfrey. Occasional: moist mixed hardwood forest slopes. 183

Echium vulgare **L.**, Viper's bugloss. Rare: dry roadside slope. 238

* *Myosotis macrosperma* **Englem.** Uncommon: disturbed hardwood forest slopes. 818

M. stricta Link ex Roemer & J.A.Schultes, forget-me-not. Uncommon: fields. 761

BRASSICACEAE

Arabidopsis thaliana (**L.**) Heynhold, mouse-ear cress. Occasional: cultivated fields and field margins. 42

Barbarea verna (**Miller**) Ascherson, early yellow rocket. Common: moist roadside ditches and floodplains of small streams. 55

B. vulgaris (**L.**) R. Br., yellow rocket. Common: roadsides, field margins, lawns, and powerline cuts, and forest margins. 39

* *Cardamine bulbosa* (**Schreber**) **BSP**, spring cress. Uncommon: stream sides. 99

C. concatenata (**Michaux**) **O. Schwarz**, cutleaf toothwort. Rare: moist hardwood forest slope and flood plain of small stream. 746

C. hirsuta **L.**, hairy bittercress. Very common: fields, field margins, lawns, roadsides, powerline cuts, and forest margins. 19

C. pennsylvanica **Muhl.**, Pennsylvania bittercress. Common: stream sides, floodplains of small streams. 61

Lepidium campestre (**L.**) R. Br., field pepperweed. Very common: fields, field margins, lawns, roadsides, and powerline cuts. 75

L. virginicum **L.**, Virginia pepperweed. Very common: fields, field margins, lawns, roadsides, and powerline cuts. 216

Lunaria annua L., money plant. Rare: apparent dump site at forest margin. 401

Raphanus raphanistrum L. wild radish. Uncommon: cultivated fields, field margins, roadsides. 102

Teesdalia nudicaulis (L.) R. Br. Very common: roadsides, field margins, and lawns. 37, 82

BUDDLEJACEAE

Polypremum procumbens L. Common: roadsides, lawns, and powerline cuts. 346

CACTACEAE

Opuntia humifusa (Raf.) Raf., eastern prickly pear. Occasional: roadsides and sandy beach. 250

CALLITRICHACEAE

Callitriche heterophylla Pursh., water star-wort. Occasional: slow-moving water and ponds. 228

CAMPANULACEAE

Lobelia cardinalis L., cardinal flower. Common: streamsides, wet ditches, and freshwater marsh. 436

L. inflata L., Indian tobacco. Common: wooded trails, forest margins, and powerline cuts. 391, 431

L. nuttallii R. & S., Nuttall's lobelia. Rare: unmown roadside and forest margin. 381

* *L. puberula* Michx., downy lobelia. Common: roadsides, open woods, and powerline cuts. 1, 461, 559

Triodanis perfoliata (L.) Nieuwl. var. *perfoliata*, Venus' looking-glass. Common: fields and roadsides. 144

CAPRIFOLIACEAE

Lonicera japonica Thunb., Japanese honeysuckle. Very common: pine/mixed hardwood forest, forest margins, moist thickets, fence rows, wooded roadsides. 139.

L. sempervirens L., trumpet honeysuckle. Uncommon: pine/mixed hardwood forest, forest trails. 174

CARYOPHYLLACEAE

Cerastium glomeratum Thuillier., chickweed. Very common: Very common: fields, field margins, lawns, roadsides, and powerline cuts. 71

Dianthus armeria L., Depford pink. Occasional: fields, roadsides, fence rows. 201

Sagina decumbens (El.) T.&G., pearlwort. Occasional: dry, gravelly roadsides. 733, 777

Saponaria officinalis L., bouncing bet. Rare (LA): roadside field margin. 577

Scleranthus annuus L., knawel. Occasional: roadsides, field margins, sandy/gravelly sites. 314

S. latifolia Poir., bladder campion. Occasional: roadsides, field margins. 145, 319

* *S. stellata* L. Aiton f., starry campion. Uncommon: mixed hardwood forest slopes. 574

Stellaria graminea L., lesser stitchwort. Uncommon: fields, powerline cuts. 199

S. media (L.) Vill., chickweed. Very common: lawns, roadsides, field margins, forest margins. 22, 164, 229

CELASTRACEAE

Euonymus americanus L., hearts abustin'. Occasional: pine/mixed hardwood forest, forest margins, forested trails. 4, 178

CHENOPODIACEAE

Atriplex patula L., orach. Occasional: sandy river beach, margin of brackish marsh. 684

Chenopodium album L., lamb's quarters. Occasional: sandy creek bank, sandy roadsides. 650

CISTACEAE

Lechea racemulosa Michx., pinweed. Common: powerline cuts, cut-over areas, and roadsides.

CLETHRACEAE

Clethra alnifolia L., sweet pepperbush. Common: pond margins, stream margins, swamps, and moist thickets.

CLUSIACEAE

* *Hypericum crux-andreae* (L.) Crantz., St. Peterswort. Rare: moist depression in cut-over area. 560

H. gentianoides (L.) BSP., orange grass. Occasional: dry cut-over areas. 412

H. hypericoides (L.) Crantz., St. Andrew's cross. Occasional: forest margins (mostly pine), forested trails, and sandy roadsides. 420, 423

H. mutilum L. Occasional: pond margin, wet ditches, pools in forested trails. 364, 411

H. perforatum L., common St. John's wort. Uncommon: field margins, roadside ditches. 452

* *H. punctatum* Lam., spotted St. John's wort. Common: forest margins and powerline cuts. 306

CONVOLVULACEAE

Calystegia sepium (L.) R. Br., hedge bindweed. Uncommon: freshwater marsh margin. 282

Ipomoea coccinea L., red morning glory. Common: roadsides and field margins. 15

I. hederacea Jacq., ivy-leaved morning glory. Common: roadsides and field margins. 526

I. lacunosa L. small white morning glory. Occasional: cultivated fields and field margins. 571

* *I. pandurata* (L.) Meyer, wild potato vine. Occasional: cut-over areas and roadsides. 424

I. purpurea (L.) Roth, common morning glory. Occasional: cultivated fields, field margins, and roadside ditches. 305

CORNACEAE

Cornus amomum Mill., silky dogwood. Uncommon: swamps and stream banks. 633, 841

Cornus florida L., flowering dogwood. Common: mixed hardwood forest, forest margins. 72

CRASSULACEAE

* *Sedum sarmentosum* Bunge., stringy stonecrop. Rare: mown lawn of cemetery. 597

CUSCUTACEAE

Cuscuta compacta Jussieu., compact dodder. Uncommon: twining on various vegetation on creek banks. 648

C. campestris Yunker, field dodder. Common: twining on various vegetation at field margins, roadside ditches, and stream banks. 286, 410

DIPSACACEAE

Dipsacus fullonum L., Fuller's teasel. Uncommon: dry roadside banks. 483

EBENACEAE

Diospyros virginiana L., persimmon. Occasional: swamps and stream margins. 230

ELEAGNACEAE

* *Elaeagnus umbellata* Thunb., Russian olive. Occasional: fence rows, forest margins, and powerline cuts. 466

ERICACEAE

Epigaea repens L., trailing arbutus. Occasional: shaded roadside banks and margins of pine/mixed hardwood forest. 212

Eubotrys racemosa (L.) Nutt., fetterbush. Occasional: stream margins and moist forest. 124, 135

Gaylussacia baccata (Wang.) K. Koch, black huckleberry. Common: pine/mixed hardwood forest, forest margins, dry roadside banks, powerline cuts, and cut-over areas. 94, 382

G. frondosa (L.) T.&G., blue huckleberry. Common: pine/mixed hardwood forest, forest margins, and cut-over areas. 138, 255, 383

Kalmia latifolia L., mountain laurel. Common: pine/mixed hardwood forest slopes, especially Beech-dominated forest, forest margins and powerline cuts. 157

Lyonia mariana (L.) D. Don, staggerbush. Uncommon: wooded roadsides and powerline cut. 213

- * *Monotropa uniflora* L., Indian pipe. Uncommon: pine/mixed hardwood forest, edges of forested trails. 3

Oxydendrum arboretum (L.) DC., sourwood. Occasional: forest margins, powerline cuts, and cut-over areas. 417

- * *Rhododendron atlanticum* (Ashe) Rehder, dwarf azalea. Uncommon: margins of pine/mixed hardwood forest and dry, shaded roadsides. 806

R. periclymenoides (Michx.) Shinn., pinkster. Common: roadside margins of pine/mixed hardwood forest and forest margin at powerline cuts. 91

- * *Vaccinium formosum* Andr., southern blueberry. Uncommon: moist mixed hardwood slope and pond margin. 25

V. fuscatum Aiton, black highbush blueberry. Occasional: roadside ditches and pond margin. 256

V. stamineum L., deerberry. Common: pine/mixed hardwood forest, forested trails, and powerline cuts. 88, 259

EUPHORBIACEAE

Acalypha gracilens Gray, three-seeded mercury. Common: roadsides, field margins, and hunting and logging trails through mixed woods. 409

A. rhomboidea Raf. Occasional: roadsides and hunting and logging trails through mixed woods. 544b

Chamaesyce maculata (L.) Small, small milk purslane. Occasional: roadsides, edge of parking lot, gravelly areas. 601

Croton glabulosus L. var. *septentrionalis* Muell.-Arg., croton. Occasional: roadsides and field margins. 583

Euphorbia corollata L., flowering spurge. Common: roadsides, field margins, and forest margins. 342, 450

- ** *E. cyathophora* Murr., fire on the mountain. Rare: roadside ditch and margin of cultivated field. 608

E. cyparissias L., cypress spurge. Uncommon: yards and roadside ditches. 719

FABACEAE

Albizia julibrissin Durazzini, mimosa tree. Occasional: forest margins and disturbed stream banks. 312

- * *Amphicarpa bracteata* (L.) Fern., hog peanut. Uncommon: stream banks and wet ditches in forested trails. 644
- Apios americana* Medic., wild bean. Uncommon: stream banks. 546
- Baptisia tinctoria* (L.) R. Br., wild indigo. Uncommon: roadsides and forest margins. 624
- Centrosema virginiana* (L.) Bentham, spurred butterfly pea. Rare: forested roadside slope. 459
- Cercis canadensis* L., red bud. Uncommon: moist hardwood forest slopes and forest margins. 78
- Chamaecrista fasciculata* (Michx.) Greene var. *fasciculata*, partridge pea. Common: roadsides, disturbed sunny stream banks, and powerline cuts. 6
- C. nictitans* (L.) Moench, wild sensitive plant. Common: roadsides and cut-over areas. 407
- * *Clitoria mariana* L., butterfly pea. Uncommon: sloping pond margin and forest margins. 395
- ** *Coronilla varia* L., queen vetch. Uncommon: roadsides. 239
- Cytisus scoparius* (L.) Link, scotch broom. Uncommon: roadsides. 98
- * *Desmodium canescens* (L.) DC., hairy tick trefoil. Common: roadsides and forest margins. 396, 478
- * *D. ciliare* (Muhl. ex Willd.) DC., hairy small-leaved tick trefoil. Uncommon: dry pine/mixed hardwood forest and forested hunting trails. 628
- D. laevigatum*., smooth tick trefoil. Uncommon: powerline cuts and cut-over areas. 640
- D. nudiflorum* (L.) DC., naked-flower tick trefoil. Uncommon: hunting trails through pine/mixed hardwood forest and forest margins. 428
- D. paniculatum* (L.) DC. var. *paniculatum*, paniced tick trefoil. Common: roadsides, field margins, and forest margins. 605
- * *D. pauciflorum* (Nutt.) DC., few-flowered tick trefoil. Rare: moist ravine bottom. 433
- * *D. rotundifolium* DC. Rare: mixed hardwood forest slopes. E. Squires 29
- Galactia volubilis* (L.) Britt., downy milk pea. Occasional: powerline cuts and field margins. 481, 512
- Kummerowia striata* (Thunb.) Schindl., Japanese clover. Very common: lawns and mown roadsides. 523
- Lathyrus hirsutus* L. Occasional: field margins and roadsides. 227
- L. latifolius* L., everlasting pea. Rare: old homesite. 215
- Lespedeza cuneata* (Dum.-Coors.) G. Don, Very common: roadsides, powerline cuts, and cut-over areas. 547b
- L. repens* (L.) Barton, creeping bushclover. Common: roadsides, forest margins, and forested trails. 349†, 414, 626

- L. virginica* (L.) **Britt.**, slender bushclover. Common: roadsides and powerline cuts. 593
- ** *Lotus corniculatus* L., bird's-foot trefoil. Rare: fields. 763
- * *Lupinus perennis* L., wild lupine. Uncommon: steep roadside banks. 76
- Melilotus albus* Medic., sweet clover. Occasional: powerline cuts and forest margins.
- M. officinalis* (L.) Lam., yellow sweet clover. Uncommon: freshwater marsh and moist roadsides. 107b
- Pueraria montana* (Lour.) Merr. var. *lobata* Maesen & S. Almeida, kudzu. Common: roadsides and forest margins. 479
- Robinia pseudoacacia* L., black locust. Common: roadsides and forest margins. 115
- Stylosanthes biflora* (L.) **BSP.**, pencil flower. Common: roadsides and powerline cuts. 243
- Tephrosia virginiana* (L.) **Pers.**, goat's rue. Uncommon: forest margin and powerline cut. 220
- Trifolium arvense* L., rabbit's foot clover. Occasional: roadsides and field margins. 251
- T. campestre* Schreb., large hop clover. Very common: roadsides and yards. 110
- T. dubium* Sibthorp, little hop clover. Common: roadsides and yards.
- T. incarnatum* L., crimson clover. Occasional: fields. 161
- T. pratense* L., red clover. Common: roadsides and field margins. 142
- T. repens* L., white clover. Common: roadsides, field margins, and yards. 116
- V. hirsuta* (L.) SF. Gray. Occasional: roadsides and margin of parking lot. 105
- V. sativa* L., spring vetch. Common: roadsides and field margins. 50, 111
- ** *V. villosa* Roth ssp. *villosa*, cow vetch. Uncommon: fields and field margins. 17†

FAGACEAE

- Castanea dentata* (Marsh.) **Borkh.**, American chestnut. Rare: hunting trail through pine/mixed hardwoods. 629
- C. pumila* (L.) **Mill.**, chinquapin. Occasional: margins of pine/mixed hardwood forest. 247, 307
- Fagus grandifolia* **Ehrhart**, American beech. Common: flat and sloping hardwood forest. ?
- Quercus alba* L., white oak. Common: flat to gently sloping mixed hardwood forest. 632
- Q. coccinea* **Muenchh.**, scarlet oak. Uncommon: dry mixed hardwood forest slopes and forest margin. 465
- Q. falcata* **Michx.**, southern red oak. Common: dry mixed hardwood forest and pine/mixed hardwood forest, powerline cuts, and cut-over areas. 159

- ** *Q. laurifolia* Michx., swamp laurel oak. Rare: wet, sandy depression at margin of brackish marsh. 662
- Q. marilandica* Muenchh., blackjack oak. Uncommon: roadsides and forest margins. 221
- Q. michauxii* Nutt., basket oak. Common: swamps and margins of stream flood plains. 659, 682†
- Q. montana* L., chestnut oak. Rare: gaps in upland pine/mixed hardwood forest. 123
- Q. phellos* L., willow oak. Occasional: forested margin of brackish marsh and Rappahannock River beach. 507
- Q. rubra* L., northern red oak. Common: mixed hardwood forest slopes. 681
- Q. stellata* Wang., post oak. Rare: forested margin of brackish marsh and Rappahannock River beach. 506
- * *Q. velutina* Lam., black oak. Common: mixed hardwood forest, forest margins, and powerline cuts. 154, E. Squires 10

GENTIANACEAE

- Sabatia angularis* (L.) Pursh., rose pink. Uncommon: forest margins and powerline cuts. 435

GERANIACEAE

- Geranium carolinianum* L., Carolina cranesbill. Common: roadsides and field margins. 106
- Geranium molle* L., dovesfoot cranesbill. Common: roadsides, field margins, and yards. 73, 732

HAMAMELIDACEAE

- * *Hamamelis virginiana* L., witch hazel. Occasional: pine/mixed hardwood forest slopes, forest margins, and margins of freshwater marsh. 437
- Liquidambar styraciflua* L., sweet gum. Very common: moist, mixed hardwood forest slopes and forest margins. 790

HYDRANGACEAE

- Hydrangea arborescens* L., wild hydrangea. Rare (LA): steep, north-facing, forested creek bank. 296
- ** *Philadelphus inodorus* L., mock orange. Rare: roadside forest margin. 187

ITEACEAE

- Itea virginica* L., sweetspire. Occasional: swamp margins and stream margins. 193

JUGLANDACEAE

- Carya alba* (L.) Nutt. ex Ell., mockernut hickory. Common: mixed hardwood forest slopes and forest margins. 394, 462†
- * *C. pallida* (Ashe) Engl. & Graebn., sand hickory. Occasional: pine/mixed hardwood forest, forest margins, powerline cuts. 463†, 548†
- C. glabra* (Mill.) Sweet, pignut hickory. Uncommon: mixed hardwood forest. 269
- * *C. illinoensis* (Wang.) K. Koch, pecan. Rare: sandy beach of Rappahannock River. 502
- Juglans nigra* L., black walnut. Occasional: moist forested slopes, forest margins, margins of freshwater marsh, and public park. 480

LAMIACEAE

- * *Clinopodium vulgare* L., wild basil. Occasional: open areas and trails though mixed hardwoods and powerline cuts. 324
- * *Collinsonia canadensis* L., horse balm. Rare (LA): ravine bottom. 669
- * *Cunila origanoides* (L.) Britt., dittany. Uncommon: mixed hardwood forests slopes.
- Glechoma hederacea* L., ground ivy. Common: lawns, field margins, and roadside ditches. 56
- Lamium amplexicaule* L., henbit. Very common: fields, field margins, and lawns. 43
- L. purpureum* L., purple dead nettle. Very common: fields, field margins, and lawns. 29
- Lycopus virginicus* L., bugleweed. Occasional: margins of pine/mixed hardwood forest.
- * *Mentha spicata* L., spearmint. Rare (LA): creek bank near homesite. 530
- Perilla frutescens* (L.) Britt., beefsteak plant. Common: moist forested trails and wet ditches. 647
- Prunella vulgaris* L., selfheal. Common: roadsides, fields, and field margins and cut-over areas. 377
- Salvia lyrata* L., lyre-leaved sage. Common: roadsides, fields, field margins, and powerline cuts. 121
- * *Scutellaria elliptica* Muhl. ex Spreng., hairy skullcap. Occasional: mixed hardwood slopes and forest margins. 249
- S. integrifolia* L., hyssop skullcap. Common: roadsides, fields, and powerline cuts. 252, 366
- * *S. lateriflora* L., mad-dog skullcap. Occasional: stream banks and margin of freshwater marsh. 475
- Teucrium canadense* L., American germander. Uncommon: freshwater marsh. 427

LENTIBULARIACEAE

- * *Utricularia gibba* L., humped bladderwort. Occasional: floating in water or growing in mud of ponds and flooded tire ruts of wooded trails. 261, 516

LINACEAE

- * *Linum medium* (Planch.) Fern. var. *texanum* (Planch.) Fern., stiff yellow flax. Uncommon: powerline cut. 274, 379†

LYTHRACEAE

- Decodon verticillatus* (L.) Ell., swamp loosestrife. Uncommon: swamps and stream banks. 510
- Lythrum lineare* L., Uncommon: margin of brackish marsh. 500
- * *Rotala ramosior* (L.) Koehne. Rare: flooded tire rut in powerline cut. 587

MALVACEAE

- Anoda cristata* (L.) Schlecht. Rare: roadside ditch. 651
- Hibiscus moscheutos* L., rose-mallow. Common: fresh and brackish marshes. 490
- * *H. syriacus* L., rose of Sharon. Uncommon: persisting and spreading at old homesites and roadsides. 532
- Kosteletzkya virginica* (L.) K. Presl. ex A. Gray var. *aquilonia* Fern., seashore mallow. Occasional: brackish marshes.
- * *Sida spinosa* L., prickly mallow. Occasional: roadsides and field margins. 522

MELASTOMATACEAE

- Rhexia mariana* L., meadow beauty. Common: moist roadsides and field margins. 368
- R. virginica* L., meadow beauty. Occasional: pond margins and moist pine woods. 405, 453

MENISPERMACEAE

- * *Menispermum canadense* L., moonseed. Rare: moist Paw-paw thicket. 595

MOLLUGINACEAE

- Mollugo verticillata* L., carpetweed. Common: roadsides, field margins, and edge of parking lot. 316

MORACEAE

- Broussonetia papyrifera* (L.) Vent., paper mulberry. Uncommon: forest margins and field margins. 579
- Morus alba* L., white mulberry. Occasional: forest margins, fence rows, and old homesites. 182

M. rubra L., red mulberry. Uncommon: forest margins, fence rows, and old homesites. 642

MYRICACEAE

Myrica cerifera (L.) Small, wax myrtle. Common: forest margins, marsh margins, pond margins, and roadsides. 270

NYSSACEAE

Nyssa sylvatica Marsh., black gum. Common: moist pine/mixed hardwood forest and stream banks. 309, 513

OLEACEAE

Chionanthus virginicus L., fringe tree. Rare: mixed hardwood forest margins. 795

Forsythia suspensa (Thunb.) Vahl, forsythia. Persisting at dump sites and old homesites and appearing to spread to forest margins. 730

Fraxinus pennsylvanica Marsh., green ash. Common: swamps, stream flood plains. 658

Ligustrum sinense Loureiro, privet. Occasional: persisting from cultivation at old homesites. 196

ONAGRACEAE

Circaea lutetiana L. ssp. *canadensis* (L.) A.&M., enchanter's nightshade. Common: moist mixed hardwood forest, stream flood plain, moist thickets. 296, 389

Ludwigia alternifolia L., seedbox. Common: freshwater marshes, moist ditches, pond margins, stream banks. 380, 408, 470

L. decurrens Walter. Uncommon: pond margins. 539

L. palustris (L.) Ell., marsh seedbox. Occasional: pond margins and stream banks. 521

Oenothera biennis L., evening primrose. Occasional: roadsides and fields. 447

O. fruticosa L., sundrops. Rare: roadside. 707

O. laciniata Hill, cut-leaved evening primrose. Common: roadsides and fields. 219

OROBANCHACEAE

Epifagus virginiana (L.) Barton, beech drops. Common: mixed hardwood slopes with large beech trees. 16

OXALIDACEAE

Oxalis dillenii Jacq. 114†, 323†

Oxalis stricta L., yellow wood sorrel. Very common: roadsides, field margins, powerline cuts, and disturbed woodlands. 90, 108, 120, 300

- * *O. violacea* L., violet wood sorrel. Uncommon: moist, mixed hardwood forest slopes, forest margins, and grassy powerline cut. 119

PAPAVERACEAE

Sanguinaria canadensis L., bloodroot. Occasional: mixed hardwood forest slopes. 31

Papaver dubium L. Uncommon: cultivated field margins. 810

PASSIFLORACEAE

Passiflora lutea L., passionflower. Occasional: forest margins. 388

PAULOWNIACEAE

Paulownia tomentosa (Thunb.) Sieb. & Zucc. ex Steud., princess tree. Uncommon: homesites and forest margins. 359, 639†

PENTHORACEAE

Penthorum sedoides L. Rare: streambank. 645

PHRYMACEAE

Phryma leptostachya L., lopseed. Uncommon: mixed hardwood forest slopes and edges of forested trails. 430

PHYTOLACACEAE

Phytolacca americana L., pokeweed. Occasional: roadsides, fields, cut-over areas, and powerline cuts. 240

PLANTAGINACEAE

Plantago aristata Michx. Common: roadsides. 288

P. lanceolata L., English plantain. Common: roadsides. 151

- * *P. major* L., common plantain. Uncommon: lawns. 486

P. rugelii DCNE., pale plantain. Very common: roadsides, field margins, and lawns. 326

P. virginica L. Occasional: roadsides and cultivated fields. 70

PLATANACEAE

Platanus occidentalis L., sycamore. Occasional: forested roadsides, forest margins, and flood plains of streams. 789

POLEMONIACEAE

- * *Phlox paniculata* L., perennial phlox. Rare: roadside ditch. 575

POLYGALACEAE

- Polygala curtissii* Gray. Occasional: roadsides, field margins, and powerline cuts. 369
- * *P. lutea* L., orange milkwort. Rare: pine woods bordering headwater pond. 404
- P. mariana* Mill., Maryland milkwort. Common: roadsides, field margins, and powerline cuts. 273

POLYGONACEAE

- Fallopia japonica* (Houtt.) Ronse Decr., Japanese knotweed. Common: roadsides and ditches. 360
- F. scandens* (L.) Holub, climbing false buckwheat. Uncommon: creekside banks. E. Squires 32
- * *Persicaria arifolia* (L.) Haraldson, halberd-leaved tearthumb. Common: swamps, marsh margins, many moist disturbed sites. 351
- ** *P. lapathifolia* L., curlytop knotweed. Rare: roadside ditch. 641
- * *P. longiseta* (Bruijn) Kitag., oriental ladythumb. Common: swamps, roadside ditches, and other moist disturbed sites. 14, 192, 308, 357
- P. maculosa* S.F. Gray, common ladythumb. Common: roadside ditches, moist forest margins. 334, 399
- P. pennsylvanica* (L.) Gomez, Pennsylvania smartweed. Uncommon: roadside ditches. 515
- P. punctata* (Ell.) Small, water smartweed. Common: swamps, and wet areas in fields, forested trails, and powerline cuts. 12, 418, 505
- P. sagittata* (L.) H. Gross, arrow-leaved tearthumb. Common: swamps, marsh margins, stream flood plains, and many moist disturbed sites. 363
- P. virginiana* (L.) Gaertn., Virginia knotweed. Occasional: stream flood plains, and many moist disturbed sites. 544
- Polygonum aviculare* L., common knotweed. Occasional: lawns, ditches, and gravelly sites. 354
- Rumex acetosella* L., common sheep sorrel. Very common: lawns, roadsides, field margins, and powerline cuts. 74, 217
- R. crispus* L., dock. Occasional: edge of parking lot, unmown roadsides, and many other disturbed sites. 104†

PORTULACACEAE

- Claytonia virginica* L., spring beauty. Common: stream flood plains and moist mixed hardwoods slopes. 36
- Portulaca grandiflora* Hook., rose moss. Rare: persisting at edge of field and concrete sidewalk. 598

P. oleracea L., common purslane. Rare: gravel driveway at residence. 528

PRIMULACEAE

Anagallis arvensis L., scarlet pimpernel. Rare: field margins. 315

* *Lysimachia ciliata* L., fringed loosestrife. Rare: moist, grassy margin of mixed hardwoods. 325

L. quadrifolia L., whorled loosestrife. Occasional: forest margins and forested trails. 233

* *Samolus valerandi* L. ssp. *parviflorus* (Raf.) Hulten, water pimpernel. Uncommon: margins of fresh and brackish marshes. 285, 488

PYROLACEAE

Chimaphila maculata (L.) Pursh, spotted wintergreen. Common: mixed hardwood forest slopes. 18

* *C. umbellata* (L.) W. Bart., pipsissewa. Uncommon: pine/mixed hardwood forest slopes. 552

RANANCULACEAE

Actaea pachypoda Ell., white baneberry. Uncommon: ravine slopes. 204, 205

Anemone virginiana L., thimbleweed. Uncommon: sunny gaps on mixed hardwood forest slopes. 434

Aquilegia canadensis L., wild columbine. Uncommon: roadside ditches. 97

* *Caltha palustris* L., marsh marigold. Rare: single location on floodplain of small stream. 100

Clematis virginiana L., virgin's bower. Uncommon: wet, disturbed thickets, marsh margins, forest margins. 712

Hepatica americana (DC.) Ker, var. *americana*, hepatica. Occasional: mixed hardwood slopes, ravine slopes. 32

Ranunculus abortivus L., kidneyleaf buttercup. Common: stream banks, stream flood plains, moist mixed hardwoods, and various moist disturbed sites. 68

R. bulbosus L., bulbous buttercup. Very common: roadsides, fields, field margins, and lawns. 47

** *R. ficaria* L., lesser celandine. Rare: dump site and forest margin. E. Squires 5

R. hispidus Michx., bristly buttercup. Rare: bottom of ravine slope. 745

R. parviflorus L., small flower buttercup. Occasional: lawns and gravelly sites. 756

R. recurvatus Poiret. Occasional: stream banks and moist hardwood forest. 117

R. sardous Crantz, buttercup. Occasional: field margins and lawns. 107

Thalictrum pubescens Pursh, tall meadow rue. Occasional: margin of freshwater marsh and sunny stream banks. 329

ROSACEAE

- * *Agrimonia pubescens* Wallroth, agrimony. Uncommon: pine/mixed hardwood forest slopes and forest trails. 429
- * *Amelanchier spicata* (Lam.) K. Kock., serviceberry. 735†
- Aronia arbutifolia* (L.) Ell., chokeberry. Uncommon: forest margins and cut-over areas. 557, 749
- * *A. melanocarpa* (Michx.) Ell., black chokeberry. Rare: roadside. 807
- Duchesnea indica* (Andrs.) Focke, Indian strawberry. Common: roadsides and field margins. 52
- Fragaria virginiana* Duchesne, wild strawberry. Occasional: roadsides and field margins. 92, 158, 740b
- * *Geum canadense* Jacq., avens. Occasional: streambanks, powerline cuts, and moist forested trails. 298, 327, 432
- * *Malus pumila* Miller, common apple. Rare: forest margin. 64
- Potentilla canadensis* L. var. *canadensis*, dwarf cinquefoil. Common: roadsides, field margins, and lawns. 53, 93
- P. recta* L., sulphur cinquefoil. Occasional: roadsides, fields, fencerows, and powerline cuts. 210
- P. simplex* Michx., common cinquefoil. Occasional: disturbed woods and moist thickets. 148
- Prunus persica* (L.) Batsch, peach. Rare: roadside forest margin. 754
- Prunus serotina* Ehrhart, wild black cherry. Common: forest margins, roadsides, field margins. 218, 737
- Pyrus calleryana* Decne., Bradford pear. 404†
- P. communis* L., pear. Uncommon: forest margins and powerline cuts. 728
- Rosa multiflora* Thunb. ex Murr., multiflora rose. Common: pond margins, moist thickets, and forest margins. 197
- R. palustris* Marsh., swamp rose. Occasional: freshwater marsh. 330
- R. virginiana* Mill., pasture rose. Common: roadside ditches and field margins. 247†
- Rubus argutus* Link, sawtooth blackberry. Common: roadsides, powerline cuts, and forested trails. 131, 198, 341, 833
- * *R. bifrons* Vest. Himalayaberry. Rare: planted or escaped to grassy hillside near Totuskey Creek public boat launch. 839
- R. flagellaris* Willd., northern dewberry. Occasional: pine forest, powerline cuts and roadsides. 85

R. hispidus L., bristly dewberry. Common: mixed hardwood forest slopes and powerline cuts. 246

R. phoenicolasius Maxim., wineberry. Uncommon: forest margins and forested trails. 202

RUBIACEAE

Cephalanthus occidentalis L., buttonbush. Occasional: freshwater marshes and creek banks. 477

Diodia teres Walt., buttonweed. Common: roadsides, field margins, and powerline cuts. 317

D. virginiana L., buttonweed. Occasional: roadsides and field margins. 313

Galium aparine L., cleavers. Common: disturbed hardwood forest margins and moist thickets. 89, 163

G. circaezans Michx., wild licorice. Occasional: mixed hardwood forest and forested trails. 188

G. obtusum Bigelow var. *obtusum*, bedstraw. Occasional: streambanks and stream flood plains. 190, 440

G. pilosum Aiton, hairy bedstraw. Uncommon: mown grassy roadsides. 348

* *G. tinctorium* L. Scop. var. *tinctorium*. Uncommon: streambanks. 472

G. triflorum Michx., fragrant bedstraw. Mixed hardwood forest and forest margins. 299, 337

Houstonia caerulea L., bluet. Common: roadsides, forest margins, and powerline cuts. 77

H. purpurea L. Occasional: forested trails. 122

* *H. pusilla* Schoepf., tiny bluet. Rare: mown lawn. 731

Mitchella repens L., partridge berry. Common: pine/mixed hardwood forest and pond margin. 57, 137

Sherardia arvensis L., field madder. Occasional: roadsides, field margins, and lawns. 48

SALICACEAE

Populus alba L., white poplar. Uncommon: roadsides, cut-over areas, and yards. 580

* *P. grandidentata* Michx., big-toothed aspen. Occasional: roadsides and cut-over areas. 343

Salix nigra Marsh., black willow. Occasional: wet roadside ditches and margin of freshwater marsh. 223

SANTALACEAE

Comandra umbellata (L.) Nutt., bastard toad-flax. Rare: margin of pine/mixed hardwood forest. 774

SAXIFRAGACEAE

- Chrysosplenium americanum* Schwein., golden saxifrage. Occasional: springy ravine bottoms and stream banks. 724
- * *Heuchera americana* L., alumroot. Rare: shady, lichen-covered slope in powerline cut. 241

SCROPHULARIACEAE

- Agalinis purpurea* (L.) Pennell., false foxglove. Uncommon: powerline cuts. 703
- * *Aureolaria virginica* (L.) Pennell., false foxglove. Occasional: forest margins and forested roadside slopes. 384
- * *Chelone glabra* L., turtlehead. Rare: stream flood plain. 5
- Gratiola virginica* L., hedge hyssop. Occasional: disturbed stream margins and wet ditches. 179
- * *Lindernia dubia* (L.) Pennell. var. *anagallidea* (Michx.) Cooper. Rare: margin of stream flowing through powerline cut. 456
- * *L. dubia* (L.) Pennell. var. *dubia*. Occasional: water filled tire tracks in wooded trails. 535
- Mimulus alatus* Aiton. Rare: streambank. 545
- M. ringens* L., monkey flower. Occasional: disturbed wet areas and marsh margins. 469, 501
- Nuttallanthus canadensis* (L.) D.A. Sutton, old field toad-flax. Common: roadsides, field margins, and powerline cuts. 83, 126
- * *Pedicularis canadensis* L., wood betony. Rare: mixed hardwood forest slope. E. Squires 7
- Penstemon laevigatus* (L.) Aiton. Eastern smooth beardtongue. Uncommon: roadsides and forest margins. 236
- Verbascum blattaria* L., moth mullein. Uncommon: grassy roadsides. 347
- V. thapsis* L., common mullein. Common: roadsides and powerline cuts. 272
- Veronica arvensis* L., corn speedwell. Very common: roadsides, field margins, and lawns. 112, 113
- V. hederifolia* L., ivy-leaved speedwell. Occasional: field margins and disturbed wooded slopes. 21
- V. peregrina* L., purslane speedwell. Uncommon: dry roadsides. 734
- V. persica* Poiret, bird's eye. Common: roadsides, field margins, and lawns. 23

SOLANACEAE

- Datura stramonium* L., jimsonweed. Occasional: roadsides, field margins, and highly disturbed woodland margins. 525

- * *Physalis longifolia* Nutt. var. *subglabrata* (Mackenzie & Bush) Cronq., groundcherry. Rare: roadside ditch. 609

Solanum carolinense L., horse nettle. Common: roadsides, field margins, cut-over areas, and dump sites. 242

S. ptycanthum Dunal., black nightshade. Occasional: roadsides, field margins, and powerline cuts. 419, 718

ULMACEAE

Celtis laevigata Willd., hackberry. Uncommon: roadsides. 582

Ulmus rubra Muhl., slippery elm. Occasional: pine/mixed hardwood forest and forest margins. 441

URTICACEAE

Boehmeria cylindrica (L.) Swartz, false nettle. Common: stream flood plains, margin of freshwater marsh, and moist mixed hardwood forest. 445, 476

Pilea pumila (L.) Gray, clearweed. Common: pond margin and marsh margins. 850

VALERIANACEAE

Valerianella locusta (L.) Latterade, cornsalad. Common: roadside ditches, fields, and powerline cuts. 51

V. radiata (L.) DuRoi., cornsalad. Occasional: roadside ditches, fields, and powerline cuts. 753

VERBENACEAE

Verbena urticifolia L., white vervain. Uncommon: trail through mixed hardwood forest. 335

VIOLACEAE

- ** *Viola affinis* Le Conte. Rare: pine/mixed hardwood forest slope near Mulberry Road bridge.

V. arvensis Murr., wild pansy. Occasional: cultivated fields and field margins. 143

V. bicolor Pursh, field pansy. Common: roadsides, fields, field margins and lawns. 20, 736

- * *V. cucullata* Aiton. Marsh blue violet. Occasional: moist ravine bottoms. 49, 130

- * *V. palmata* L., early wood violet. Occasional: mixed hardwood forest and forest margins. 87

- * *V. pedata* L., bird's foot violet. Occasional: roadsides banks and powerline cuts. 38

V. primulifolia L., primrose-leaved violet. Common: stream flood plains, ravines, mixed hardwood forest, and powerline cuts. 79, 129

V. sagittata Aiton, arrow-leaved violet. Uncommon: powerline cuts. 84, 711

- * *V. sororia* Willd., common blue violet. Common: roadsides, field margins, powerline cuts, and disturbed streambanks. 44

VISCACEAE

Phoradendron leucarpum (Raf.) Reveal & M.C. Johnston, eastern mistletoe. Uncommon: parasitic on upper branches of trees near freshwater marsh and on creek banks. 844

VITACEAE

Parthenocissus quinquefolia (L.) Planchon, Virginia creeper. Very common: pine/mixed hardwood forests, forest margins, powerline cuts, and roadsides. 416

Vitis aestivalis Michx., summer grape. Common: forest margins and cut-over areas. 345

- * *V. riparia* Michx. 573†

V. rotundifolia Michx. Occasional: forest margins and cut-over areas. 344

MONOCOTYLEDONS

AGAVACEAE

Yucca filamentosa L. Spanish bayonet, yucca. Occasional: extensive colony found in flat, dry pine/mixed hardwood forest, also found along roadsides. 612

ALISMATACEAE

- * *Alisma subcordatum* Raf., southern water plantain. Uncommon: muddy pools in logging and hunting trails through pine/mixed hardwood forest. 362

Sagittaria graminea Michx., grass-leaved arrow-head. Occasional: margins of freshwater marsh. 355

S. latifolia Willd., common arrow-head. Occasional: wet roadside ditches. 514

ARACEAE

Arisaema triphyllum (L.) Schott, jack-in-the-pulpit. Common: moist mixed hardwoods, ravine slopes, floodplains of small streams. 66

- * *Orontium aquaticum* L., golden club. Rare: single population along muddy stream running parallel to northern end of Canal Road. E. Squires 2

Peltandra virginica (L.) Schott & Endlicher, arrow arum. Common: freshwater marsh and floodplains of small streams. 284

Symplocarpus foetidus (L.) Nutt., skunk cabbage. Rare (LA): floodplain of small tributary of Totuskey Creek at intersection with Luttrellville Lane. 721

COMMELINACEAE

Commelina communis L., Asiatic dayflower. Common: moist roadside ditches and stream margins. 289

Murdannia keisak (Hasskarl) Had.-Mazz. Uncommon (LA): wet ditches and pools in hunting and logging trails. 620

CYPERACEAE

Bulbostylis capillaris (L.) Clarke. Rare: dry, cutover area. 553

Carex albicans Willd. ex Sprengl, var. *emmonsii* (Dewey ex Torr.) J. Rettig,

C. albolutescens Schwien. Occasional: pond margins and moist lawn. 652†, 792

C. amphibola Steudel. Uncommon: moist hardwood forest slopes. 820

* *C. annectens* Bicknell. Uncommon: moist disturbed sites. 105b

C. atlantica Baily ssp. *atlantica*. Uncommon: moist hardwood forest slopes, pond margins, and flood plains of streams. 81, 133†, 799, 793

* *C. blanda* Dewey. Uncommon: pine/mixed hardwood forest and flood plain of stream. 195, 785

C. cephalophora Muhl. ex Schkuhr. Occasional: fields and forest margins. 765

C. comosa Boott. Occasional: margin of freshwater marsh, inundated sites. 328

C. crebiflora Wiegand. Uncommon: forest margins and hunting trails. 739

C. crinita Lam. Uncommon: hardwood forest slopes and forest margins. 197

C. debilis Michx. Common: marsh margins and moist hardwood slopes. 794, 830

C. intumescens Rudge. Uncommon: pond margins. 136

C. lavaevaginata (Kukenth.) Mackenzie. Uncommon: stream floodplains. 780†

C. laxiculmis Schwein. Occasional: moist mixed hardwood slopes and stream floodplains. 748

C. lurida Wahl. Common: marsh margins, wet ditches, and other moist, disturbed areas. 106b

C. nigromarginata Schwien. Uncommon: powerline cuts and forest margins. 725

* *C. pensylvanica* Lam. Rare: moist hardwood forest slopes. 27

* *C. prasina* Schwien. Rare: moist ravine bottom. 744†

C. platyphylla Carey. Uncommon: hardwood forest slopes. 804

C. rosea Schk. ex Willd. Occasional: streambanks, ravine bottoms. 747

C. seorsa Howe. Occasional: moist mixed hardwood slopes and stream floodplains. 63, 81†, 793†

- * *C. squarrosa* L. Uncommon: forest margins and trails. 194
- C. stricta* Lam. Rare: margin of mixed hardwood slope and freshwater marsh. 821
- * *C. swanii* (Fern.) Mack. Rare: sandy bank of creek at base of hardwood forest slope. 828
- C. umbellata* Schkuhr. Uncommon: powerline cuts and forest margins. 725b
- C. vulpinoidea* Michx. Occasional: roadside ditches, disturbed moist sites. 400
- * *Cyperus echinatus* (L.) Wood. Uncommon: margin of brackish marshes. 494
- * *C. esculentus* L. Uncommon: dry fields and disturbed sites. 581
- C. filicinus* Vahl., Uncommon: margin of brackish marshes. 492
- C. frankii* Kunth. 762†
- C. iria* L., Rare: clear-cut area. 554
- C. lancastriensis* Porter, Uncommon: margin of brackish marshes. 496
- C. lupulinus* (Sprengel) Marcks. Uncommon: roadside ditches. 386
- * *C. retrorsus* Chapman. Common: roadsides, disturbed sites, and forest margins. 271, 358
- Dulichium arundinaceum* (L.) Britton. Uncommon: pond margins. 538
- * *Eleocharis engelmannii* Steudel. Rare: water-filled tire ruts at powerline cut. 586
- E. flavescens* (Poiret) Urban. var. *flavescens*. Rare: muddy pond margin. 267†
- E. obsusa* (Willd.) Schultz. Common: pools and moist tire ruts on open trails and powerline cuts
361
- E. palustris* (L.) Roem. & Schult., common spikerush. 796†
- Fimbristylis autumnalis* (L.) R&S. Uncommon: moist tire ruts on open forest trails. 585
- * *Kyllinga gracillima* Miquel. Uncommon: roadside margin near brackish marsh. 485
- * *K. pumila* Michx. Uncommon: low, moist areas of lawns. 540
- Rhynchospora capitellata* (Michx.) Vahl. Uncommon: shaded forest margins. 370, 520
- Schoenoplectus americanus* (Pers.) Volk ex Schinz & Keller. Occasional: freshwater and slightly brackish marshes. 352, 542
- S. robustus* (Pursh) M. T. Strong, bulrush. Common: freshwater and slightly brackish marshes.
438
- S. tabernaemontani* (Gmelin) Palla, softstem bulrush. Common: freshwater and brackish marshes. 831
- * *Scirpus atrovirens* Willd. Rare: wet depressions in cut-over area. 376, 826†

- * *S. cyperinus* (L.) Kunth. Occasional: wet depressions in cut-over area and dry stream beds. 556
- * *S. polyphyllus* Vahl. Uncommon: margins of streams through powerline cuts and open areas. 457

DIOSCOREACEAE

Dioscorea villosa L. wild yam. Uncommon: mixed hardwood forest slopes and forest margins. 191

IRIDACEAE

Sisyrinchium angustifolium P. Mill., blue-eyed grass. Common: open areas in pine/mixed hardwood forest and hunting and logging trails. 118

JUNCACEAE

Juncus acuminatus Michx. 757†, 768†

J. bufonius L., toad rush. Uncommon: margin of brackish marsh and roadside ditches. 797, 838

J. coriaceus Mackenzie. Uncommon: wet depressions at cut-over areas and roadside ditches. 373

J. effusus L. soft rush. Common: moist ditches, pond and stream margins. 80

J. marginatus Rostk.. Uncommon: water-filled tire ruts and pools in shaded forest trails. 536

J. scirpoides Lam. Uncommon: moist depressions at cut-over areas. 372

Luzula bulbosa (Wood) Rydb., woodrush. Occasional: Moist, hardwood forest slopes. 28

L. echinata (Small) Herm., woodrush. Rare: edge of stream at Drinking Swamp near Mulberry Road. 59

LEMNACEAE

- * *Lemna valdiviana* Philipii., duckweed. Occasional: surfaces of ponds and other still water. 225, 509

LILIACEAE

Allium vineale L., field garlic. Common: roadsides and field margins. 287

Asparagus officinalis L., wild asparagus. Occasional: roadsides, field margins, marsh margins. 226

- * *Erythronium americanum* Ker-Gawl. ssp. *americanum*, trout lily. Uncommon: flood plains of small streams. 751

Hemerocallis fulva (L.) L., orange daylily. Occasional: roadsides and persisting at old homesites. 320

- * *Hypoxis hirsuta* (L.) Coville, common star-grass. Rare: middle of cleared hunting trail through pine/mixed hardwood forest, and powerline cut. 173
- Maianthemum racemosum* (L.) Link ssp. *racemosum*, false Solomon's seal. Occasional: hardwood forest slopes, and forest margins along roadsides. 166
- Medeola virginiana* L., Indian cucumber root. Common: moist ravine slopes, ravine bottoms, mixed hardwood forest slopes. 128
- Muscari* sp., grape hyacinth. Uncommon: cultivated fields and field margins. 45
- Polygonatum biflorum* (Walt.) Ell., Solomon's seal. Uncommon: mixed hardwood forest slopes, and forested roadside ditches. 146
- Uvularia perfoliata* L., perfoliate-leaved bellwort. Occasional: moist mixed hardwood slopes, stream margins. 670
- * *U. sessilifolia* L., sessile-leaved bellwort. Uncommon: Mixed hardwood forest. E. Squires 12

ORCHIDACEAE

- Aplectrum hyemale* (Muhl. ex Willd.) Torrey, putty root. Rare: base of moist hardwood forest slope. 722
- * *Corallorhiza odontorhiza* (Willd.) Nuttall var. *odontorhiza*, autumn coral root. Rare: a single stem on steep roadside slope on Richmond Hill Road. 680
- Cypripedium acaule* Aiton, pink lady's slipper, moccasin flower. Occasional: upland pine/mixed hardwood forest, forest margins, and persisting temporarily under shrubs in recent clear cut areas and powerline cuts. 152
- Galearis spectabilis* (L.) Raf., showy orchis. Uncommon: bottoms of moist, mixed hardwood forest slopes, and forested trail. 177
- Goodyera pubescens* (Willd.) R.Br. ex Aiton f., downy rattlesnake plantain. Occasional: flat and sloping pine/mixed hardwood, and mixed hardwood forest, and forest trails. 17
- * *Liparis liliifolia* (L.) L.C.Rich. ex Ker-Gawl., lily-leaved twayblade. Rare: flat mixed hardwood forest, and side of hunting trail through pine/mixed hardwood forest. 393
- * *Malaxis unifolia* Michaux, adder's mouth. Occasional: upland pine/mixed hardwood forest. 244
- * *Platanthera clavellata* (Michx.) Luer, club-spur orchid. Uncommon: moist pine/mixed hardwood forest, floodplain of small stream and pond. 402
- * *P. lacera* (Michx.) G. Don, ragged fringed orchid. Uncommon: stream floodplains and moist hardwood forest. 847
- Tipularia discolor* (Pursh) Nutt., crane fly orchid. Occasional: upland mixed hardwood forest. 58

POACEAE

- Aira caryophyllea* L., hairgrass. Occasional: gravelly roadsides. 776, 825
- * *A. praecox* L., early hairgrass. Rare: single population on gravelly roadside. 775
- * *Alopecurus carolinianus* Walt., foxtail. Rare: peaty (burned?) soil at margin of moist meadow.
- Andropogon ternarius* Michx., beardgrass. Occasional: roadsides and powerline cuts. 674
- A. virginicus* L., broomsedge. Occasional: roadsides and powerline cuts. 674b
- Anthoxanthum odoratum* L., sweet vernalgrass. Very common: roadsides, field margins, forest margins. 40, 62
- Arundinaria gigantea* (Walt.) Muhl. ssp. *tecta* (Walt.) McClure., switchcane. Rare (LA): disturbed streambanks. 723
- * *Avena sativa* L., common oats. Uncommon: agricultural fields. 788
- Bromus inermis* Leysser., smooth brome. Uncommon: disturbed forest margin and field. 832
- B. hordaceus* L., soft brome. 798†
- B. racemosus* L., Common: roadsides and fields. 808, 814
- Cenchrus tribuloides* L., sand bur. Rare: single population on sandy river beach. 503
- Chasmanthium laxum* (L.) Yates. Occasional: cut-over areas and forest margins. 518, 563, 851†
- Cinna arundinacea* L., woodreed. Occasional: streambanks in powerline cuts. 588
- Cynodon dactylon* (L.) Pers., burmuda grass. Common: roadsides and lawns. 263
- Dactylis glomerata* L., orchard grass. Very common: roadsides, field margins, and disturbed woodland. 760
- Danthonia spicata* (L.) Beauv. ex R.&S., june grass. Very common: roadsides and powerline cuts. 771, 811, 834
- Dichanthelium acuminatum* (Swartz) G. & C. Disturbed forest, forest margin, forested trail. 631
- D. boscii* (Poir.) G. & C. Uncommon: mixed hardwoods, trails, roadside ditches. 222
- D. commutatum* (Shultes.) Gould. Forest margins. 156
- D. depauperatum* (Muhl.) Gould. Uncommon: powerline cuts. 836
- D. dichotomum* (L.) Gould. Occasional: disturbed forest, forest margin. 551, 827, 829
- D. scoparium* (Lam.) Gould. Very common: powerline cuts, cut-over areas, roadsides. 375
- * *D. sphaerocarpon* (Ell.) Gould. Uncommon: Disturbed hardwood forest. 336
- Digitaria sanguinalis* (L.) Scop., crab grass. Occasional: roadsides and lawns. 611

- Echinochloa muricata* (Beauv.) Fern. **var. muricata.**, barnyard grass. Uncommon: roadsides and disturbed forest trails. 546b, 655
- E. walteri* (Pursh.) Heller. Occasional: freshwater and brackish marsh margins, and creek banks. 543
- Elusine indica* (L.) Gaertn., goose grass. Common: roadsides and lawns. 517
- Elymus virginicus* L., wild rye. Occasional: roadsides and disturbed forest trails. 385
- Eragrostis curvula* (Schrader) Nees. Very common: roadsides, river beaches, and cut-over areas. 449, 800, 819
- Eragrostis spectabilis* (Pursh) Steudel, purple lovegrass. Common: roadsides and field margins. 584
- Festuca arundinacea* Schreb., tall fescue. Very common: roadsides and fields. 484†, 750
- F. subverticillata* (Pers.) Alexeev., nodding fescue. Occasional: moist forested trails. 803
- Glyceria striata* (Lam.) Hitchc., fowl-meadow grass. Occasional: streambanks. 782
- * *Holcus lanatus* L., velvet grass. Uncommon: roadsides. 822
- Hordeum pusillum* Nutt., little barley. Common: roadsides and field margins. 799
- H. vulgare* L., field barley. Rare: roadsides. 150
- Leersia virginica* Willd. Uncommon: wet depressions in disturbed forested trails. 550
- Lolium perrene* L., rye grass. Common: roadsides, field margins, and lawns. 773
- Microstegium vimineum* (Trin.) A. Camus, Japanese stiltgrass. Common: disturbed moist forest, moist roadside ditches. 843
- * *Miscanthus sinensis* Anders. Rare: escaped to powerline cut. 672
- Panicum anceps* Michx., beaked panicgrass. Occasional: roadsides and field margins. 423
- P. dichotomiflorum* Michx., Occasional: margin of freshwater marsh. 610
- P. miliaceum* L. ssp. *miliaceum*, millet. 702†
- P. virgatum* L., switchgrass. Occasional: brackish marsh. 491
- Paspalum dilatatum* Poir., dallisgrass. Common: roadsides and field margins. 487
- P. floridanum* Michx. Uncommon: disturbed woodland. 624
- P. leave* Michx., Rare (LA): roadside. 398
- P. setaceum* Michx., thin paspalum. Occasional: fields and field margins. 468
- * *Phragmites australis* (Cav.) Trin. ex. Steud., common reed. Occasional: forming relatively small, but dense patches in freshwater and brackish marshes. 663

- Piptochaetium avenaceum* (L.) **Parodi**, black oat grass. Rare: powerline cut. 837
- Poa annua* L., annual bluegrass. Common: roadsides and lawns. 41
- P. autumnalis* **Muhl. ex Ell.** Uncommon: streambanks. 783
- P. cuspidata* **Nutt.**, early bluegrass. Uncommon: mixed hardwood slopes and ravines. 109, 741
- P. pratensis* L., Kentucky bluegrass. Very common: roadsides, field margins, and disturbed forest trails. 740
- Saccharum brevibarbe* (Michx.) **Pers. var. contortum** (L.) **R. Web.**, plumegrass. Uncommon: powerline cuts. 715
- Setaria parviflora* (Poir.) **Kerg.**, bristlegrass. Common: roadsides and fields. 451, 493
- Sorghum halepense* (L.) **Pers.**, Johnsongrass. Occasional: field margins, roadsides. 842
- Spartina alterniflora* **Loisel.**, salt-water cordgrass. Common: brackish marsh. 692
- S. cynosuroides* (L.) **Roth**, tall cordgrass. Common: freshwater and brackish marshes. 537
- Sphenopholis obtusata* (Michx.) **Scribn.** Occasional: roadsides and disturbed forest margins. 767, 816
- * *S. pensylvanica* (L.) **Hitchc.** Uncommon: stream floodplain. 787
- Tridens flavus* (L.) **Hitchc.**, red-top. Common: roadsides and field margins. 448
- Tripsacum dactyloides* (L.) **L.**, gamagrass. Common: roadsides. 290
- Triticum aestivum* L., wheat. Uncommon: roadsides and unmown lawns. 805
- * *Urochloa platyphylla* (Monroe ex. **Wright**) **R. Web.**, signalgrass. Rare: roadside. 677
- Vulpia myuros* (L.) **K.C. Gmel.**, rat-tail fescue. Occasional: gravelly roadsides and lawns. 770, 812
- * *V. octoflora* (Walt.) **Rydb. var. octoflora**, six-weeks fescue. Common: gravelly roadsides, open fields, and powerline cuts. 772, 815
- Zizania aquatica* L., wild rice. Occasional: freshwater marsh. 439

PONTIDERIACEAE

- * *Heteranthera reniformis* **R. & P.**, mud plantain. Rare: single population in deep muddy pool along hunting trail. 482
- Pontederia cordata* L., pickerelweed. Common: freshwater marshes. 283

POTOMOGETONACEAE

- * *Potamogeton foliosus* **Raf. ssp. foliosus**, leafy pondweed. Rare: algae-infested stormwater pool. 603

SMILACACEAE

Smilax bona-nox L. Occasional: clearcuts, grassy fields, and other disturbed sites. 356

S. glauca Walter. Common: forest margins, roadsides, fencerows. 589

* *S. herbacea* L. Uncommon: moist hardwoods and thickets. 848

S. rotundifolia L., common greenbrier. Common: forest margins, roadsides, clear-cuts. 209

SPARGANIACEAE

Sparganium americanum Nutt., bur reed. Occasional: wet ditches, and emergent in streams and pools. 266

TYPHACEAE

Typha angustifolia L., narrow-leaved cattail. Common: Brackish marshes. 497, 593

T. latifolia L., common cattail. Occasional: freshwater marsh, stream margins, stormwater pools. 615

APPENDIX B

Photographic Records



Anagallis arvensis L. C. Johnstone #315



Ophioglossum vulgatum L. C. Johnstone #446



Lythrum lineare L. C. Johnstone #500



Corallorhiza odontorhiza (Willd.) Nuttall var. *odontorhiza*
C. Johnstone #680



Aplectrum hyemale (Muhl. ex Willd.) Torrey. C. Johnstone #722



Phoradendron leucarpum (Raf.) Reveal & M.C. Johnston.
C. Johnstone #844



***Liparis liliifolia* (L.) L.C. Rich. ex Ker-Gawl.**

C. Johnstone 393.

Photo credit: Zach R. Bradford

APPENDIX C

List of taxa in each phytogeographic range category from the flora of the Totuskey Creek watershed

RANGE 1: CIRCUMBOREAL SPECIES

<i>Atriplex patula</i>	<i>Chimaphila umbellata</i>	<i>Osmunda regalis</i>
<i>Botrychium virginianum</i>	<i>Eleocharis obtusa</i>	<i>Prunella vulgaris</i>
<i>Circaea lutetiana</i>	<i>Galium aparine</i>	<i>Pteridium aquilinum</i>
<i>Caltha palustris</i>	<i>Galium triflorum</i>	
<i>Calystegia sepium</i>	<i>Ophioglossum vulgatum</i>	

RANGE 2: SPECIES NATIVE TO NORTH AMERICA AND EASTERN ASIA

<i>Adiantum pedatum</i>	<i>Monotropa uniflora</i>	<i>Phryma leptostachya</i>
<i>Dendrolycopodium obscurum</i>	<i>Onoclea sensibilis</i>	<i>Symplocarpus foetidus</i>
<i>Huperzia lucidula</i>	<i>Persicaria virginiana</i>	
<i>Liparis liliifolia</i>	<i>Penthorum sedoides</i>	

RANGE 3: SPECIES RANGING WEST TO THE PACIFIC COAST

Range 3a: Uninterrupted distribution

<i>Apocynum cannabinum</i>	<i>Erigeron strigosus</i>	<i>Symphotrichum racemosum</i>
<i>Bidens frondosa</i>	<i>Fragaria virginiana</i>	<i>Oenothera biennis</i>
<i>Cardamine pensylvanica</i>	<i>Galium tinctorium</i>	<i>Plantago aristata</i>
<i>Carex stricta</i>	<i>Geranium carolinianum</i>	<i>Plantago virginica</i>
<i>Carex vulpinoidea</i>	<i>Glyceria striata</i>	<i>Ranunculus abortibus</i>
<i>Celtis laevigata</i>	<i>Helianthus tuberosus</i>	<i>Rubus occidentalis</i>
<i>Danthonia spicata</i>	<i>Juncus tenuis</i>	<i>Scutellaria lateriflora</i>
<i>Dulicium arundinaceum</i>	<i>Lactuca canadensis</i>	<i>Setaria parviflora</i>
<i>Elymus virginicus</i>	<i>Lepidium virginianum</i>	<i>Teucrium canadense</i>
<i>Erigeron annuus</i>	<i>Symphotrichum lanceolatum</i>	<i>Viola sororia</i>
		<i>Vulpia octoflora</i>

Range 3b: Interrupted distribution

<i>Alopecurus carolinianus</i>	<i>Hypericum mutilum</i>	<i>Rhynchospora capitellata</i>
<i>Carex comosa</i>	<i>Juncus acuminatus</i>	<i>Sagittaria graminea</i>
<i>Carex pensylvanica</i>	<i>Juncus effusus</i>	<i>Schoenoplectus americanus</i>
<i>Clinopodium vulgare</i>	<i>Lemna valdiviana</i>	<i>Scirpus cyperinus</i>
<i>Diospyros virginiana</i>	<i>Physalis longifolia</i> var. <i>subglabrata</i>	<i>Solidago altissima</i>
<i>Eleocharis engelmannii</i>	<i>Pluchea odorata</i>	

RANGE 4: SPECIES RANGING SOUTH OF THE UNITED STATES TO THE NEW WORLD TROPICS

<i>Agalinis purpurea</i>	<i>Elephantopus carolinianus</i>	<i>Parthenocissus quinquefolia</i>
<i>Alisma subcordatum</i>	<i>Euphorbia cyathophora</i>	<i>Persicaria punctatum</i>
<i>Ambrosia artemisiifolia</i>	<i>Fimbristylis autumnalis</i>	<i>Pityopsis graminifolia</i>
<i>Anoda cristata</i>	<i>Gamochaeta purpurea</i>	<i>Plantago major</i>
<i>Asclepias tuberosa</i>	<i>Heteranthera reniformis</i>	<i>Platanus occidentalis</i>
<i>Baccharis halimifolia</i>	<i>Hordeum pusillum</i>	<i>Polygonatum biflorum</i>
<i>Bidens bipinnata</i>	<i>Hydrocotyle ranunculoides</i>	<i>Polyprenum procumbens</i>
<i>Bidens laevis</i>	<i>Hydrocotyle umbellata</i>	<i>Polystichum acrostichoides</i>
<i>Boehmeria cylindrica</i>	<i>Hydrocotyle verticillata</i>	<i>Potamogeton foliosus</i>
<i>Bulbostylis capillaris</i>	<i>Hypericum hypericoides</i>	<i>Prunus serotina</i>
<i>Callitriche heterophylla</i>	<i>Ipomoea purpurea</i>	<i>Rhus glabra</i>
<i>Carex albolutescens</i>	<i>Juncus acuminatus</i>	<i>Rotala ramosior</i>
<i>Carex lurida</i>	<i>Kosteletzkya virginica</i>	<i>Rubus argutus</i>
<i>Cephalanthus occidentalis</i>	<i>Lindernia dubia</i> var. <i>anagallidea</i>	<i>Rudbeckia hirta</i>
<i>Cercis canadensis</i>	<i>Lindernia dubia</i> var. <i>dubia</i>	<i>Sagittaria latifolia</i>
<i>Chamaesyce maculata</i>	<i>Liquidambar styraciflua</i>	<i>Sambucus canadensis</i>
<i>Cicuta maculata</i>	<i>Lidwigia decurrens</i>	<i>Samolus valerandi</i>
<i>Conoclinium coelestinum</i>	<i>Mikania skandens</i>	<i>Sida spinosa</i>
<i>Conyza canadensis</i>	<i>Myrica cerifera</i>	<i>Smilax bona-nox</i>
<i>Corallorhiza odontorhiza</i>	<i>Nuphar advena</i>	<i>Spartina alterniflora</i>
<i>Cornus florida</i>	<i>Nymphaea odorata</i>	<i>Sphenopholis obtusata</i>
<i>Cuscuta campestris</i>	<i>Nuttallanthus canadensis</i>	<i>Toxicodendron radicans</i>
<i>Cyperus filicinus</i>	<i>Nyssa sylvatica</i>	<i>Triodanis perfoliata</i>
<i>Desmodium ciliare</i>	<i>Oenothera laciniata</i>	<i>Tripsacum dactyloides</i>
<i>Eclipta prostrata</i>	<i>Oxalis stricta</i>	<i>Veronica perigrina</i>
<i>Eleocharis flavescens</i> var. <i>flavescens</i>	<i>Panicum virgatum</i>	

RANGE 5: SPECIES RANGING WEST OF THE MISSISSIPPI BUT NOT TO THE PACIFIC COAST

Range 5a: Generally distributed north and south

<i>Acalypha gracilens</i>	<i>Aronia arbutifolia</i>	<i>Carex blanda</i>
<i>Acalypha rhomboidea</i>	<i>Arundinaria gigantea</i> ssp. <i>tecta</i>	<i>Carex cephalophora</i>
<i>Acer rubrum</i>	<i>Asclepias amplexicaulis</i>	<i>Carex debilis</i>
<i>Acer saccharinum</i>	<i>Asclepias incarnata</i>	<i>Carex frankii</i>
<i>Actaea pachypoda</i>	<i>Asclepias syriaca</i>	<i>Carex intumescens</i>
<i>Ageratina altissima</i>	<i>Asclepias variegata</i>	<i>Carex laevivaginata</i>
<i>Agrimonia pubescens</i>	<i>Asimina triloba</i>	<i>Carex laxiculmis</i>
<i>Alnus serrulata</i>	<i>Asplenium platyneuron</i>	<i>Carex prasina</i>
<i>Amphicarpa bracteata</i>	<i>Athyrium filix-femina</i>	<i>Carex rosea</i>
<i>Andropogon virginicus</i>	<i>Betula nigra</i>	<i>Carex squarrosa</i>
<i>Angelica venenosa</i>	<i>Bidens aristosa</i>	<i>Carpinus caroliniana</i>
<i>Antennaria parlinii</i> ssp. <i>fallax</i>	<i>Botrychium biternatum</i>	<i>Carya glabra</i>
<i>Apios americana</i>	<i>Campsis radicans</i>	<i>Carya pallida</i>
<i>Aquilegia canadensis</i>	<i>Cardamine bulbosa</i>	<i>Carya tomentosa</i>
<i>Aralia spinosa</i>	<i>Cardamine concatenata</i>	<i>Centrosema virginiana</i>
<i>Arisaema triphyllum</i>	<i>Carex amphibola</i>	<i>Chamaecrista fasciculata</i>
<i>Aristolachia serpentaria</i>	<i>Carex annectens</i>	<i>Chamaecrista nictitans</i>

Range 5a (continued)

Castanea dentata	Festuca subverticillata	Morus rubra
Castanea pumila	Fraxinus pennsylvanica	Myosotis macrosperma
Chasmanthium laxum	Galactia volubilis	Oenothera fruticosa
Chelone glabra	Galearis spectabilis	Opuntia humifusa
Chionanthus virginicus	Galium circaezans	Oxalis violacea
Chrysopsis mariana	Gaylussacia baccata	Oxydendrum arboreum
Chrysosplenium americanum	Geum canadense	Panicum anceps
Cinna arundinacea	Goodyera pubescens	Panicum dichotomiflorum
Claytonia virginica	Gratiola virginiana	Paspalum laeve
Clematis virginiana	Hamamelis virginiana	Paspalum setaceum
Clitoria mariana	Hepatica americana	Passiflora lutea
Collinsonia canadensis	Heuchra americana	Pedicularis canadensis
Comandra umbellata	Hieracium gronovii	Peltandra virginica
Commelina virginica	Houstonia caerulea	Penstemon laevigatus
Coreopsis lanceolata	Houstonia purpurea	Persicaria arifolia
Corylus americana	Houstonia pusilla	Persicaria pensylvanica
Cryptotaenia canadensis	Hydrangea arborescens	Persicaria sagittata
Cunila origanoides	Hypericum gentianoides	Phegopteris hexagonoptera
Cuscuta compacta	Hypericum punctatum	Philadelphus inodorus
Cynoglossum virginianum	Hypoxis hirsuta	Phlox paniculata
Cyperus lancastris	Ilex verticillata	Phytolacca americana
Cyperus lupulinus	Impatiens capensis	Pilea pumila
Cypripedium acaule	Ipomoea lacunosa	Piptochaetium avenaceum
Decodon verticillatus	Ipomoea pandurata	Plantago rugelli
Desmodium canescens	Juglans nigra	Platanthera clavellata
Desmodium marilandicum	Juncus dichotomus	Platanthera lacera
Desmodium nudiflorum	Juncus scirpoides	Poa autumnalis
Desmodium paniculatum	Juniperus virginiana	Podophyllum peltatum
Desmodium pauciflorum	Kalmia latifolia	Polygonum virginianum
Desmodium rotundifolium	Krigia virginica	Pontederia cordata
Dichanthelium boscii	Kyllinga pumila	Potentilla canadensis
Dichanthelium commutatum	Lechea racemulosa	Potentilla simplex
Dichanthelium depauperatum	Leersia virginica	Pseudognaphalium obtusifolium
Dichanthelium dichotomum	Lespedeza repens	Quercus alba
Dichanthelium polyanthes	Lespedeza virginica	Quercus coccinea
Diodia teres	Lindera benzoin	Quercus marilandica
Diodia virginiana	Linum medium var. texanum	Quercus rubra
Echinochloa walteri	Liriodendron tulipifera	Quercus stellata
Epifagus virginiana	Lobelia cardinalis	Quercus velutina
Epigaea repens	Lobelia inflata	Ranunculus hispidus
Eragrostis spectabilis	Lobelia puberula	Ranunculus recurvatus
Erigeron philadelphicus	Lonicera sempervirens	Rhexia virginica
Erythronium americanum	Ludwigia alternifolia	Rhus copallina
Euonymus americanus	Luzula bulbosa	Robinia pseudoacacia
Eupatorium fistulosum	Lycopus virginicus	Rosa palustris
Eupatorium capillifolium	Lysmachia ciliata	Rosa virginiana
Eupatorium purpureum	Mainthemum racemosum	Rubus hispidus
Eupatorium rotundifolium	Malaxis unifolia	Ruellia caroliniensis
Eupatorium saltuense	Medeola virginiana	Sabatia angularis
Euphorbia corollata	Menispermum canadense	Saccharum brevibarbe
Euthamia graminifolia	Mimulus alatus	Sagina decumbens
Fagus grandifolia	Mimulus ringens	Salix nigra
Fallopia scandens	Mitchella repens	Salvia lyrata

Range 5a (continued)

<i>Sanguinaria canadensis</i>	<i>Solidago odora</i>	<i>Vaccinium stamineum</i>
<i>Sanicula canadensis</i>	<i>Solidago puberula</i>	<i>Valerianella radiata</i>
<i>Sassafras albidum</i>	<i>Solidago rugosa</i>	<i>Verbena urticifolia</i>
<i>Saururus cernuus</i>	<i>Sparganium americanum</i>	<i>Viburnum acerifolium</i>
<i>Scirpus atrovirens</i>	<i>Sphenopholis pensylvanica</i>	<i>Viburnum prunifolium</i>
<i>Scirpus polyphyllus</i>	<i>Stylosanthes biflora</i>	<i>Viola affinis</i>
<i>Scutellaria elliptica</i>	<i>Symphyotrichum cordifolium</i>	<i>Viola bicolor</i>
<i>Sericocarpus linifolius</i>	<i>Symphyotrichum dumosum</i>	<i>Viola cucullata</i>
<i>Silene stellata</i>	<i>Symphyotrichum pilosum</i>	<i>Viola palmata</i>
<i>Silphium asteriscus</i>	<i>Symphyotrichum puniceum</i>	<i>Viola pedata</i>
<i>Sisyrinchium angustifolium</i>	<i>Symphyotrichum undulatum</i>	<i>Viola primulifolia</i>
<i>Smilax glauca</i>	<i>Tephrosia virginiana</i>	<i>Viola sagittata</i>
<i>Smilax herbacea</i>	<i>Thelypteris noveboracensis</i>	<i>Vitis aestivalis</i>
<i>Smilax rotundifolia</i>	<i>Tipularia discolor</i>	<i>Woodwardia areolata</i>
<i>Solanum carolinense</i>	<i>Tridens flavus</i>	
<i>Solanum ptycanthum</i>	<i>Uvularia perfoliata</i>	
<i>Solidago caesia</i>	<i>Uvularia sessilifolia</i>	
<i>Solidago juncea</i>	<i>Ulmus rubra</i>	
<i>Solidago nemoralis</i>	<i>Urochloa platyphylla</i>	

Range 5b: Species generally northern in distribution

<i>Aronia melanocarpa</i>	<i>Croton glandulosus</i>	<i>Populus grandidentata</i>
<i>Carex crinita</i>	<i>Dioscorea villosa</i>	<i>Rubus flagellaris</i>
<i>Carex swanii</i>	<i>Erechtites hieracifolia</i>	<i>Solidago bicolor</i>
<i>Cirsium discolor</i>	<i>Polypodium virginianum</i>	

Range 5c: Species generally southern in distribution

<i>Andropogon ternarius</i>	<i>Elephantopus tomentosus</i>	<i>Sanicula smallii</i>
<i>Bignonia capreolata</i>	<i>Ilex opaca</i>	<i>Verbesina occidentalis</i>
<i>Chaerophyllum tainturieri</i>	<i>Paspalum floridanum</i>	
<i>Cyperus echinatus</i>	<i>Pyrrhopappus carolinianus</i>	

Range 5d: Species extending west beyond the Mississippi in the North

<i>Amelanchier spicata</i>	<i>Aplectrum hyemale</i>	<i>Baptisia tinctoria</i>
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Range 5e: Species extending west beyond the Mississippi in the South

<i>Carex nigromarginata</i>	<i>Dichanthelium acuminatum</i>	<i>Hypericum crux-andreae</i>
<i>Carex umbellata</i>	<i>Dichanthelium scoparium</i>	<i>Itea virginica</i>
<i>Cenchrus tribuloides</i>	<i>Eubotrys racemosa</i>	<i>Iva frutescens</i>
<i>Clethra alnifolia</i>	<i>Galium obtusum</i>	<i>Juncus coriaceous</i>
<i>Cyperus retrorsus</i>	<i>Galium pilosum</i>	<i>Lyonia mariana</i>

Range 5e (continued)

<i>Magnolia virginiana</i>	<i>Quercus michauxii</i>	<i>Spartina cynosuroides</i>
<i>Pinus taeda</i>	<i>Quercus phellos</i>	<i>Taxodium distichum</i>
<i>Polygala mariana</i>	<i>Rhexia mariana</i>	<i>Utricularia gibba</i>
<i>Quercus falcata</i>	<i>Rhododendron atlanticum</i>	<i>Viburnum nudum</i>
<i>Quercus laurifolia</i>	<i>Scutellaria integrifolia</i>	

RANGE 6: RANGES LIMITED TO EASTERN NORTH AMERICA EAST OF THE MISSISSIPPI RIVER

Range 6a1: Extending widely beyond the Atlantic Coastal Plain

<i>Anemone virginiana</i>	<i>Hieracium venosum</i>	<i>Sericocarpus asteroides</i>
<i>Antennaria solitaria</i>	<i>Lobelia nuttallii</i>	<i>Solidago erecta</i>
<i>Aureolaria virginica</i>	<i>Lupinus perennis</i>	<i>Symphyotrichum subulatum</i>
<i>Carex albicans</i> var. <i>emmonsii</i>	<i>Luzula echinatus</i>	<i>Thalictrum pubescens</i>
<i>Carex atlantica</i> var. <i>atlantica</i>	<i>Lysimachia quadrifolia</i>	<i>Vaccinium fuscatum</i>
<i>Carex seorsa</i>	<i>Packera anonyma</i>	<i>Vernonia glauca</i>
<i>Chimaphila maculata</i>	<i>Pinus virginiana</i>	<i>Vernonia noveboracensis</i>
<i>Cornus amomum</i>	<i>Poa cuspidata</i>	<i>Viburnum dentatum</i> var. <i>lucidum</i>
<i>Diphasiastrum digitatum</i>	<i>Polygala curtissii</i>	
<i>Eupatorium dubium</i>	<i>Prenanthes serpentaria</i>	
<i>Eupatorium hyssopifolium</i>	<i>Quercus prinus</i>	
<i>Eupatorium pilosum</i>	<i>Rhododendron periclymenoides</i>	

Range 6a2: Mostly limited to the Atlantic Coastal Plain

<i>Amaranthus cannabinus</i>	<i>Lythrum lineare</i>	<i>Solidago pinetorum</i>
<i>Eurybia compacta</i>	<i>Orontium aquaticum</i>	<i>Vaccinium formosum</i>
<i>Gaylussacia frondosa</i>	<i>Polygala lutea</i>	
<i>Liatis graminifolia</i>	<i>Zizania aquatica</i>	

Range 6b: Generally northern in distribution

Carex platyphylla

Range 6c: Generally southern in distribution

<i>Helianthus atrorubens</i>	<i>Hibiscus moscheutos</i>
<i>Hexastylis virginica</i>	<i>Yucca filamentosa</i>

RANGE 7: INTRODUCED SPECIES

<i>Acer platanoides</i>	<i>Forsythia suspensa</i>	<i>Portulaca grandiflora</i>
<i>Achillea millefolium</i>	<i>Geranium molle</i>	<i>Portulaca oleracea</i>
<i>Aira caryophylla</i>	<i>Glechoma hederaceae</i>	<i>Potentilla recta</i>
<i>Aira praecox</i>	<i>Hedera helix</i>	<i>Prunus persica</i>
<i>Albizia julibrissin</i>	<i>Hemerocallis fulva</i>	<i>Pseudognaphalium stramerium</i>
<i>Allium vineale</i>	<i>Hibiscus syriacus</i>	<i>Pueraria montana</i> var. <i>lobata</i>
<i>Amaranthus hybridus</i>	<i>Holcus lanatus</i>	<i>Pyrus calleryana</i>
<i>Anagallis arvensis</i>	<i>Hordeum vulgare</i>	<i>Pyrus communis</i>
<i>Anthemis arvensis</i>	<i>Hypochaeris radicata</i>	<i>Ranunculus bulbosus</i>
<i>Anthoxanthum odoratum</i>	<i>Ipomoea coccinea</i>	<i>Ranunculus perviflorus</i>
<i>Arabidopsis thaliana</i>	<i>Ipomoea hederacea</i>	<i>Ranunculus sardous</i>
<i>Artemisia vulgaris</i>	<i>Kyllinga gracillima</i>	<i>Raphanus raphanistrum</i>
<i>Asparagus officinalis</i>	<i>Lamium amplexicaule</i>	<i>Rosa bifrons</i>
<i>Avena sativa</i>	<i>Lamium purpureum</i>	<i>Rosa multiflora</i>
<i>Barbarea verna</i>	<i>Lathyrus hirsutus</i>	<i>Rubus phoenicolasius</i>
<i>Barbarea vulgaris</i>	<i>Lathyrus latifolius</i>	<i>Rumex acetosella</i>
<i>Bromus hordaceus</i>	<i>Lepidium campestre</i>	<i>Rumex crispus</i>
<i>Bromus inermis</i>	<i>Lespedeza cuneata</i>	<i>Saponaria officinalis</i>
<i>Bromus racemosus</i>	<i>Kummerowia striata</i>	<i>Scleranthus annuus</i>
<i>Broussonetia papyrifera</i>	<i>Leucanthemum vulgare</i>	<i>Sedum sarmentosum</i>
<i>Buglossoides arvensis</i>	<i>Ligustrum sinense</i>	<i>Senecio vulgaris</i>
<i>Cardamine hirsuta</i>	<i>Lolium perrene</i>	<i>Setaria viridis</i>
<i>Carya illinoensis</i>	<i>Lonicera japonica</i>	<i>Sherardia arvensis</i>
<i>Centaurea cyanus</i>	<i>Lotus corniculatus</i>	<i>Silene latifolia</i>
<i>Centaurea stoebe</i> spp. <i>micranthos</i>	<i>Malus pumila</i>	<i>Sorghum halepense</i>
<i>Cerastium glomeratum</i>	<i>Melilotus albus</i>	<i>Stellaria graminea</i>
<i>Chenopodium album</i>	<i>Melilotus affinalis</i>	<i>Stellaria media</i>
<i>Cichorium intybus</i>	<i>Mentha spicata</i>	<i>Teesdalia nudicaulis</i>
<i>Cirsium arvense</i> var. <i>horridum</i>	<i>Microstegium vimineum</i>	<i>Trifolium arvense</i>
<i>Commelina communis</i>	<i>Miscanthus sinensis</i>	<i>Trifolium campestre</i>
<i>Coronilla varia</i>	<i>Mollugo verticillata</i>	<i>Trifolium dubium</i>
<i>Cynodon dactylon</i>	<i>Morus alba</i>	<i>Trifolium incarnatum</i>
<i>Cyperus iria</i>	<i>Murdannia keisak</i>	<i>Trifolium pratense</i>
<i>Cytisus scoparius</i>	<i>Muscari</i> sp.	<i>Trifolium repens</i>
<i>Dactylis glomerata</i>	<i>Myosotis stricta</i>	<i>Triticum aestivum</i>
<i>Datura stramonium</i>	<i>Ornithogallum umbellatum</i>	<i>Valerianella locusta</i>
<i>Daucus carota</i>	<i>Panicum miliaceum</i>	<i>Verbascum blattaria</i>
<i>Dianthus armeria</i>	<i>Papaver dubium</i>	<i>Verbascum thapsis</i>
<i>Digitaria sanguinalis</i>	<i>Paspalum dilatatum</i>	<i>Veronica arvensis</i>
<i>Dipsacus fullonum</i>	<i>Paulownia tomentosa</i>	<i>Veronica hederifolia</i>
<i>Draba verna</i>	<i>Perilla frutescens</i>	<i>Veronica persica</i>
<i>Duchesnea indica</i>	<i>Periscaria longiseta</i>	<i>Vicia hirsuta</i>
<i>Echium vulgare</i>	<i>Persicaria maculosa</i>	<i>Vicia sativa</i>
<i>Elaeagnus umbellata</i>	<i>Plantago lanceolata</i>	<i>Vicia villosa</i> ssp. <i>villosa</i>
<i>Elusine indica</i>	<i>Poa annua</i>	<i>Viola arvensis</i>
<i>Euphorbia cyparissias</i>	<i>Poa pratensis</i>	<i>Vulpia myuros</i>
<i>Fallopia japonica</i>	<i>Polygonum aviculare</i>	<i>Xanthium strumerium</i>
<i>Festuca arundinacea</i>	<i>Populus alba</i>	

RANGE 8: COSMOPOLITAN AND NEARLY COSMOPOLITAN SPECIES

Cyperus esculentus

Juncus bufonius

Ludwigia palustris

Osmunda cinnamomea

Phragmites australis

Polygonum lapathifolium

Schoenoplectus tabernaemontani

Thelypteris palustris

Typha angustifolia

Typha latifolia

Vita

Christopher W. Johnstone

Born October 3, 1983 in Burlington, Vermont. Raised in South Burlington, Vermont and Sacramento, California. Graduated from South Burlington High School in 2001. Attended the University of New Hampshire in Durham, NH and received a degree of Bachelor of Science in biology in 2005. Began graduate studies at the College of William and Mary in August of 2005. Future plans include pursuing licensure to teach science in the secondary school grades.