VASCULAR FLORA OF THE JONES AND MILL CREEK WATERSHED, POWHATAN COUNTY, VIRGINIA

A Thesis

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APPROVAL SHEET

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ABSTRACT

This floristic study in the southeastern Virginia Piedmont began in February, 1976 and continued until June, 1977. The study area encompasses approximately 25 square miles in northeastern Powhatan County. The boundaries of the area include the James River and the natural watershed divides of Jones and Mill Creek. Some of the more interesting and unusual habitats in the area, to which special attention was paid in this study, include the rocky bluffs and steep ravines along the James River, the granitic outcrops which occur throughout the area, and two extensive swamps, each adjoining an old mill pond. While many interesting and sometimes unusual species were found in these habitats, the characteristic Piedmont flora was also observed and collected throughout the study area.

A total of 814 species of vascular plants have been collected and identified, the majority of which are new Powhatan County records. Some of the distributional records established include *Eriochloa gracilis*, a state record, and *Crotalaria mucronata* and *Iresine rhizomatosa*, both new Piedmont records.

The geology of the study area is discussed, and a phytogeographical analysis made of the flora of the Jones and Mill Creek Watershed. The geographical affinities include circumboreal, eastern Asiatic, tropical, and cosmopolitan links. A comparison is made with the phytogeographical affinities of three other Virginia locations, including Coastal Plain, Allegheny, and northwestern Piedmont locations. The geographical affinities of all the areas considered is in general similiar, but significant differences are noted and discussed.

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INTRODUCTION

The Jones and Mill Creek Watershed is located in the Fine Creek Mills area of northeast Powhatan County, in the southeast section of the Virginia Piedmont. The study area, encompassing approximately 25 square miles, is delimited by major watercourses and by highways that follow natural watershed divides: the James River on the north, Fine Creek and Virginia Route 628 on the west, Virginia Route 671 on the south, and Norwood Creek and Virginia Routes 613 and 614 on the east (see attached map). The study area includes Jones Creek east of Virginia Route 628, and its tributary Mill Creek. Also included is the continuation of Jones Creek below Woodberry Pond, Norwood Creek, and Fine Creek north of Virginia Route 711. Elevation in the study area ranges from 150 ft. on the James River to 450 ft. in the southern half of the area, with a relief of 300 feet.

The Piedmont location of the study area was chosen with the deficiencies in the overall floristic knowledge of the state in mind in anticipation of providing information toward the proposed manual of the Flora of Virginia. In the past the Piedmont had been considered by botanists to be floristically depauperate and therefore the least attractive of the physiographic provinces in Virginia (Harvill 1969a), and thus its flora is the least known. There are also many well known mountain-coastal plain disjuncts in Virginia (Harvill 1965, 1972, 1975), and only as more work is done in the Piedmont will it be known if these disjuncts are real, or merely collecting artifacts. Besides small collections made by Johnson (1970, 1972a), only scattered collecting has been done, and few published records exist for Powhatan County. The Fine Creek Mills area of Powhatan County has three very interesting habitats: steep rocky bluffs along the James River, two old mill ponds and their associated swamps, and a series of granitic rock outcrops which occur throughout the area. Thus, the Jones and Mill Creek Watershed seemed an ideal location for a floristic study.

In addition to studying the flora of Powhatan County, it was felt that a phytogeographical analysis of the flora would be interesting and informative. Harvill (1969b, 1972, 1973b, 1973c, 1975) has written on the phytogeography of Virginia plants, and Appler (1974) analyzed the affinities of the flora of Ft. Eustis. A study of the geographical affinities of the flora of the Jones and Mill Creek Watershed is made, and compared to the geographical relationships of the floras of three other areas in Virginia: a northwestern Piedmont location in Fluvanna County (Diggs 1976), an Allegheny location in Rockingham County (Roe 1977), and a Coastal Plain location in the City of Newport News (Appler 1974).

All of the information yielded by this research will be made available to the Flora Committee of the Virginia Academy of Science to eventually be included in the proposed manual of the Flora of Virginia.

HISTORICAL BACKGROUND

The Historical Records Survey of the Work Projects Administration has compiled an inventory of the Powhatan County archives (1939) and the historical information contained within this work can be summarized as follows:

Sir Christopher Newport was the first explorer to see what is now called Powhatan County when he made his expedition up the James River in 1608. The fierce Monacan Indians were the first inhabitants of Powhatan, and lived in the area until the early 1700's. In the year 1700, 700 Huguenot colonists set sail from France in order to pursue the freedom to practice their Protestant religion. After landing at the mouth of the James River they settled in Powhatan and began civilizing the wilderness.

Powhatan County was originally part of Henrico Shire, and later part of Goochland and Cumberland Counties as Virginia was progressively divided into smaller magisterial districts. In 1777, after repeated protests from the settlers that the distance to the courthouse was too great, the land between the James and Appomatox Rivers was separated from Cumberland County, and Powhatan County was established, being named for the famed Indian chief, King Powhatan.

The first coal mined in the United States came from the Richmond Basin, part of which lies in Powhatan County, and was discovered by the early Huguenots. The Powhatan Railroad Company was established in 1839 to haul coal from the mines. Another industry present in Powhatan in the early 1800's was a cotton factory built on Jones Creek. Powhatan was also an important source of flour in the past. In addition, there was a famous spa at Huguenot Springs, a sulphur spring thought to have healing power since Indian times.

Mills were an important aspect of the culture, and there are three old mills in the study area, on Fine, Mill, and Jones Creeks. Woodberry Mill and Pond on Jones Creek and Fine Creek Mill are both over 200 years old.

Since the 1700's Powhatan County has remained a rural area with farming as the chief occupation. The 1970 census listed only 7,696 people within the county's 272 square miles (Virginia Department of Highways 1973). However, by 1977 the population had jumped to over 11,000, and the county has one of the fastest rates of in-migration in the state (Paulette 1977). Much of the wooded area is being destroyed to make room for subdivisions as the county is overcome by the continued expansion of the City of Richmond. It was indeed a shock to the author to see the changes which took place just during the course of this research, and it seems fortunate that the study was undertaken before the vegetation of this area was severely impacted by this development.

CLIMATE

Powhatan County, with its southeastern Piedmont location, has a mild continental climate. While there is no climatological reporting station within the county, one at Columbia, Virginia, just upstream on the James River in Fluvanna County provides useful data. The climates in the two areas are assumed to be quite similiar, as both are located on the James River.

In the past 16 years the mean temerature ranged between 54.2 ^{o}F and 57.3 ^{o}F. The annual precipation range was from 26.87 inches to 63.45 inches. Also, the growing season, the number of days between frosts, has ranged from 145 to 192 days.

Additional climatological data are given in Table 1.

TABLE 1

Summary of the climatological data,
Columbia, Fluvanna County, Virginia[a]

	TEMPERATURE (°F)			PRECIPITATION			
	MEAN	HIGH	LOW	ANNUAL(in.)	LAST SPRING MIN. OF 32°	FIRST FALL MIN. OF 32°	DAYS BETWEEN THESE DATES
1961	54.9	97	-2	53.65	5/5	10/5	153
1962		94	-6	45.16	4/21	10/24	186
1963	54.8	98	-1	29.39	5/3	9/25	145
1964	56.0	99	0	28.33	4/10	9/7	180
1965		98	-1	26.87		9/5	
1966	54.4	99	-1	40.45	5/11	9/7	149
1967	54.2	93	1	36.78	4/29	10/20	174
1968	55.2	101	2	30.65	5/7	9/5	151
1969							
1970	56.1	99	0	29.16	5/7	9/5	151
1971	56.1	95	4	52.74	4/30	11/5	189
1972	55.5	95	0	63.45	4/27	10/11	167
1973	57.3	96	6	47.03	4/15	10/18	186
1974	56.8	95	9	43.62	4/11	10/3	175
1975	56.7	97	10	57.42	4/22	10/31	192
1976	55.5	98	1	43.18	4/29	10/12	166

[a]Adapted from U. S. Dept. of Commerce, Weather Bureau. Climatological Data (Annual Summaries 1961-1976 for Virginia). Vol. 62-82.

GEOLOGY

Powhatan County lies within the Piedmont physiographic province, the non-mountainous portion of the "older Appalachians" (Fenneman 1938). The Piedmont plateau surface, which has a gentle southeast slope, is the result of the degradation of its crystalline rocks, both sedimentary and igneous, which have been greatly altered by metamorphism (Watson 1907). The topography of Powhatan County is similiar to that of the rest of the Piedmont, a rolling surface of gentle slopes into which streams have sunk their channels.

In 1907 Dr. Thomas Watson said, "Lack of systematic study in the Virginia Piedmont region forbids more than a general description of its geology at this time." On the whole, this is still true in 1977, as geologists have generally avoided the Piedmont as have the botanists. However, in 1976 Fred Poland and Lynn Glover of Virginia Polytechnical Institute and State University, studied the geology of the rocks along the James River in Powhatan County (Poland and Glover 1976). The following description of the geology of the Fine Creek Mills area is taken from their report:

"The study area lies within the gneisses and schists of the eastern Virginia Piedmont. The Fine Creek Mills Granite, which is the light colored, coarse grained, two-feldspar, biotite granite that outcrops at Fine Creek Mills, occupies the core of an antiform of State Farm Gneiss, and extends from the James River southward possibly to or beyond Flat Rock. The State Farm Gneiss, which may be related to the Baltimore Gneiss, is a medium to coarse grained, two-feldspar, biotite gneiss, with quartz being a common float constituent. It is a north-northeast trending doubly plunging antiform, and analysis suggests a sedimentary origin. Above the gneiss and flanking the antiform lies the Sabot Amphibolite, a massive fine to medium grained plagioclase-hornblende amphibolite. The floodplain is covered with Quaternary alluvium of sand, silt, and gravel and the bluffs are topped by beds of Tertiary gravel, poorly sorted quartz gravels with brown to red sand and silt."

Poland suggests from his petrographic study that there has been one period of amphibolite grade metamorphism with two deformational events resulting in the foliation of the rocks and the warping into north-northeast trending folds. His isotopic analysis places the age of the regional metamorphism between 340 and 360 million years ago, and the emplacement of the Fine Creek Mills Granite into the State Farm Gneiss sometime late in the period of metamorphism. The sites where the Fine Creek Mills Granite outcrops are the result of the severe erosion of the crest of the regional antiform (Poland and Glover 1976).

Also interesting in the geology of the area is the Richmond Basin, a Mesozoic basin which lies in several counties, including the eastern portion of Powhatan. The rocks bordering on and underlying the basin are the typical Piedmont granites and gneisses. The basin itself is a series of sandstone, shale and coal beds. The Richmond Basin was the first source of coal in the United States and was mined for many years (Watson 1907).

The Piedmont province is not noted for its soil fertility, and erosion has long been a problem. The alluvial plains offer the best soils. (Fenneman 1938) The soil type in the study area is the common one all over the Piedmont, red and yellow podzolic. It has a thin dark colored organic layer over a yellow-gray or gray-brown leached layer over a darker clayey layer of deposition which grades into the deeply weathered parent material. (Hunt 1972) More specifically, there are two soil associations that are important in the study area. In the lowland along the river occurs the Altavista-Wicham-Chewacla association, a moderately drained soil with a yellowish-brown to yellowish-red friable clay loam to gray silty loam subsoil. In the uplands of the area occurs the Cecil-Masada association, a deep well drained soil with a red to yellowish-red firm clayey subsoil. (United States Department of Agriculture Soil Conservation Service, 1972)

METHODS

Collection of specimens of the vascular flora of the Jones and Mill Creek Watershed began in February 1976, with trips being made at least once weekly through October 1976, and with several additional trips made through June 1977. In order to be as thorough as possible in the collection of the flora, sites representative of each habitat type present in the area were visited and collected at on each expedition. Specimens were collected in triplicate when at all feasible, and numbered with the author's collecting number. Note was made of the location, habitat, and abundance of each plant. Abundance was classified as rare (one to few individuals seen), uncommon (several individuals seen), occasional (small colonies seen at more than one site), common (colonies seen at several sites), or abundant (colonies seen throughout the area). After pressing and identification of the specimens, the voucher set was deposited in the Herbarium of the College of William and Mary. Additional sets of specimens are being deposited at the University of Wisconsin, the University of North Carolina, and other herbaria.

Identification of the specimens began in May, 1976 and continued until June, 1977 with the following manuals being used: Radford, Ahles, and Bell (1968), Gleason and Cronquist (1963), Gleason (1952), Fernald (1950), Bailey (1949), Hitchcock (1935), Rehder (1967), and Gould (1975). Nomenclature in the annotated checklist and all tables and appendices follows Radford, Ahles, and Bell (1968), except where noted, and in that case follows Hitchcock (1935).

Determination of state, Piedmont, southern Piedmont (south of the James River), and county distributional records was made by consulting the published records of Allard and Leonard (1943, 1944, 1952, 1962), Bradley (1972), Diggs (1976), Duncan (1967), Harvill (1967, 1969a, 1973a, 1977), Hathaway and Ramsey (1973), Johnson (1970, 1971a, 1971b, 1972a, 1972b, 1974a, 1974b, 1974c), Kral and Bostick (1969), Lewis (1958), Massey (1961), Mazzeo (1972), Nessler (1976), Ramsey (1967), Ramsey, et al. (1969), Roane (1975), Roe (1977a, 1977b), Shinners (1962), Thacker, et al. (1968), and Uttal and Mitchell (1970).

The geographical range of the plants of the Jones and Mill Creek Watershed was determined by consulting Fernald (1950), Gleason (1952), Gleason and Cronquist (1963), Small (1933), Hitchcock (1935), Harvill (1973), Li (1952), and Hultén (1937, 1958). The phytogeographical range patterns used were adapted from Harvill (1973) and Appler (1974). The range of each species is listed in the annotated checklist and the significant phytogeographical affinities of the flora of the Jones and Mill Creek Watershed are discussed and compared to the findings of other floristic and phytogeographical work that has been done in Fluvanna and Rockingham Counties and the City of Newport News.

HABITAT ANALYSIS

The Fine Creek Mills area of Powhatan County has, in addition to the typical Piedmont topography and vegetation, three unusually interesting habitats, to which special attention has been paid in this study: the steep rocky bluffs and ravines on the James River, the series of granitic rock outcrops which occur throughout the area, and the two old mill ponds and their associated swamps. Many of the unusual and floristically interesting species were found in these habitats, but the characteristic Piedmont flora was also observed and collected throughout the entire study area.

The James River valley is quite a diverse portion of the study area, with its rocky bluffs, rich ravines, and flat floodplains, both open and wooded. Polypodium virginianum, Carex blanda, C. platyphylla, Iris cristata, Erythronium americanum, Sanguinaria canadensis, and Rhododendron nudiflorum are characteristic species found on the bluffs of the James. An association of Dicentra canadensis, Asarum canadense, Adiantum pedatum, and a large colony of Jeffersonia diphylla is growing in one particularly rich and steep ravine. In another ravine through which a stream flows into the James grows Carex albursina, Habenaria clavellata, Orchis spectabilis, Liparis lilifolia, Melanthium virginicum, Uvularia pudica, Aristolochia serpentaria, and Matelea suberosa. Species commonly growing along the floodplain of the James include Impatiens capensis, Ellisia nyctelea, Nemophila microcalyx, Humulus japonicus, *Conium maculatum*, *Erysimum cheiranthoides*, and several *Solidago* spp.. Other species, such as *Impatiens pallida*, *Hydrophyllum canadense*, *Arisaema dracontium*, *Sicyos angulatus*, *Erigeron philadelphicus*, *Agastache nepetoides*, and *Iresine rhizomatosa* are also found along the floodplain, although much less frequently. Interesting grasses recorded along the floodplain include *Arthraxon hispidus*, *Eragrostis hypnoides*, *Microstegium vimineum*, and *Paspalum fluitans*.

The upland woods in the study area are of several types. In the deciduous woods in sites such as the bluffs the common species include *Quercus alba*, *Q. falcata*, *Q. prinus*, *Carya ovalis*, *C. tomentosa*, *Cercis canadensis*, *Ostrya virginica*, *Carpinus carolinianus*, and *Chionanthus virginicus*. Stands of mixed pine-deciduous woods are common in the study area. The typical tree species seen in these woods are *Pinus virginiana*, *P. echinata*, *Juniperus virginiana*, *Quercus alba*, *Carya tomentosa*, *Cornus florida*, and *Ilex opaca*. There are also several pure stands of *Pinus virginiana* and *P. echinata* in the area. Shrubs such as *Gaylussacia baccata*, and *Vaccinium stamineum* are common in the pine woods, as are herbs such as *Cypripedium acaule*, *Chimaphila maculata*, and *C. umbellata*.

Low woods occur on the floodplain of the James as well as surrounding the streams, lakes, and ponds in the area. Here *Acer rubrum*, *A. negundo*, *A. saccharinum*, *Liquidambar styraciflua*, *Nyssa sylvatica*, *Betula nigra*, *Salix nigra*, and *Carpinus caroliniana* are found, as well as *Platanus occidentalis*, *Fraxinus pennsylvanica*, *Liriodendron tulipifera*, *Ulmus americana*, *Carya cordiformis*, and *Cornus florida*. Shrubs found around wet areas include *Alnus serrulata*, *Cephalanthus occidentalis*, *Itea virginica*, and *Leucothoe racemosa*.

Two of the old mill ponds in the area, Woodberry Pond on Jones Creek and Mill Pond on Mill Creek, have extensive swamps behind them, and many interesting taxa occur in these waterways. Potamogeton diversifolius, P. epihydrus, Spirodela polyrrhiza, Egeria densa, Heteranthera reniformis, Utricularia biflora, Callitriche heterophylla, Nuphar luteum, and Nymphaea odorata are some of the aquatics found. Common emergents include Juncus spp., Carex spp., Cyperus spp., Dulichium arundinaceum, Alisma subcordatum, Sagittaria latifolia, Sparganium americanum, Peltandra virginica, and Chelone glabra. Herbs found in low woods surrounding the waters include Lycopodium lucidulum, Selaginella apoda, Symplocarpus foetidus, Dryopteris cristata, Ophioglossum vulgatum, Chrysosplenium americanum, Euphorbia obtusata, Aconitum uncinatum, Habenaria lacera, H. flava, and Apios americana. Common bottomland grasses are Eragrostis capillaris, Glyceria striata, Leersia virginica, Panicum capillare, P. stipitatum, Poa sylvestris, and P. trivialis.

Granitic rock outcrops occur throughout the study area, with two very extensive ones at Fine Creek Mills and Flat Rock. These outcrops were surveyed by Berg in his study of the vegetation and succession on Piedmont granitic outcrops in Virginia (Berg 1974). While several southeastern outcrop endemics such as Sedum pusillum, S. smallii, Rumex hastatulus, Cyperus granitophyllus, and Juncus georgianus are not found on the outcrops in Powhatan, other characteristic species are found. Typical dicotyledons growing on the outcrops are Opuntia compressa, Arenaria groenlandica var. glabra, Talinum teretifolium, Crotonopsis elliptica, Portulacca oleracea, Phacelia dubia, Linaria canadensis, Krigia virginica, Sherardia arvensis, and Hypericum gentianoides.

Outcrop pteridophytes and monocotyledons include *Selaginella rupestris*, *Cyperus aristatus*, *Eleocharis engelmannii*, *E. obtusa*, *Fimbristylis autumnalis*, *Bulbostylis capillaris*, *Xyris torta*, *Agrostis elliottiana*, and *Panicum laxiflorum*.

Successional areas around Fine Creek Mills include mostly abandoned fields, and these are quite common as farms are sold to build subdivisions. Interesting species found in abandoned fields are *Kickxia elatine*, *Abutilon theophrastii*, *Thlaspi arvense*, *Isanthus brachiatus*, and *Triosteum perfoliatum*. More commonly found are *Asclepias* spp., *Solidago* spp., *Erigeron* spp., *Eupatorium* spp., *Liatris squarrosa*, *Spiranthes gracilis*, *S. grayi*, *Papaver dubium*, and *Centaurea cyanus*. Grasses found in old fields include *Eragrostis spectabilis*, *Sorghum halepense*, *Setaria* spp., and *Andropogon* spp..

At the most recently disturbed areas such as roadsides and building sites are found many weedy species. The most common grasses are *Panicum* spp., *Paspalum* spp., *Aristida* spp., *Andropogon* spp., *Aira caryophyllea*, *A. elegans*, *Eragrostis curvula*, *Erianthus contortus*, *Miscanthus sinensis*, and a grass newly reported for Virginia, *Eriochloa gracilis*. Other herbs found in disturbed areas include *Holosteum umbellatum*, *Aster* spp., *Coreopsis lanceolata*, *C. verticillata*, *Daucus carota*, *Amaranthus* spp., *Baptisia tinctoria*, *Lespedeza* spp., *Desmodium* spp., *Trifolium* spp., and *Viola* spp..

PHYTOGEOGRAPHICAL ANALYSIS

In order to determine the geographical affinities of the flora of the Jones and Mill Creek Watershed a phytogeographical analysis has been performed. Phytogeography of the plants of Virginia is of particular interest at the present time, considering the contribution a study of this type could make to the proposed manual of the Flora of Virginia. Harvill has written often on the phytogeography of Virginia (1969b, 1972, 1973b, 1973c, 1975) and Appler discussed the phytogeography of the flora of Ft. Eustis (1974).

The ranges of all plants have been determined using the following range patterns which have been adapted from Harvill (1973) and Appler (1974):

Range 1 — Circumboreal (totally circumboreal or interrupted)

Range 2 — Native to North America and Eastern Asia

Range 3 — Ranging west to the Pacific Coast

- Range 3a — Uninterrupted distribution from eastern North America to the Pacific Coast
- Range 3b — Ranging from eastern North America west beyond the Mississippi River, and found on the Pacific Coast, interrupted distribution

Range 4 — Ranging south beyond the United States

Range 5 — 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 westward beyond the Mississippi in the north

<u>Range 5e</u> Generally distributed along the Coastal Plain and Mississippi Valley, extending westward beyond the Mississippi in the south

<u>Range 6</u> Ranges limited to eastern 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> Ranges extending south of the United States and to the Old World (including cosmopolitan and nearly cosmopolitan species)

All analysis has been done on the species level, with a broad view of each species being taken, i.e. the range used is the combined range of all varieties of a species. The range of a species has been determined by consulting several manuals: Fernald (1950), Gleason (1952), Gleason and Cronquist (1963), Small (1933), Hitchcock (1935), Li (1952), Hultén (1937, 1958), and Harvill (1973). As no single manual seemed to be comprehensive in range listings, especially in the case of ranges which extended outside the United States, no one manual has been taken as absolute. The final range listed for each species is the composite of all locations as listed by each author.

Of the 814 species collected in Powhatan County, 174, or 21.4%, have been introduced. Into this category fall the long naturalized immigrants from the Old World as well as escapes from cultivation and the "noxious" weeds that are currently extending their ranges across America.

A small proportion, 2.5%, of the plants collected represents the circumboreal fraction of the flora. These 20 plants are listed in Table 2 (arranged alphabetically by genus), and it is interesting to note that seven of these are pteridophytes.

Had analysis been done on the generic level, the east Asian link to our North American flora would have been more prominent. However, Onoclea sensibilis, Lycopodium obscurum, Symplocarpus foetidus, Monotropa uniflora, Phryma leptostachya, Tovara virginiana, Adiantum pedatum, and Carex pensylvanica, 1% of the species collected, do demonstrate the connection between the east Asian and North American floras.

In Table 3 are listed those plants which are widespread in North America. Twenty-seven species, 3.3%, range from eastern North America uninterrupted to the Pacific Coast, and six species, 0.7%, range interruptedly to the West Coast. Here it is interesting to note that 17 of these 33 species, more than half, are monocotyledons.

The 88 plants listed in Table 4 are those in range 4, which

TABLE 2

RANGE 1
CIRCUMBOREAL SPECIES

Botrychium virginianum	*Erysimum cheiranthoides*	*Potentilla norvegica*
Calystegia sepium	*Galium aparine*	*Prunella vulgaris*
Cardamine parviflora	*G. triflorum*	*Pteridium aquilinum*
Chimaphila umbellata	*Luzula multiflora*	*Pyrola rotundifolia*
Circaea lutetiana	*Ophioglossum vulgatum*	*Rorippa islandica*
Dryopteris cristata	*Osmunda regalis*	*Typha latifolia*
D. spinulosa	*Polypodium virginianum*	

TABLE 3

RANGE 3
SPECIES RANGING WEST TO THE PACIFIC COAST

RANGE 3a UNINTERRUPTED DISTRIBUTION

Apocynum cannabinum	*Erigeron annuus*	*Panicum capillare*
Bidens frondosa	*Festuca octoflora*	*Plantago aristata*
Carex comosa	*Galium tinctorium*	*P. virginica*
C. vulpinoidea	*Geranium carolinianum*	*Potamogeton epihydrus*
Cyperus erythrorhizos	*Juncus tenuis*	*Ranunculus abortivus*
C. ferruginescens	*Lactuca canadensis*	*Scirpus validus*
Danthonia spicata	*Lepidium virginicum*	*Scutellaria lateriflora*
Dulichium arundinaceum	*Lycopus americanus*	*Sphenopholis intermedia*
Eleocharis engelmannii	*Orobanche uniflora*	*Teucrium canadense*

RANGE 3b INTERRUPTED DISTRIBUTION

Agrimonia gryposepala	*Cyperus strigosus*	*Ranunculus pusillus*
Aristida oligantha	*Eleocharis obtusa*	*Rhynchospora capitellata*

illustrates the affinity of the flora of Powhatan County to the West Indies, Mexico, Central and South America. Two pteridophytes, 35 monocotyledons, and nine members of the Asteraceae are included in this southward ranging group, which is 10.8% of the species collected.

The largest group of plants, 55%, fall into range 5, extending from eastern North America beyond the Mississippi River to varying extents, but not as far west as the Pacific Coast. It is interesting to see the subsets which this group can be broken into. Four hundred five species, 49.7%, are generally distributed north and south. Seventeen species including eight Carices, 2.1%, are generally northern in distribution, while eight species, 1%, are generally southern in distribution. While no plants extend westward in the north while occurring mainly along the Coastal Plain and Mississippi Valley, 18 species, 2.2%, do range along the Coastal Plain and Mississippi Valley and extend westward in the south. See Table 5 for a listing of the species in range 5.

Another small, but significant portion of the flora is listed in Table 6, those plants which occur only in eastern North America. Thirty-four species, 4.2%, are in this category. Twenty-two plants, including ten members of the Asteraceae, are generally distributed north and south in eastern United States and are not mostly limited to the Coastal Plain. Only the distribution of Danthonia sericea is north and south but generally limited to the Coastal Plain. Phlox subulata, Oenothera parviflora, and Thalictrum polygamum are generally northern in distribution in the eastern United States, and eight species are generally southern in distribution in eastern United States.

TABLE 4

RANGE 4
SPECIES RANGING SOUTH BEYOND THE UNITED STATES

Agalinis purpurea	Commelina erecta	Linaria canadensis
Agrimonia parviflora	Corallorhiza odontorhiza	Lindernia dubia
Agrostis elliottiana	Cornus florida	Liquidambar styraciflua
A. hyemalis	Cuscuta campestris	Ludwigia decurrens
A. perennans	Desmodium glutinosum	Mikania scandens
Alisma subcordatum	Elephantopus carolinianus	Monarda fistulosa
Amaranthus spinosus	Eragrostis hypnoides	Monotropa hypopithys
Ambrosia artemisiifolia	E. spectabilis	Muhlenbergia schreberi
A. trifida	Erigeron canadensis	Myosotis verna
Asclepias tuberosa	Eriochloa gracilis	Nuphar luteum
A. viridiflora	Eupatorium coelestinum	Nymphaea odorata
Bidens bipinnata	Euphorbia maculata	Oenothera laciniata
Boehmeria cylindrica	Fimbristylis autumnalis	Oxalis dillenii
Bulbostylis capillaris	Glyceria striata	O. stricta
Callitriche heterophylla	Gnaphalium purpureum	Panicum dichotomiflorum
Carex albolutescens	Heteranthera reniformis	P. laxiflorum
C. lurida	Hordeum pusillum	P. scoparium
C. physorhyncha	Hydrocotyle ranunculoides	P. sphaerocarpon
Cephalanthus occidentalis	Hypericum hypericoides	Parthenocissus quinquefolia
Cercis canadensis	Juncus acuminatus	Paspalum fluitans
Cicuta maculata	Lemna perpusilla	Physalis pubescens

TABLE 4, con't.

Polygonatum biflorum	*Rudbeckia hirta*	*Sorghastrum nutans*
Polygonum hydropiperoides	*Sagittaria latifolia*	*Specularia biflora*
P. punctatum	*Sambucus canadensis*	*S. perfoliata*
Polypremum procumbens	*Scleria oligantha*	*Sphenopholis obtusata*
Polystichum acrostichoides	*Scutellaria ovata*	*Spirodela polyrrhiza*
Potamogeton diversifolius	*Selaginella apoda*	*Tripsacum dactyloides*
Prunus serotina	*Setaria geniculata*	*Veronica peregrina*
Rhus glabra	*Silene antirrhina*	
R. radicans	*Smilax bona-nox*	

TABLE 5

RANGE 5b-5c-5e
SPECIES EXTENDING WEST BEYOND THE MISSISSIPPI RIVER, BUT NOT TO THE PACIFIC COAST

RANGE 5b SPECIES GENERALLY NORTHERN IN DISTRIBUTION

Carex albursina	*C. squarrosa*	*Lysimachia terrestris*
C. crinita	*C. swanii*	*Rubus allegheniensis*
C. gracillima	*Geum virginianum*	*R. flagellaris*
C. grayi	*Helianthus decapetalus*	*Solidago bicolor*
C. platyphylla	*Lilium canadense*	*Valerianella umbilicata*
C. prasina	*Lycopodium lucidulum*	

RANGE 5c SPECIES GENERALLY SOUTHERN IN DISTRIBUTION

Chaerophyllum tainturieri	*Matelea carolinensis*	*Ulmus alata*
Erianthus contortus	*Sanicula smallii*	*Vitis rotundifolia*
Iresine rhizomatosa	*Tilia floridana*	

TABLE 5 con't.

RANGE 5e <u>SPECIES GENERALLY DISTRIBUTED ALONG COASTAL PLAIN AND MISSISSIPPI VALLEY, EXTENDING WEST BEYOND MISSISSIPPI RIVER IN THE SOUTH</u>

Elephantopus tomentosus	*Itea virginica*	*Polygonum setaceum*
Eragrostis hirsuta	*Juncus coriaceus*	*Quercus falcata*
Eupatorium album	*Magnolia virginiana*	*Q. phellos*
Gratiola pilosa	*Paspalum floridanum*	*Rhexia mariana*
Hypericum walteri	*Pinus taeda*	*Scutellaria integrifolia*
Ilex decidua	*Polygala mariana*	*Viburnum nudum*

TABLE 6

RANGE 6a1-6a2-6b-6c
SPECIES LIMITED TO EASTERN NORTH AMERICA

RANGE 6a1 SPECIES GENERALLY DISTRIBUTED NORTH AND SOUTH, EXTENDING WIDELY BEYOND THE COASTAL PLAIN

Aconitum uncinatum	Conopholis americana	Silphium trifoliatum
Arenaria groenlandica	Phacelia dubia	Solidago erecta
Aster divaricatus	Pinus virginiana	Talinum teretifolium
A. infirmus	Poa cuspidata	Vernonia glauca
A. paternus	Prenanthes serpentaria	V. noveboracensis
Chimaphila maculata	Rhododendron nudiflorum	Vitis labrusca
Chrysogonum virginianum	Senecio smallii	
Clematis ochroleuca	Silene caroliniana	

RANGE 6a2 SPECIES GENERALLY DISTRIBUTED NORTH AND SOUTH, MOSTLY LIMITED TO THE COASTAL PLAIN

Danthonia sericea

RANGE 6b SPECIES GENERALLY NORTHERN IN DISTRIBUTION

Phlox subulata	Oenothera parviflora	Thalictrum polygamum

TABLE 6 con't.

RANGE 6c SPECIES GENERALLY SOUTHERN IN DISTRIBUTION

Helianthus atrorubens	*Matelea suberosa*	*Uvularia pudica*
Hexastylis virginica	*Philadelphus inodorus*	*Yucca filamentosa*
Hibiscus moscheutos	*Solidago pinetorum*	

Lastly, nine species, 1.1%, represent the cosmopolitan fraction of the flora. These are listed in Table 7 and it is interesting to note that only three are dicotyledons, while two are pteridophytes and four are monocotyledons.

In summary, the largest fraction of the flora, over one-half, are species extending westward beyond the Mississippi River, but not to the Pacific Coast. Over one-fifth of the flora of the Jones and Mill Creek Watershed is introduced. Small, but significant, portions of the flora are species limited to eastern North America or which extend westward to the Pacific. One-tenth of the flora extends southward and small fractions of the flora exhibit circumboreal, East Asian, or cosmopolitan affinities.

In addition to analyzing the phytogeographical affinities of the Jones and Mill Creek Watershed, it was thought that a comparative analysis to other floristic studies of similar scope in other physiographic provinces in Virginia could be informative. To that end, the same phytogeographical analysis has been performed on three other floristic lists: Roe's 1977 Hone Quarry Flora, Rockingham County, an Allegheny location; Diggs' 1976 Kent Branch Flora, a northwestern Piedmont location; and Appler's 1974 Ft. Eustis Flora, Newport News, a Coastal Plain location. The methods and range patterns used for the Jones and Mill Creek Watershed analysis are also employed in these analyses. Appler's data has been reworked by the methods of this study in order to eliminate discrepancies due to method.

The grand total of the species represented in one or more of the floras considered is 1233. Table 8 lists the number of species exclusive to the given floras. One hundred eighty-one species are recorded in all

TABLE 7

RANGE 8

SPECIES EXTENDING SOUTH OF THE UNITED STATES AND TO OLD WORLD

Cyperus aristatus	*Juncus bufonius*	*Osmunda cinnamomea*
C. polystachyos	*J. effusus*	*Polygonum lapathifolium*
Eclipta alba	*Ludwigia palustris*	*Thelypteris palustris*

TABLE 8

NUMBER OF SPECIES EXCLUSIVE TO GIVEN FLORAS

FLORA SPECIES LIMITED TO	NUMBER
Powhatan & Fluvanna & Ft. Eustis & Hone Quarry	181
Powhatan & Fluvanna & Ft. Eustis	146
Powhatan & Fluvanna & Hone Quarry	98
Powhatan & Ft. Eustis & Hone Quarry	2
Fluvanna & Ft. Eustis & Hone Quarry	9
Powhatan & Fluvanna	163
Powhatan & Ft. Eustis	46
Powhatan & Hone Quarry	29
Fluvanna & Ft. Eustis	18
Fluvanna & Hone Quarry	41
Ft. Eustis & Hone Quarry	4
Ft. Eustis	126
Hone Quarry	134
Fluvanna	87
Powhatan	149

Grand total of species represented in one or more floras= 1233.

four floras. The Jones and Mill Creek Watershed has the highest number of exclusive species, but the Ft. Eustis and Hone Quarry floras also each have large numbers of exclusive species. These species, which are listed in the Appendix, represent the mountain endemics which occur in Hone Quarry and the Coastal Plain endemics which occur at Ft. Eustis. It is also significant that a large number of species, 163, are exclusive to the Powhatan and Fluvanna floras.

In Table 9 is listed the number of species common to given floras, and their coefficients of similarity. The coefficient has been calculated by the formula 2w/a+b x 100, where w is the number of species common to two floras and a and b are the total number of species in each flora. The Powhatan and Fluvanna floras are the most closely related, with 75.5% similarity. The Powhatan flora is also more similar to the Ft. Eustis flora than to the Hone Quarry flora. This is to be expected, because the Jones and Mill Creek Watershed is much closer to the Fall Line and the Coastal Plain than to the mountains. The Fluvanna flora is nearly equally similar to the Ft. Eustis and Hone Quarry floras. Least similar are the Ft. Eustis and Hone Quarry floras, with only 37.9% similarity.

Table 10 lists the percent phytogeographical range composition of the total flora of each of the localities considered. The most striking point about the comparison of the affinities of the four floristic studies is that they are so similar, especially when the possible random difference is taken into consideration. The Fluvanna County location, north of the James River and close to the Blue Ridge Mountains, and the Powhatan County location, south of the James River and close to the Fall Line, are nearly identical. There seems to be

TABLE 9

NUMBER OF SPECIES COMMON TO GIVEN FLORAS

FLORAS SPECIES COMMON TO	NUMBER
Powhatan & Fluvanna	588
Powhatan & Ft. Eustis	375
Powhatan & Hone Quarry	310
Fluvanna & Hone Quarry	329
Fluvanna & Ft. Eustis	354
Ft. Eustis & Hone Quarry	196

COEFFICIENTS OF SIMILARITY

Powhatan-Fluvanna	75.5%
Powhatan-Ft. Eustis	55.6%
Powhatan-Hone Quarry	47.2%
Fluvanna-Hone Quarry	52.9%
Fluvanna-Ft. Eustis	55.3%
Ft. Eustis-Hone Quarry	37.9%

TABLE 10

% COMPOSITION OF THE TOTAL FLORA

	FT. EUSTIS	POWHATAN	FLUVANNA	HONE QUARRY
RANGE 1	2.8%	2.5%	2.7%	2.6%
RANGE 2	1.1%	1.0%	1.2%	1.4%
RANGE 3	4.6%	4.0%	3.6%	6.4%
3a	3.7%	3.3%	3.1%	5.6%
3b	0.9%	0.7%	0.5%	0.8%
RANGE 4	15.9%	10.8%	10.0%	6.2%
RANGE 5	49.8%	55.0%	55.7%	53.7%
5a	41.0%	49.7%	50.9%	49.7%
5b	0.4%	2.1%	2.1%	3.2%
5c	1.5%	1.0%	0.7%	---
5d	0.2%	---	---	---
5e	6.7%	2.2%	2.0%	0.6%
RANGE 6	3.1%	4.2%	5.3%	9.4%
6a1	1.3%	2.7%	3.8%	6.4%
6a2	0.7%	0.1%	0.3%	---
6b	---	0.4%	0.4%	1.0%
6c	1.1%	1.0%	0.8%	1.8%
RANGE 7	20.5%	21.4%	20.2%	19.2%
RANGE 8	2.0%	1.1%	1.3%	1.4%

no notable difference in any range category. This is not surprising when the large number of common species and the 75.5% coefficient of similarity is considered.

The greatest differences can be seen when the Allegheny and Coastal Plain studies are compared. Ft. Eustis has a higher percentage and Hone Quarry a lower percentage of plants in range 4, those ranging to the south of the United States. This could be due to the typically mountain plants in Hone Quarry being limited to North America, while many of the Coastal Plain species found at Ft. Eustis extend further south.

The same effect can again be seen in range 5, those species extending west of the Mississippi River, but not to the Pacific. Ft. Eustis has a lower percentage of these plants in total, as well as fewer westward ranging plants that are generally distributed north and south (5a). Yet, Ft. Eustis has the highest percentage overall of westward ranging plants that are generally southern in distribution (5c), and species distributed along the Coastal Plain and Mississippi Valley (5d and 5e). This is assumed to be due to the large number of typical Coastal Plain species which are found at Ft. Eustis and naturally have these types of distribution.

Another interesting comparison is seen in range 6, species restricted to the eastern United States. Hone Quarry has a much higher percentage of these plants than the other localities. This could be due to the mountain endemics in Rockingham County which extend down the Appalachians but do not extend to the west of this.

In summary, the phytogeographical affinities of all four floras are very similar. The most significant differences are between the

Coastal Plain and Allegheny locations, as expected. The contrasts are due to the Coastal Plain and mountain endemics which are restricted to the two areas and which naturally have different range patterns.

In the following Checklist of the Vascular Flora of the Jones and Mill Creek Watershed the species listed are annotated to indicate their phytogeographical range and whether they are also recorded in the Ft. Eustis, Fluvanna, and/or Hone Quarry Floras. In the Appendices is a listing of species reported from one or more of the latter areas but not from the Jones and Mill Creek Watershed, and their phytogeographical ranges. These lists may be consulted to determine if a species occurs in the floras analyzed, and its total geographical range.

DISTRIBUTION RECORDS

AND

ANNOTATED CHECKLIST OF THE VASCULAR FLORA

OF THE JONES AND MILL CREEK WATERSHED

A total of 814 species representing 433 genera of 120 families of vascular plants are recorded here for Powhatan County. Six hundred fifty-eight of these species have not been previously reported in the literature as occuring in Powhatan County. Twenty-six of the 658 are new to the Piedmont of Virginia, and 51 of the 658 have not been reported to occur in the Virginia Piedmont south of the James River. One species, *Eriochloa gracilis*, is newly reported for the state of Virginia. Other species of special distributional interest are *Crotalaria mucronata*, previously reported in Virginia only from Gloucester County in the Coastal Plain, and *Iresine rhizomatosa*, previously reported in Virginia from four Coastal Plain counties.

None of the species newly recorded for the Piedmont or southern Piedmont in Virginia in this study are classical mountain-Coastal Plain disjunct species (Harvill 1972, 1973c). All new records are either introduced species or species heretofore known only from the mountains, Coastal Plain, and/or the northern Piedmont.

In the checklist nomenclature follows Radford, Ahles and Bell (1968) unless noted by a cross (+), and in these cases nomenclature follows Hitchcock (1950). Species that are county records are preceded by an asterisk (*); species that are southern Piedmont records are preceded by a double asterisk (**); species that are Piedmont records by a triple asterisk (***); and state records by four asterisks (****). The abundance of each species is indicated by the following abbreviations: R = rare; U = uncommon; O = occasional; C = common; A = abundant. The habitat from which each species was collected is listed and followed by a number indicating its phytogeographical range (range patterns are described in the Phytogeographical Analysis). Each entry is then annotated to indicate if it is recorded in the Diggs 1976 Fluvanna Flora (Fl); the Appler 1974 Ft. Eustis Flora (FE); and/or the Roe 1977 Hone Quarry Flora (HQ). The last number in each species entry is the author's collecting number.

A summary of the taxa recorded is given in Table 11.

TABLE 11

SUMMARY OF THE TAXA

	PTERIDOPHYTA and CONIFEROPHYTA	MONOCOTYLEDONEAE	DICOTYLEDONEAE
FAMILIES	11	18	91
GENERA	20	97	316
SPECIES	32	210	572

Total Families = 120

Total Genera = 433

Total Species = 814

ANNOTATED CHECKLIST

PTERIDOPHYTA

ASPIDIACEAE: *Athyrium asplenioides, C, creekbank, 5a, Fl, FE, HQ; 1003. *A. thelypterioides, U, base of rock bluff above James River, 5a; 1417. *Cystopteris protrusa, R, wooded bluff above James River, 5a; 571. *Dryopteris cristata, C, stream edge, 1, Fl; 679. D. marginalis, O, wooded bluff above James River, 5a, Fl, HQ; 1409. *D. spinulosa, O, low woods, 1, Fl, HQ; 1465. Onoclea sensibilis, O, wet roadside ditch, 2, Fl, FE, HQ; 1494. Polystichum acrostichoides, C, low woods, 4, Fl, FE, HQ; 12. *Thelypteris hexagonoptera, O, wooded ravine, 5a, Fl, FE, HQ; 1133. T. noveboracensis, O, wet roadside ditch, 5a, Fl, FE, HQ; 1502. T. palustris, O, low woods, 8, Fl; 1468. Woodsia obtusa, O, rock outcrop, 5a, Fl, HQ; 699.

ASPLENIACEAE: Asplenium platyneuron, C, stream bank, 5a, Fl, FE, HQ; 1083.

BLECHNACEAE: *Woodwardia areolata, C, stream head, 5a, Fl, FE; 911.

LYCOPODIACEAE: Lycopodium flabelliforme, A, low woods, 5a, Fl, FE, HQ; 1599. *L. lucidulum, O, stream bank, 5b, Fl, HQ; 1075. *L. obscurum, A, stream bank, 2, Fl, HQ; 86.

OPHIOGLOSSACEAE: Botrychium dissectum, O, open woods, 5a, Fl, FE, HQ; 9. B. virginianum, C, wooded bluffs on James R. , 1, Fl, FE, HQ; 119. *Ophioglossum vulgatum var. pycnostichum, U, stream bank, 1, Fl, FE; 576.

OSMUNDACEAE: *Osmunda cinnamomea, O, stream head, 8, Fl, FE, HQ; 200.

O. regalis var. spectabilis, U, edge of spring, 1, Fl, FE; 642.

POLYPODIACEAE: *Polypodium virginianum, R, rocky bluffs above James R., 1, Fl, HQ; 16.

PTERIDACEAE: *Adiantum pedatum, O, wooded bluff above James R., 2, Fl, FE, HQ; 1410. Dennstaedtia punctilobula, O, grassy opening, 5a, Fl, HQ; 1637. Pteridium aquilinum, O, edge of pine woods, 1, Fl, FE, HQ; 958.

SELAGINELLACEAE: *Selaginella apoda, O, swampy area, 4, Fl; 131. S. rupestris, A, rock outcrop, 5a; 1517.

CONIFEROPHYTA

CUPRESSACEAE: Juniperus virginiana, C, rock outcrop, 5a, Fl, FE, HQ; 1514.

PINACEAE: *Pinus echinata, O, mixed pine-deciduous woods, 5a, Fl, FE; 1565. *P. taeda, O, field edge, 5e, Fl, FE; 1427. P. virginiana, A, edge of mixed woods, 6a1, Fl, FE, HQ; 1423.

ANTHOPHYTA

MONOCOTYLEDONEAE

ALISMATACEAE: Alisma subcordatum, O, creekbank, 4, Fl; 1060. *Sagittaria latifolia var. pubescens, A, edge of mill pond, 4; 835.

AMARYLLIDACEAE: *Hypoxis hirsuta, U, power line cut, 5a, Fl, FE, HQ; 328.

ARACEAE: *Arisaema dracontium, O, floodplain of James R., 5a, Fl; 795. A. triphyllum, C, low woods, 5a, Fl, FE, HQ; 327. Peltandra virginica, C, low woods, 5a; 604. Symplocarpus foetidus, A, swampy woods, 2, Fl; 83.

COMMELINACEAE: Commelina communis, O, roadside ditch, 7, Fl, FE; 869. C. erecta, O, rock outcrop, 4; 1527. C. virginica, O, low woods, 5a, FE; 1054. *Tradescantia virginiana, U, abandoned homesite, 5a; 479.

CYPERACEAE: *Bulbostylis capillaris, C, rock outcrop, 4, Fl; 1120. Carex albolutescens, O, wet depression at rock outcrop, 4, FE; 1096. *C. albursina, wooded slope above stream, 5b, U; 232. *C. blanda, O, rocky bluffs above James R., 5a, Fl, FE, HQ; 320. C. caroliniana, O, wet depression on rock outcrop, 5a, FE; 695. *C. cephalophora, O, low woods, 5a, FE; 671. *C. comosa, O, swamp edge, 3a; 1145. C. complanata, O, low woods, 5a, Fl; 326. C. crinita, O, stream edge, 5b, Fl, HQ; 678. C. debilis, O, swamp edge, 5a, Fl; 356. *C. frankii, O, creek edge, 5a, Fl; 1115. C. gracillima, O, rock outcrop, 5b; 446. C. grayi, O, floodplain of James R., 5b; 552. C. grisea, C, low woods, 5a, Fl; 532. **C. howei, U, low woods, 5a; 318. C. intumescens, O, swamp edge, 5a, Fl; 355. C. laevivaginata, O, creekbank, Fl, FE; 258. *C. leavenworthii, O, low woods, 5a; 367. C. lupulina, O, swamp edge, 5a, Fl; 1157. C. lurida, C, pond edge, 4, Fl, FE, HQ; 666. *C. muhlenbergii, O, low woods, 5a; 489. *C. pensylvanica, O, floodplain of James R., 2, Fl, HQ; 331. C. physorhyncha, U, low woods, 4; 215. *C. platyphylla, C, wooded bluffs above James R., 5b, HQ; 295. *C. prasina, O, low woods, 5b, Fl; 221. C. rosea, C, low woods, 5a, Fl, HQ; 675. *C. sparganioides, O, wooded bluffs above James R., 5a, Fl; 321. C. squarrosa, U, creekbank, 5b; 1399. **C. swanii, O, rocky woods at outcrop edge, 5b, FE; 612. *C. tribuloides, O, James R. floodplain, 5a, HQ; 569. C. vulpinoidea, O, pond edge, 3a, Fl, FE, HQ; 988. **Cyperus aristatus, U, grassy meadow at outcrop edge, 8; 1100.

*C. erythrorhizos, U, low woods, 3a, FE; 1481. *C. ferruginescens, O, bank of James R., 3a; 1302. *C. filiculmis, O, weed in cornfield, 5a; 1140. C. lancastriensis, O, roadside ditch, 5a, FE; 923a. C. ovularis, O, roadside, 5a, Fl, FE; 919. *C. polystachyos var. texensis, U, low wet field, 8, FE; 1244. *C. strigosus, O, roadside, 3b, Fl, FE, HQ; 1260. *Dulichium arundinaceum, O, pond edge, 3a; 1148. Eleocharis engelmannii, C, wet depression on outcrop, 3a, Fl, HQ; 434. E. obtusa, O, wet depression on outcrop, 3b, Fl, FE; 1091. *E. tenuis, O, pond edge, 5a, Fl; 632. *Fimbristylis autumnalis, O, rock outcrop, 4, Fl, FE; 1095. *Rhynchospora capitellata, O, lake edge, 3b, Fl; 1252. *Scirpus cyperinus, C, swamp edge, 5a, Fl, FE, HQ; 980. *S. polyphyllus, C, roadside ditch, 5a, Fl, HQ; 931. *S. purshianus, O, pond edge, 5a, Fl; 1614. S. validus, U, creek bottom, 3a; 732. *Scleria oligantha, U, low woods, 4; 788.

DIOSCOREACEAE: Dioscorea villosa, O, woods along creek, 5a, Fl, FE, HQ; 500.

HYDROCHARITACEAE: Egeria densa, A, in Woodberry Pond, 7; 723.

IRIDACEAE: *Iris cristata, O, wooded slope on James R., 5a; 222. **I. pseudacorus, O, edge of pond, 7; 363. Sisyrinchium angustifolium, O, woods at outcrop edge, 5a, Fl, FE, HQ; 439.

JUNCACEAE: Juncus acuminatus, O, pond edge, 4, Fl; 616. *J. bufonius, O, pond edge, 8; 631. J. coriaceus, O, wet depression on outcrop, 5e, Fl, FE; 1128. J. effusus, C, swamp edge, 8, Fl, FE, HQ; 989. J. marginatus, O, lake edge, 5a, Fl, HQ; 1249a. *J. tenuis, O, James R. floodplain, 3a, Fl, FE, HQ; 894. *Luzula bulbosa,O, cemetary, 5a, Fl, FE, HQ; 144. *L. echinata, O, low woods, 5a, Fl, FE; 230. *L. multiflora, U, wooded bluffs above James R., 1; 17.

LEMNACEAE: *Lemna perpusilla, U, on James R., 4, FE; 1536. *Spirodela polyrrhiza, O, on creek, 4, FE; 639.

LILIACEAE: *Allium cepa, U, roadside escape, 7; 388. *A. vineale, C, grassy area, 7, Fl, FE; 711. *Asparagus officinalis, U, roadside, 7, Fl, FE; 405. Erythronium americanum, A, rocky bluff on James R., 5a; 49. *Hemerocallis fulva, C, roadside, 7, Fl, FE; 719. *Lilium canadense, O, stream bank, 5b; 593a. *L. superbum, U, low woods, 5a; 1005. *Medeola virginiana, O, low woods, 5a, Fl, HQ; 342. *Melanthium virginicum, O, low woods, 5a; 742. *Muscari racemosa, O, grassy area, 7, Fl FE; 237. *Polygonatum biflorum, O, roadside bank, 4, Fl, FE, HQ; 188. *Smilacina racemosa, C, wooded slope above James R., 5a, Fl, FE, HQ; 198. *Smilax bona-nox, O, roadside ditch, 4, Fl, FE; 343. ***S. ecirrhata, O, wooded slope above James R., 5a, HQ; 1170. *S. glauca, C, low woods, 5a, Fl, HQ; 357. *S. herbacea, O, woods along stream, 5a, Fl; 307. *S. hispida, O, wooded slope above James R., 5a, Fl, FE, HQ; 751. S. rotundifolia, O, low woods, 5a, Fl, FE; 358. *Uvularia perfoliata, A, low woods, 5a, Fl, HQ; 486. *U. pudica, U, low woods, 6c, HQ; 206. *Yucca filamentosa var. smalliana, O, roadside bank, 6c, Fl; 684.

ORCHIDACEAE: *Aplectrum hyemale, O, low woods, 5a, Fl; 304. *Corallorhiza odontorhiza, U, dry woods, 4, Fl, FE, HQ; 1459. Cypripedium acaule, O, pine woods, 5a, Fl, FE, HQ; 251. Goodyera pubescens, O, mixed pine-deciduous woods, 5a, Fl, FE, HQ; 839. Habenaria clavellata, C, stream head, 5a, Fl; 905. *H. flava, U, swampy woods, 5a; 651. *H. lacera, O, low woods, 5a, Fl; 1476. Liparis lilifolia, R, wooded hillside, 5a, Fl, FE, HQ; 341. *Malaxis unifolia, R, upland woods, 5a, Fl, FE; 657. *Orchis spectabilis, R, wooded bluff above James R., 5a, Fl; 334. *Spiranthes gracilis, U, old pasture, 5a, Fl, HQ; 1012. *S. grayi, U, grassy area, 5a, Fl; 1313. *S. ovalis, O, low woods, 5a, Fl; 1493. Tipularia discolor, U, low woods, 5a, Fl, FE; 985.

POACEAE: Agrostis elliottiana,O, rock outcrop, 4; 436. *A. hyemalis, O, rock outcrop, 4, Fl; 625. A. perennans, C, base of rocks on James R., 4, Fl, FE, HQ; 972b. A. stolonifera, O, roadside, 7, Fl; 920. *Aira caryophyllea, U, roadside, 7, Fl; 502. A. elegans, O, roadside, 7, Fl; 524. *Andropogon scoparius, O, power-line cut, 5a, Fl, FE; 1574. *A. ternarius, C, cut-over field, 5a; 1451. Anthoxanthum odoratum, C, graveyard, 7, Fl, HQ; 143. *Aristida curtissii, O, rock outcrop, 5a; 1354. *A. dichotoma, O, dry roadside, 5a, Fl; 1573a. *A. oligantha, O, roadside, 3b, Fl, FE; 1330. *Arthraxon hispidus, O, James R. floodplain, 7, Fl, FE; 1546. Avena sativa, O, pasture, 7, Fl; 640. *Bromus catharticus, O, James R. floodplain, 7, FE; 543. B. japonicus, O, old homesite, 7, Fl, FE, HQ; 817. B. purgans, O, low woods, 5a, Fl, HQ; 766. Cinna arundinacea, C, greek bank, 5a, Fl, FE; 1369. *Cynodon dactylon, C, pasture, 7; 886. Dactylis glomerata, A, open area, 7, Fl, HQ; 712. *Danthonia sericea, O, roadside, 6a2, Fl; 690. D. spicata, O, low woods, 3a, Fl, FE, HQ; 661. *Digitaria ischaemum, O, roadside, 7, Fl; 1339. *D. sanguinalis, O, field edge, 7, Fl HQ; 1023. Echinochloa crusgalli, O, pond dam, 7, Fl, FE, HQ; 1193. *Eleusine indica, O, James R. bank, 7, Fl, HQ; 1299. **Elymus villosus, O, James R. floodplain, 5a, Fl; 883. E. virginicus, C, roadside, 5a, Fl, FE; 942. Eragrostis capillaris, O, lake edge, 5a, HQ; 1248. **E. curvula, O, power-line cut, 7, Fl; 691. *E. hirsuta, O, rock outcrop, 5e, FE; 1522. *E. hypnoides, O, James R. floodplain, 4; 1305. *E. pilosa, O, rock outcrop, 7; 1351. E. spectabilis, O, barnlot, Fl, FE;

1235. *Erianthus alopecuroides, O, grassy opening, 5a; 1316. *E. contortus, C, roadside, 5c, FE; 1182. ****Eriochloa gracilis+, U, field edge, 4; 1185. Festuca elatior, C, James R. floodplain, 7,Fl, FE; 546. *F. myuros, C, roadside, 7, Fl, FE; 606. F. obtusa, O, Fl, HQ; 599. F. octoflora, U, old field, 3a, Fl; 464. Glyceria striata, O, creek bank, 4, Fl, FE, HQ; 682. Hordeum pusillum, C, barnlot, 4, Fl, FE; 396. Hystrix patula, O, around old mill, 5a, Fl, HQ; 714. *Leersia virginica, O, pond edge, 5a, Fl, FE, HQ; 983. **Lolium multiflorum, O, James R. floodplain, 7, Fl; 545. L. perenne, C, grassy yard, 7, Fl, FE; 816. Melica mutica, O, wooded slope, 5a, Fl, FE; 386. *Microstegium vimineum, C, low woods, 7; 1548. *Miscanthus sinensis, A, roadside, 7, Fl; 1402. *Muhlenbergi schreberi, O, ravine on James R., 4, Fl, FE, HQ; 1627. Panicum anceps, O, roadside, 5a, Fl, FE; 1324. P. boscii, C, power-line cut, 5a, Fl, FE, HQ; 830. *P. capillare, O, swampy area, 3a, Fl, FE; 1261. P. clandestinum, O, James R. floodplain, 5a, Fl, FE, HQ; 541. P. commutatum, C, old field, 5a, Fl, FE, HQ; 465. *P. dichotomiflorum, O, James R. bank, 4, Fl, FE; 1301. P. dichotomum, O, low woods, 5a, Fl, FE, HQ; 493. P. laxiflorum, O, rock outcrop, 4, FE; 449. *P. polyanthes, O, low woods, 5a, Fl, FE; 1055. P. scoparium, C, power-line cut, 4, Fl; 856. *P. sphaerocarpon, C, burned-over field, 4; 887. P. stipitatum, O, swamp, 5a, Fl; 1218. *Paspalum dilatatum, O, farm pond, 7, FE; 1263. *P. floridanum, C, field edge, 5e; 948. *P. fluitans, U, James R. bank, 4; 1300. *P. laeve, C, cornfield, 5a, Fl, FE; 1139a. P. pubescens+, U, cornfield, 5a; 1139. *Poa annua, C, barnlot, 7, Fl, FE; 114. P. autumnalis, O, rock outcrop, 5a, Fl, FE; 429. P. compressa, O, power-line cut, 7, Fl, HQ; 831. P. cuspidata, C, low woods, 6a1, Fl, HQ; 44.

*P. pratensis, A, pasture, 7, Fl, FE, HQ; 265. *P. sylvestris, U, creek bank, 5a; 232a. *P. trivialis, O, low woods, 7; 592. Secale cereale, U, field edge, 7, HQ; 1395. Setaria faberi, C, old field, 7, Fl, HQ; 978. *S. geniculata, O, field edge, 4, Fl, FE; 860. *S. glauca, C, pond dam, 7, Fl, HQ; 1194. S. viridis, O, roadside, 7, Fl; 815b. *Sorghastrum nutans, U, field edge, 4, Fl; 1394a. *Sorghum halepense, C, old field, 7, Fl; 806. *Sphenopholis intermedia, C, James R. floodplain, 3a; 544. *S. nitida, O, low woods, 5a, Fl, HQ; 264. *S. obtusata, O, low woods, 4, Fl, FE; 597a. *Sporobolus vaginiflorus, O, road edge, 5a; 1605. Stipa avenacea, U, rocky woods, 5a, Fl, HQ; 617. Tridens flavus, O, cornfield, 5a, Fl, FE, HQ; 1142. *Tripsacum dactyloides, U, waste ground, 4, Fl; 1268. *Trisetum pensylvanicum, O, low woods, 5a, Fl; 638. Uniola latifolia, O, rock outcrop, 5a; 1101. *Zea mays, O, roadside escape, 7, Fl; 924.

PONTEDERIACEAE: *Heteranthera reniformis, O, stream and pond, 4, FE; 1482.

POTAMOGETONACEAE: Potamogeton diversifolius, O, farm pond, 4; 633. **P. epihydrus, A, Jones Creek, 3a, Fl; 650.

SPARGANIACEAE: *Sparganium americanum, A, ponds, 5a, Fl, HQ; 725.

TYPHACEAE: Typha latifolia, O, old mill pond, 1, Fl, FE, HQ; 862.

XYRIDACEAE: *Xyris torta, U, in stream on rock outcrop, 5a, Fl; 1620.

DICOTYLEDONEAE

ACANTHACEAE: *Justicia americana, O, James R. bank, 5a, Fl; 971. *Ruellia caroliniensis, O, roadside, 5a, Fl, FE; 870. *R. purshiana, U, low woods, 5a; 504.

ACERACEAE: **Acer negundo*, O, James R. floodplain, 5a, Fl; 542. **A. rubrum*, C, pond bank, 5a, Fl, FE, HQ; 130. ***A. saccharinum*, O, woods on James R., 5a; 560.

AIZOACEAE: **Mollugo verticillata*, O, field edge, 7, Fl, FE, HQ; 1020.

AMARANTHACEAE: ***Amaranthus hybridus*, C, roadside, 7, Fl; 1184. **A. spinosus*, C, James R. floodplain, 4, Fl; 1545. ****Iresine rhizomatosa*, R, James R. bank, 5c; 1174.

ANACARDIACEAE: **Rhus copallina*, O, roadside, 5a, Fl, FE; 937. **R. glabra*, O, roadside ditch, 4, Fl; 863. **R. radicans*, A, roadside ditch, 4, Fl, FE, HQ; 515. ***R. vernix*, O, low woods, 5a; 710.

ANNONACEAE: **Asimina triloba*, A, ravine on James R., 5a, Fl, FE; 113.

APIACEAE: **Angelica venenosa*,U, wooded hillside, 5a, Fl, HQ; 785. ***Chaerophyllum procumbens*, O, low woods, 5a,; 234. **C. tainturieri*, A, mixed pine-deciduous woods, 5c, FE; 243. **Cicuta maculata*, O, roadside marsh, 4, Fl; 936. **Conium maculatum*, O, James R. floodplain, 7; 610. **Cryptotaenia canadensis*, U, low woods, 5a, Fl, FE, HQ; 587. **Daucus carota*, C, pasture, Fl, FE, HQ; 752. ***Hydrocotyle ranunculoides*, C, in creeks, 4; 132. **Osmorhiza claytonii*, A, low woods, 5a, HQ; 217. **Oxypolis rigidior*, R, low woods, 5a, Fl; 225. *Sanicula canadensis*, O, low woods, 5a, Fl, FE, HQ; 594. **S. smallii*, O, low woods, 5c, Fl; 498. **Thaspium barbinode*, O, low woods, 5a, Fl, HQ; 499.

APOCYNACEAE: **Apocynum cannabinum*, O, old field, 3a, Fl, FE, HQ; 976. **Vinca minor*, C, grassy field, 7, Fl, FE; 20.

AQUIFOLIACEAE: *Ilex decidua*, U, rock outcrop, 5e; 1104. **I. opaca*, C, low woods, 5a, Fl, FE; 1596. *I. verticillata, O, low woods, 5a, Fl, FE; 659.

ARALIACEAE: *Aralia spinosa, O, mixed pine-deciduous woods, 5a, FE; 1388.

ARISTOLOCHIACEAE: *Aristolochia serpentaria, U, low woods, 5a, Fl; 574. *Asarum canadense, A, low woods, 5a, HQ; 205. *Hexastylis virginica, U, mesic wooded slope, 6c, Fl, FE; 382.

ASCLEPIADACEAE: *Asclepias amplexicaulis, O, weedy roadside, 5a; 509. *A. incarnata, C, pond edge, 5a, Fl, FE; 1000. *A. syriaca, C, pasture, 5a, Fl, HQ; 756. *A. tuberosa, O, grassy area, 4, Fl, FE; 706. *A. variegata, O, weedy roadside, 5a, FE; 507. A. viridiflora, O, cornfield, 4, Fl; 1137. *Matelea carolinensis, U, rock outcrop, 5c, Fl; 1638. *M. suberosa, U, low woods, 6c; 744.

ASTERACEAE: *Achillea millefolium, C, roadside, 7, Fl, FE, HQ; 390. *Ambrosia artemisiifolia, A, pond dam, 4, Fl, FE, HQ; 1191. *A. trifida, O, roadside, 4, Fl; 1230. *Antennaria plantaginifolia, O, low woods, 5a, Fl, FE, HQ; 99. *A. solitaria, O, bluffs above James R., 5a; 204. *Anthemis arvensis, O, roadside, 7, Fl, HQ; 182. *Arctium minus, O, pasture, 7, Fl, HQ; 758. **Artemisia annua, U, James R. floodplain, 7; 1418. *Aster cordifolius, O, James R. floodplain, 5a, HQ; 1628. *A. divaricatus, O, rocky bluffs on James R., 6al, Fl, HQ; 1415. *A. infirmis, C, base of James R. bluffs, 6al, Fl; 969. *A. lateriflorus, O, pine woods edge, 5a, FE; 1610. *A. patens, U, field edge, 5a, Fl; 1592. *A. paternus, O, field edge, 6al, Fl, FE, HQ; 717. *A. pilosus, C, grassy area, 5a, Fl, FE, HQ; 1528. *A. puniceus, O, roadside ditch, 5a, Fl; 1499. *A. undulatus, O, roadside, 5a, Fl, HQ; 1589. *Bidens aristosa, C, roadside, 5a, Fl FE; 1225. *B. bipinnata, O, barnlot, 4, Fl, FE, HQ; 1236. *B. frondosa, O, roadside, 3a, Fl, FE, HQ; 1448. *B. tripartita, O, creek bank, 7, Fl, HQ; 1366. Carduus discolor, O, roadside, 5a, Fl, FE, HQ; 1189. C. lanceolatus, O, cut-over area, 7, Fl, HQ; 1042. *Centaurea cyanus, A, cornfield, 7; 351. C. maculosa, O, roadside, 7, Fl, HQ; 687. Chrysanthemum leucanthemum, A, old field, 7, Fl, FE, HQ; 352. Chrysogonum virginianum, U, low woods, 6a1, Fl; 94. Cichorium intybus, O, roadside, 7, Fl, FE, HQ; 857. *Coreopsis lanceolata, C, roadside, 5a, Fl; 387. C. verticillata, C, roadside, 5a, Fl; 689. *Eclipta alba, O, James R. bank, 8, Fl, FE; 1289. *Elephantopus carolinianus, O, roadside bank, 4, Fl, FE; 1015. *E. tomentosus, C, low woods, 5e, Fl FE; 912. *Erechtites hieracifolia, O, woods edge, 5a, Fl, FE, HQ; 1392. *Erigeron annuus, C, old field, 3a, Fl, FE, HQ; 475. *E. canadensis var. canadensis, A, roadside, 4, Fl, FE, HQ; 1199. ***E. philadelphicus, U, James R. floodplain, 5a; 329. *E. strigosus, C, grassy field, 5a, Fl, HQ; 605. *Eupatorium album, U, cut-over field, 5e, Fl; 1381. *E. capillifolium, O, wet ditch, 5a, FE; 1560. E. coelestinum, C, James R. bank, 4, Fl, FE; 1371. E. fistulosum, C, stream edge, 5a, Fl, HQ; 1358. E. hyssopifolium, O, cut-over field, 5a, Fl, FE; 1439. E. perfoliatum, O, swamp edge, 5a, Fl; 1213. *E. purpureum, O, James R. bluffs, 5a; 750. E. rotundifolium, O, roadside bank, 5a, Fl, FE; 1336. *E. rugosum, O, ravine on James R., 5a, Fl, FE, HQ; 1423. *E. sessilifolium, O, low woods, 5a; 1150. *Galinsoga ciliata, O, James R. floodplain, 7, Fl, FE, HQ; 799. *Gnaphalium obtusifolium, C, grassy bank, 5a, Fl, FE, HQ; 1328. *G. purpureum, C, grassy area, 4, Fl, FE; 262. *Helenium flexuosum, U, wet field, 5a, Fl, HQ; 1636. ***Helianthus annuus, O, field edge, 5a; 945. *H. atrorubens, O, roadside bank, 6c, Fl; 1158. *H. decapetalus, O, low woods, 5b, Fl; 1307. ***H. mollis, C, old pasture, 5a; 1594. *H. strumosus, O, roadside, 5a, Fl; 1265. *H. tuberosus, O, roadside, 5a, Fl; 1183. *Heterotheca mariana, O, roadside, 5a, Fl, FE; 1134. *Hieracium gronovii, roadside, O, 5a, Fl, FE; 1386. *H. scabrum, U, roadside ditch, 5a, Fl; 1239. H. venosum, O, roadside ditch, 5a, Fl, FE, HQ; 174. Hypochoeris radicata, C, roadside ditch, 7, Fl, FE; 235. Krigia virginica, O, roadside, 5a, Fl, FE, HQ; 159. Lactuca canadensis, C, roadside, 3a, Fl, FE, HQ; 824. L. floridana, O, stream edge, 5a, Fl, FE, HQ; 1357. *L. scariola, O, field edge, 7, Fl, FE, HQ; 1024. Liatris squarrosa, C, roadside, 5a, Fl; 927. Mikania scandens, O, rock outcrop, 4, Fl, FE; 1123. *Parthenium integrifolium, U, woods edge, 5a, Fl; 412. *Polymnia uvedalia, A, low woods, 5a, FE; 951. **Prenanthes altissima, O, low woods, 5a, HQ; 1598. *P. serpentaria, O, power-line cut, 6al, Fl; 1590. Pyrrhopappus carolinianus, O, roadside, 5a, Fl, FE; 615. Rudbeckia hirta, old pasture, C, 4, Fl, FE, HQ; 754. *R. laciniata, O, creek bank, 5a, Fl; 1371. *R. triloba, U, road shoulder, 5a; 943. *Senecio aureus, A, low woods, 5a, Fl, FE, HQ; 134. *S. obovatus, O, rocky bluffs on James R., 5a, HQ; 202. *S. smallii, C, roadside, 6al, Fl, FE; 377. *Silphium trifoliatum, U, roadside, 6al, Fl; 944. *Solidago altissima, A, field edge, 5a, Fl, FE, HQ; 1607. *S. bicolor, O, cut-over field, 5b, Fl, HQ; 1444. *S. caesia, O, woods at outcrop edge, 5a, Fl, FE; 1519. *S. erecta, O, roadside, 6al, Fl; 1555. *S. gigantea, O, rocky bluffs on James R., 5a, Fl; 1283. *S. graminifolia, O, roadside ditch, 5a, Fl; 1496. *S. juncea, C, James R. floodplain, 5a, Fl, HQ; 968. *S. nemoralis, A, cornfield, 5a, Fl, FE, HQ; 1393. *S. odora, roadside, O, 5a, Fl; 1332. *S. pinetorum, A, old pasture, 6c, FE; 1009. *S. rugosa, O, roadside ditch, 5a, Fl, FE, HQ; 1495. Sonchus asper, O, rocky roadside, 7, Fl, FE; 470. *Taraxacum officinale, C, roadside, 7, Fl, FE, HQ; 1634. *Verbesina alternifolia, A, James R. floodplain, 5a, Fl; 804. *V. occidentalis, C, roadside, 5a, FE; 925. *Vernonia glauca, O, mixed pine-deciduous woods, 6al, Fl; 1492. *V. noveboracensis, O, pond edge, 6al, Fl, FE; 1208. *Xanthium strumarium, O, James R. floodplain, 7, Fl, FE; 1544.

BALSAMINACEAE: *Impatiens capensis, A, James R. floodplain, 5a, Fl, FE, HQ; 1164. *I. pallida, C, James R. floodplain, 5a, HQ; 791.

BERBERIDACEAE: *Jeffersonia diphylla, O, wooded ravine on James R., 5a; 293. *Podophyllum peltatum, A, low woods, 5a, Fl, FE, HQ; 209.

BETULACEAE: *Alnus serrulata, C, pond edge, 5a, Fl, FE, HQ; 1069. *Betula nigra, O, pond edge, 5a, Fl; 1071. *Carpinus caroliniana, C, mixed pine- deciduous woods, 5a, Fl, FE, HQ; 1547. *Corylus americana, O, low woods, 5a, Fl; 1464. *Ostrya virginiana, U, wooded bluffs on James R., 5a, HQ; 563.

BIGNONIACEAE: Campsis radicans, C, roadside, 5a, Fl, FE; 692.

BORAGINACEAE: *Cynoglossum virginianum, U, mesic wooded slope, 5a, FE, HQ; 311. Echium vulgare, U, grassy meadow, 7, HQ; 1121. *Hackelia virginiana, U, along wooded road, 5a, Fl, FE, HQ; 1274. *Lithospermum arvense, O, old field, 7, Fl; 397. *Myosotis macrosperma, A, low woods, 5a; 308. *M. verna, O, rock outcrop, 4, Fl, FE; 252b.

BRASSICACEAE: *Alliaria petiolata, C, roadside ditch, 7; 169. *Arabidopsis thaliana, C, old field, 7, Fl, FE, HQ; 71. *Arabis canadensis, U, low woods, 5a, Fl, HQ; 488. *A. laevigata, U, open woods, 5a, HQ; 118. *Barbarea verna, C, old field, 7, Fl, FE, HQ; 103. *B. vulgaris, O, roadside, 7, Fl, FE, HQ; 170. *Brassica napus, C, old field, 7, Fl; 101. *Capsella bursa-pastoris, C, pasture, 7, Fl, HQ; 33. *Cardamine bulbosa, O, creek edge, 5a, Fl; 213. *C. concatenata, A, low woods, 5a, Fl, HQ; 36. *C. hirsuta, A, James R. floodplain, 7, Fl, FE; 25. *C. parviflora var. arenicola, U, low woods, 1; 160. *Draba verna, C, pasture, 7, Fl, FE; 32. *Erysimum cheiranthoides, C, James R. floodplain, 1; 540. *Lepidium campestre, O, roadside ditch, 7, Fl, HQ; 268. *L. virginicum, O, roadside ditch, 3a, Fl, FE, HQ; 255. *Raphanus raphanistrum, O, pasture, 7; 535. *Rorippa islandica, O, James R. bank, 1; 895. *Sisymbrium officinale var. leiocarpum, O, weedy area, 7, Fl, HQ; 269. ***Teesdalia nudicaulis, O, roadside, 7; 403. **Thlaspi arvense, O, old field, 7; 391. *T. perfoliatum, A, roadside, 7, Fl; 74.

CACTACEAE: *Opuntia compressa, A, rock outcrop, 5a; 1373.

CALLITRICHACEAE: *Callitriche heterophylla, C, creek bottom, 4, Fl, FE, HQ; 93.

CAMPANULACEAE: *Lobelia cardinalis, U, low woods, 5a, Fl, FE; 987. *L. inflata, O, James R. floodplain, 5a, Fl, FE, HQ; 893. *L. puberula, U, roadside ditch, 5a, Fl, FE; 1375. *L. siphilitica, U, James R. floodplain, 5a; 1282. *L. spicata, O, low woods, 5a, Fl, HQ; 649. ***Specularia biflora, U, pasture, 4, FE; 537. *S. perfoliata, A, grassy opening, 4, Fl, FE, HQ; 417.

CANNABACEAE: *Humulus japonicus, A, James R. floodplain, 7; 1294.

CAPRIFOLIACEAE: Lonicera japonica, A, roadside ditch, 7, Fl, FE, HQ; 481. *Sambucus canadensis, O, road edge, 4, Fl, FE; 522. *Symphoricarpos orbiculatus, O, edge of pine woods, 5a, Fl; 166. *Triosteum perfoliatum, O, old pasture, 5a; 755. *Viburnum acerifolium, O, low woods, 5a, Fl, FE, HQ; 485. *V. dentatum, C, low woods, 5a, Fl; 359. *V. nudum, O, pond edge, 5e, Fl, FE; 737. *V. prunifolium, U, roadside, 5a, Fl, FE; 128.

CARYOPHYLLACEAE: *Agrostemma githago, O, old field, 7, Fl; 478. *Arenaria groenlandica var. glabra, A, rock outcrop, 6al; 196. **A. serpyllifolia, C, pasture, 7, Fl, HQ; 538. *Cerastium glomeratum, C, old field, 7, Fl, FE; 69. Dianthus armeria, O, roadside, 7, Fl, FE, HQ; 364. **D. prolifer, meadow, 7; 1103. *Holosteum umbellatum, A, roadside, 7, FE; 79. *Lychnis alba, O, meadow, 7, Fl; 425. ***L. coronaria, U, roadside, 7; 693. *Sagina decumbens, O, grassy area, 5a, FE; 216. *Saponaria officinalis, O, roadside ditch, 7, Fl, HQ; 821. *Scleranthus annuus, O, rock outcrop, 7, FE; 432. *Silene antirrhina, O, old field, 4; 392. *S. caroliniana, O, roadside bank, 6al, HQ; 186. *S. cucubalus, O, cornfield, 7; 1135. *S. stellata, O, wooded bluffs above James R., 5a, Fl HQ; 890. *Stellaria media, A, old field, 7, Fl, FE, HQ; 1632. *S. pubera, C, bluffs above James R., 5a, Fl; 556.

CELASTRACEAE: *Euonymus americanus, O, bluffs above James R., 5a, Fl, FE; 294.

CHENOPODIACEAE: Chenopodium album, C, creek edge, 7, Fl, HQ; 1361. *C. ambrosioides, C, roadside, 7, Fl, FE; 1510.

CISTACEAE: *Lechea racemulosa, O, cut-over field, 5a, Fl; 1161. *L. tenuifolia, U, dry churchyard, 5a; 1030b.

CONVOLVULACEAE: *Calystegia sepium, O, cornfield edge, 1, Fl, FE, HQ; 554. **Cuscuta campestris, C, on roadside herbs, 4, Fl; 926. *C. compacta, O, low woods, 5a, Fl, FE; 1485. *C. gronovii, C, low woods, 5a; 1420. *Ipomoea hederacea, O, pasture edge, 7, Fl; 954. *I. lacunosa, O, field edge, 5a, Fl, FE; 1226. *I. pandurata, O, field edge, 5a, Fl; 859. *I. purpurea, O, field edge, 7, Fl; 1229.

CORNACEAE: *Cornus amomum, O, low woods, 5a, Fl; 647. *C. florida, C, mixed deciduous woods, 4, Fl, FE, HQ; 107.

CRASSULACEAE: *Penthorum sedoides, O, low woods, 5a, Fl, FE; 1466. ***Sedum sarmentosum, A, rock outcrop, 7; 454. *S. ternatum, A, bluffs above James R., 5a, HQ; 219.

CURCURBITACEAE: *Sicyos angulatus, U, base of bluffs on James R., 5a; 1411.

EBENACEAE: *Diospyros virginiana, O, mixed deciduous woods, 5a, Fl, FE; 521.

ELAEAGNACEAE: ***Elaeagnus umbellata, O, mesic wooded slope, 7, HQ; 1036.

ERICACEAE: Chimaphila maculata, C, pine woods, 6al, Fl, FE, HQ; 724. *C. umbellata, O, pine woods, 1, Fl; 584. *Gaylussacia baccata, U, power-line cut, 5a, Fl, FE, HQ; 271. *Kalmia latifolia, U, mixed deciduous woods, 5a, Fl, FE, HQ; 729. *Leucothoe racemosa, O, low woods, 5a, FE; 420. *Monotropa hypopithys, U, mixed upland woods, 4, Fl HQ; 656. *M. uniflora, O, mixed upland woods, 2, Fl, FE, HQ; 837. Oxydendrum arboreum, mixed woods, 5a, Fl, FE; 739. *Pyrola rotundifolia var. americana, U, low woods, 1, Fl; 636. *Rhododendron nudiflorum, O, mixed pine-deciduous woods, 6al, Fl, FE, HQ; 184. *Vaccinium atrococcum, O, low woods, 5a, Fl, FE; 96. *V. stamineum, U, pine woods, 5a, Fl, FE, HQ; 250. *V. vacillans, O, cut-over field, 5a, Fl, FE, HQ; 527.

EUPHORBIACEAE: *Acalypha gracilens, O, roadside, 5a, Fl, FE; 1509. *A. rhomboidea, O, roadside marsh, 5a, Fl, FE, HQ; 1500. *Croton glandulosus var. septentrionalis, O, cut-over field, 5a, Fl; 1163. *Crotonopsis elliptica, O, rock outcrop, 5a; 1094. Euphorbia corollata, C, roadside, 5a, Fl, HQ; 322. *E. cyparissias, O, roadside ditch, 7, Fl; 75. *E. maculata, O, field edge, 4, Fl, FE, HQ; 1018. **E. obtusata, U, low woods, 5a; 501.

FABACEAE: *Albizia julibrissin, O, roadside, 7, Fl, FE; 685. *Amphicarpa bracteata, O, pond edge, 5a, Fl, FE, HQ; 1477. *Apios americana, C, pond edge, 5a, Fl; 1074. *Baptisia tinctoria, O, roadside, 5a, Fl, FE, HQ; 514. *Cassia fasciculata, O, rock outcrop, 5a, Fl, FE; 1119. *C. marilandica, O, old pasture, 5a; 953. *C. nictitans, O, power-line cut, 5a, Fl, FE; 995. *Centrosema virginianum, U, road edge, 5a; 1267. *Cercis canadensis, C, ravine on James R., 4, Fl, FE; 1422. Clitoria mariana, O, cut-over field, 5a, FE; 1162. ***Crotalaria mucronata, in sand at outcrop edge, U, 7; 1518. *Cytisus scoparius, O, edge of pine woods, 7, FE; 167. *Desmodium canescens, O, roadside, 5a, FE; 1016. *D. glabellum, O, low woods, 5a, FE, HQ; 1053. ***D. glutinosum, O, low woods, 4; 771. *D. marilandicum, O, creek edge, 5a, Fl; 1362. *D. nudiflorum, O, low woods, Fl, FE, HQ; 828. *D. paniculatum, O, grassy opening, 5a, Fl, FE; 1321. **D. perplexum, C, roadside ditch, 5a, FE, HQ; 1401. *D. rotundifolium, O, cut-over field, 5a, Fl, FE; 1376. *Galactia volubilis, O, edge of pine woods, 5a, Fl; 957. *Gleditsia triacanthos, O, roadside, 5a, Fl; 1570. *Lathyrus hirsutus, O, James R. floodplain, 7; 559. *Lespedeza cuneata, O, roadside, 7, Fl, FE, HQ; 1269. *L. procumbens, O, mixed woods, 5a, Fl, FE; 1222. L. repens, O, roadside, 5a, Fl, FE, HQ; 1334. *L. stipulacea, O, roadside, 7, Fl; 1341a. *L. striata, O, roadside, 7, Fl, FE; 1341b. *L. virginica, O, cornfield, 5a, Fl; 1035. *Medicago lupulina, C, pasture, 7, Fl, FE; 596. **M. sativa, C, field edge, 7, Fl; 415. *Melilotus alba, O, roadside, 7, Fl, FE, HQ; 471. *M. officinalis, C, roadside, 7, Fl, FE, HQ; 413. *Pueraria lobata, A, roadside, 7, FE; 1233. *Robinia pseudo-acacia, O, mixed woods, 5a, Fl, FE, HQ; 275. *Stylosanthes biflora, O, roadside, 5a, Fl, FE; 858. *Tephrosia virginiana, C, roadside, 5a, Fl; 376. *Trifolium arvense, C, roadside, 7, Fl, FE, HQ; 414. *T. campestre, C, field, 7, Fl, FE, HQ; 628. *T. dubium, C, field, 7, FE; 437. *T. pratense, C, power-line cut, 7, Fl, FE, HQ; 354. *T. repens, A, open field, 7, Fl, FE, HQ; 369. *Vicia angustifolia, C, edge of field, 7, Fl, FE; 350. *V. dasycarpa, C, roadside ditch, 7, Fl, FE, HQ; 254. *V. hirsuta, O, James R. floodplain, 7; 236.

FAGACEAE: **Castanea dentata, U, mixed deciduous woods, 5a, Fl, HQ; 841. *C. pumila, O, mixed upland woods, 5a, Fl, FE; 686. *Fagus grandifolia, A, mixed woods, 5a, Fl, FE, HQ; 1552. *Quercus alba, A, churchyard, 5a, Fl, FE, HQ; 1556. *Q. coccinea, C, mixed upland woods, 5a, Fl, FE, HQ; 1559. *Q. falcata var. falcata, O, churchyard, 5e, Fl, FE; 1557. *Q. marilandica, O, mixed woods, 5a, Fl, FE, HQ; 1428. *Q. phellos, O, mixed upland woods, 5e, Fl, FE; 510. *Q. prinus, C, mixed upland woods, 5a, Fl, HQ; 1403. *Q. rubra, O, mixed woods, 5a, Fl, FE, HQ; 1553. *Q. stellata, O, field edge, 5a, Fl, FE; 1280. *Q. velutina, O, mixed upland woods, 5a, Fl, FE, HQ; 1460.

FUMARIACEAE: *Corydalis flavula, C, mesic wooded slope, 5a; 63. *Dicentra canadensis, A, ravine on James R., 5a; 109.

GENTIANACEAE: *Gentiana villosa, O, swamp edge, 5a, Fl, FE; 1491. *Obolaria virginica, R, low woods, 5a, Fl; 503. *Sabatia angularis, O, lake edge, 5a, Fl, FE; 1256.

GERANIACEAE: *Geranium carolinianum, O, roadside, 3a, Fl, FE; 270.

*G. maculatum, U, mesic wooded slope, 5a, Fl, HQ; 384. *G. molle, O, grassy yard, 7; 64.

HAMAMELIDACEAE: *Liquidambar styraciflua, C, mixed woods, 4, Fl, FE; 1431.

HYDROPHYLLACEAE: **Ellisia nyctelea, A, James R. floodplain, 5a; 288. **Hydrophyllum canadense, A, James R. floodplain, 5a; 797. ***Nemophila microcalyx, C, James R. floodplain, 5a; 29. *Phacelia dubia, O, rock outcrop, 6al; 193.

HYPERICACEAE: *Hypericum gentianoides, O, roadside, 5a, Fl, FE; 865. *H. hypericoides, O, roadside, 4, Fl, FE; 922. *H. mutilum, O, roadside, 5a, Fl, FE, HQ; 867. *H. perforatum, O, old field, 7, Fl, FE, HQ; 820. *H. prolificum, U, rocky bluff above James R., 5a; 888. H. punctatum, O, low woods, 5a, Fl, FE, HQ; 768. **H. stragalum, O, power-line cut, 5a; 829. ***H. virginicum, O, cornfield, 5a; 1136. ***H. walteri, O, low woods, 5e; 1062.

JUGLANDACEAE: *Carya cordiformis, O, low woods, 5a, Fl, FE; 1456. *C. ovalis, C, mixed upland woods, 5a, FE, HQ; 1591. *C. tomentosa, C, mixed woods, 5a, Fl, FE, HQ; 1568. *Juglans nigra, C, roadside, 5a, Fl, FE; 1563.

LAMIACEAE: *Agastache nepetoides, U, wooded ravine on James R., 5a,; 1426. ***Ajuga reptans, U, roadside ditch, 7; 161. *Collinsonia canadensis, U, wooded bluff above James R., 5a, HQ; 1404. *Cunila origanoides, C, roadside, 5a, Fl, FE, HQ; 1180. *Glecoma hederacea, O, James R. floodplain, 7, Fl, FE, HQ; 48. *Hedeoma pulegioides, O, cutover area, 5a, Fl, HQ; 1040. **Isanthus brachiatus, O, pasture, 5a; 1169. *Lamium amplexicaule, A, roadside, 7, Fl, FE; 13. *L.

purpureum,U, James R. floodplain, 7, Fl; 41. *Lycopus americanus, O, James R. bank, 3a, Fl, FE; 966. *L. virginicus, O, pond edge, 5a, Fl, FE, HQ; 1076. **Marrubium vulgare, C, barnlot, 7, Fl; 280. *Monarda fistulosa, O, old pasture, 4, FE; 757. *Perilla frutescens, C, wooded ravine on James R., 7, Fl; 1419. *Prunella vulgaris, C, roadside ditch, 1, Fl, FE, HQ; 740. *Pycnanthemum incanum, O, roadside bank, 5a, Fl, HQ; 1014. *P. tenuifolium, O, cornfield, 5a, Fl; 1131. Salvia lyrata, C, low woods, 5a, Fl, FE, HQ; 259. *Satureja calamintha var. nepeta, O, weedy area, 7, Fl; 763. *S. vulgaris, O, old pasture, 7, Fl, HQ; 903. *Scutellaria elliptica, O, James R. bank, 5a, Fl, FE; 549. *S. integrifolia, O, rock outcrop, 5e, Fl, FE, HQ; 704. *S. lateriflora, O, low woods, 3a, Fl, FE, HQ; 1001. ***S. ovata, O, wooded bluffs above James R., 4; 565. *Teucrium canadense, O, old pasture, 3a; 902. *Trichostema dichotomum, C, roadside, 5a, Fl; 1323.

LAURACEAE: *Lindera benzoin, C, low woods, 5a, Fl, FE, HQ; 1479. *Sassafras albidum, field edge, C, 5a, Fl, FE, HQ; 1571.

LENTIBULARIACEAE: ***Utricularia biflora, U, in pond, 5a; 1067.

LINACEAE: *Linum striatum, O, roadside, 5a, Fl; 916. L. virginianum, O, field edge, 5a, Fl, FE, HQ; 1017.

LOGANIACEAE: *Polypremum procumbens, O, rock outcrop, 4, Fl; 874.

LORANTHACEAE: *Phoradendron serotinum, U, in Quercus trees, 5a, FE; 1633.

MAGNOLIACEAE: *Liriodendron tulipifera, C, low woods, 5a, Fl, FE, HQ; 303. ***Magnolia virginiana, U, creek bottom, 5e, FE; 73.

MALVACEAE: **Abutilon theophrastii, O, cornfield, 7; 1159. *Hibiscus moscheutos, C, pond edge, 6c, FE; 1072. **H. syriacus, O, swampy area, 7; 1245. *Malva neglecta, C, barnlot, 7, Fl; 282. *Sida spinosa, O, field edge, 7, Fl; 1025.

MELASTOMATACEAE: *Rhexia mariana, C, roadside, 5e, Fl; 1322. *R. virginica, C, grassy area, 5a, Fl; 877.

MENISPERMACEAE: *Menispermum canadense, U, rocky bluffs above James R., 5a, Fl, HQ; 191.

MORACEAE: *Morus rubra, O, edge of mixed woods, 5a, Fl, FE; 474.

NYMPHAEACEAE: *Nuphar luteum, A, Woodberry Pond, 4, Fl; 726. Nymphaea odorata, O, Woodberry Pond, 4; 731.

NYSSACEAE: *Nyssa sylvatica, O, pond edge, 5a, Fl, FE, HQ; 736.

OLEACEAE: *Chionanthus virginicus, O, bluffs on the James R., 5a, Fl; 534. *Fraxinus americana, O, rock outcrop, 5a, Fl, HQ; 450. *F. pennsylvanica, O, James R. floodplain, 5a, Fl; 557. ***Ligustrum obtusifolium, C, low woods, 7; 360. *L. sinense, O, roadside, 7, Fl, FE; 409.

ONAGRACEAE: *Circaea lutetiana ssp. canadensis, C, spring head, 1, Fl, FE, HQ; 850. *Epilobium coloratum, O, cut-over area, 5a, HQ; 1032. *Gaura biennis, O, roadside ditch, 5a, Fl; 1572. *Ludwigia alternifolia, C, roadside, 5a, Fl, FE; 961. **L. decurrens, O, pond dam, 4, Fl; 1271. *L. palustris, O, wet depression on rock outcrop, 8, Fl, FE, HQ; 696. *Oenothera laciniata, O, old cornfield, 4, Fl, FE; 399. ***O. parviflora, O, barnlot, 6b, HQ; 1238.

OROBANCHACEAE: *Conopholis americana, C, rocky bluff on James R., 6al, HQ; 609. *Epifagus virginiana, O, mesic wooded slope, 5a, Fl, FE, HQ; 3. *Orobanche uniflora, R, bluff above James R., 3a, HQ; 223.

OXALIDACEAE: *Oxalis dillenii, O, field edge, 4, Fl, FE; 1022.

**O. florida, O, mixed mesic woods, 5a, Fl; 670. *O. stricta, O, power-line cut, 4, Fl, HQ; 993. *O. violacea, U, low woods, 5a, Fl; 240.

PAPAVERACEAE: **Papaver dubium, O, old field, 7; 402. *Sanguinaria canadensis, C, bluffs above James R., 5a, Fl, HQ; 18.

PASSIFLORACEAE: *Passiflora incarnata, U, old field, 5a, FE; 906. *P. lutea, O, lake dam, 5a, Fl, FE; 1190.

PHRYMACEAE: *Phryma leptostachya, O, low woods, 2, Fl, FE; 775.

PHYTOLACCACEAE: *Phytolacca americana, C, cut-over field, 5a, Fl, FE, HQ; 528.

PLANTAGINACEAE: Plantago aristata, C, roadside, 3a, Fl, FE, HQ; 463. P. lanceolata, C, power-line cut, 7, Fl, FE, HQ; 274. *P. rugelii, C, grassy yard, 5a, Fl, FE, HQ; 762. *P. virginica, C, cut-over field, 3a, Fl, FE, HQ; 146.

PLATANACEAE: *Platanus occidentalis, O, pond edge, 5a, Fl, FE, HQ; 1192.

POLEMONIACEAE: *Phlox divaricata, A, low woods, 5a; 228. *P. subulata, O, roadside ditch, 6b, Fl; 88.

POLYGALACEAE: ***Polygala mariana, U, roadside, 5e, FE; 1374.

POLYGONACEAE: *Polygonum arifolium, C, swamp edge, 5a, Fl, FE; 1214. **P. aviculare, C, old field, 7, Fl, FE, HQ; 811. **P. cespitosum var. longisetum, C, James R. bottom, 7, Fl, FE; 1539. *P. convolvulus, O, fencerow, 7, Fl, HQ; 1348. **P. hydropiper, O, swamp edge, 7; 1210c. *P. hydropiperoides, O, pond edge, 4, Fl, HQ; 1272a. *P. lapathifolium, O, James R. bank, 8, Fl; 1296. *P. pensylvanicum, O, James R. bank, 5a, Fl, FE; 1292. **P. persicaria, O, roadside ditch, Fl, FE, HQ; 655. **P. punctatum, C, James R. floodplain, 4, Fl, FE; 878. *P. sagittatum, A, pond edge, 5a, Fl, HQ; 1483. *P. setaceum, O, pond edge, 5e, Fl, FE; 998. *Rumex acetosella, O, grassy field, 7, Fl, FE, HQ; 145. *R. crispus, C, James R. floodplain, 7, Fl, FE, HQ; 570. *R. obtusifolius, O, open woods, 7, Fl, HQ; 803. *Tovara virginiana, U, ravine on James R., 2, Fl, FE; 882.

PORTULACACEAE: *Claytonia virginica, A, low woods, 5a, Fl; 11. *Portulaca grandiflora, U, grassy area adjacent to outcrop, 7; 1529. *P. oleracea, O, rock outcrop, 7; 1531. *Talinum teretifolium, C, rock outcrop, 6al; 530.

PRIMULACEAE: Anagallis arvensis, U, old field, 7, Fl, FE; 473. *Lysimachia ciliata, O, stream bank, 5a, Fl; 676. *L. quadrifolia, O, bluffs above James R., 5a, Fl, FE, HQ; 568. **L. terrestris, U, creek bank, 5b; 660.

RANUNCULACEAE: *Aconitum uncinatum, U, spring head, 6al, Fl; 648. *Anemone virginiana, O, low woods, 5a, Fl, FE, HQ; 777. *Cimicifuga racemosa, C, low woods, 5a, Fl, HQ; 770. Clematis ochroleuca, U, swamp edge, 6al, Fl; 247. *C. virginiana, O, low woods, 5a, Fl, HQ; 1204. *Delphinium ajacis, C, barnlot, 7, Fl; 279. *Hepatica americana, U, mesic wooded slope, 5a, Fl, HQ; 2. *Ranunculus abortivus, O, stream edge, 3a, Fl, FE, HQ; 197. *R. bulbosus, O, roadside, 7, Fl, FE, HQ; 175. *R. hispidus, O, wooded slope, 5a, Fl; 171. **R. micranthus, A, low woods, 5a; 229. **R. parviflorus, U, roadside, 7, Fl, FE; 163. *R. pusillus, A, James R. floodplain, 3b, FE; 319. *R. recurvatus, C, stream bank, 5a, Fl; 227. *Thalictrum dioicum, U, ravine on James R., 5a, HQ; 52. *T. polygamum, O, rock outcrop, 6b; 705. *T. thalictroides, C, wooded bluffs on James R., 5a, Fl; 54.

RHAMNACEAE: Ceanothus americanus, O, edge of mixed woods, 5a, Fl, HQ; 512.

ROSACEAE: *Agrimonia gryposepala, O, wooded ravine on James R., 3b, HQ; 884. *A. parviflora, O, lake edge, 4, Fl, HQ; 1258. A. pubescens, O, low woods, 5a, Fl, FE; 901. *Amelanchier arborea, U, James R. bank, 5a, Fl, HQ; 59. *Duchesnea indica, C, pasture, 7, Fl, FE; 120. *Fragaria virginiana, O, roadside, 5a, Fl, FE, HQ; 89. *Geum canadense, O, low woods, 5a, Fl, FE, HQ; 738. *G. virginianum, U, low woods, 5b, Fl, HQ; 778. *Potentilla canadensis, C, pine woods, 5a, Fl, FE, HQ; 266. *P. norvegica, U, grassy area, 1, Fl, FE, HQ; 701. *P. recta, O, roadside, 7, Fl, HQ; 404. *Prunus americana, O, mixed woods, 5a, Fl; 76. *P. avium, U, ravine in mixed woods, 7, Fl; 116. **P. persica, U, edge of woods, 7, Fl; 77. *P. serotina, C, roadside, 4, Fl, FE, HQ; 183. **Pyrus communis, U, roadside, 7, Fl, FE; 68. *Rosa carolina, O, roadside, 5a, Fl, HQ; 416. *R. multiflora, O, James R. floodplain, 7, Fl, HQ; 337b. *R. palustris, O, pond edge, 5a, Fl, FE; 733. **R. wichuraiana, O, roadside, 7, Fl, FE; 508. *Rubus allegheniensis, O, James R. floodplain, 5b, Fl, FE, HQ; 292. *R. flagellaris, U, edge of pine woods, 5b, Fl; 148. *R. occidentalis, O, open woods, 5a, Fl, HQ; 611.

RUBIACEAE: Cephalanthus occidentalis, O, pond edge, 4, Fl, FE; 845. *Diodia teres, O, roadside, 5a, Fl, FE; 864. D. virginiana, C, roadside, 5a, Fl, FE; 962. *Galium aparine, A, low woods, 1, Fl, FE; 582. G. circaezans, C, low woods, 5a, Fl, HQ; 784. **G. obtusum, C, low woods, 5a, Fl; 484. G. pilosum, C, low woods, 5a, Fl; 952. *G. tinctorium, O, low woods, 3a, Fl, FE, HQ; 1050. *G. triflorum, O, James R. bank, 1, Fl, FE, HQ; 1284. *Houstonia caerulea, O, bluffs on James R., 5a, Fl, FE, HQ; 55. *H. longifolia, O, low woods, 5a; 782. *H. purpurea, C, low woods, 5a, Fl; 302. *Mitchella repens, C, wooded slope, 5a, Fl, FE, HQ; 80. ***Sherardia arvensis, C, rock outcrop, 7, FE; 531.

SALICACEAE: **Populus alba, O, roadside, 7, Fl; 516. *P. deltoides, O, open field, 5a, Fl; 654. **P. grandidentata, O, mixed woods, 5a, Fl; 526. **Salix nigra, C, wet ditch, 5a, Fl, FE, HQ; 1635.

SAURURACEAE: Saururus cernuus, A, swampy area, 5a, Fl, FE; 664.

SAXIFRAGACEAE: **Chrysosplenium americanum, C, spring head, 5a, Fl, HQ; 82. *Heuchera americana, O, stream bank, 5a, Fl; 296. *Hydrangea arborescens, O, rocky bluffs above James R., 5a, Fl, HQ; 566. *Itea virginica, O, creek bank, 5e; 643. **Philadelphus inodorus, O, old homesites, 6c, Fl; 477. *Saxifraga virginiensis, C, wooded bluffs on James R., 5a, Fl, HQ; 31.

SCROPHULARIACEAE: *Agalinis purpurea, U, rock outcrop, 4, Fl, FE; 1505. ***Aureolaria pectinata, O, roadside, 5a; 1179. *A. virginica, O, roadside, 5a, Fl, FE; 694. *Chelone glabra, O, wet depression on rock outcrop, 5a, Fl; 1526. *Gratiola neglecta, O, low woods, 5a, Fl, HQ; 578. *G. pilosa, O, low field, 5e; 1241. *G. virginiana, O, in creek, 5a, FE; 421. *G. viscidula, O, swamp edge, 5a; 1147. *Kickxia elatine, R, cornfield, 7; 805. *Linaria canadensis, O, rock outcrop, 4, Fl, FE; 194. *Lindernia dubia, O, in creek, 4, Fl, HQ; 1056. *Mimulus alatus, O, along creek, 5a; 1058. *Paulownia tomentosa, O, mixed woods, 7, Fl, FE; 108. *Penstemon canescens, O, roadside, 5a, HQ; 422. *Scrophularia marilandica, C, low woods, 5a; 1550. Verbascum blattaria, U, old field, 7, Fl, FE, HQ; 472. *V. thapsus, C, meadow, 7, Fl, FE, HQ; 1122. ***Veronica agrestis, U, grassy yard, 7; 195. *V. arvensis, C, old field, 7, Fl, FE, HQ; 104. *V. hederaefolia, O, James R. floodplain, 7; 28. *V. officinalis, O, low woods, 7, Fl, HQ; 577. *V. peregrina, A, old field, 4, Fl, FE, HQ; 106.

SIMAROUBACEAE: *Ailanthus altissima, C, mixed woods, 7, Fl, HQ; 1430.

SOLANACEAE: *Datura stramonium, O, field edge, 7, Fl, FE; 1027. *Lycium halimifolium, U, roadside ditch, 7; 1506. **Physalis pubescens var. grisea, U, grassy area, 4, HQ; 427. *P. virginiana, O, barnlot, 5a, Fl; 1168. *Solanum americanum, U, James R. bank, 5a, Fl, FE, HQ; 1541. S. carolinense, C, roadside, 5a, Fl, FE, HQ; 372.

STAPHYLEACEAE: *Staphylea trifolia, O, wooded ravine on James R., 5a, Fl; 573.

TILIACEAE: ***Tilia floridana, U, bluffs above James R., 5c; 285.

ULMACEAE: *Celtis occidentalis, O, rock outcrop, 5a, Fl, FE; 873. *Ulmus alata, U, low woods, 5c; 244. *U. americana, O, James R. bank, 5a, Fl, FE; 56. *U. rubra, O, mixed pine-deciduous woods, 5a, Fl, HQ; 14.

URTICACEAE: *Boehmeria cylindrica, O, pond edge, 4, Fl, FE; 848. *Laportea canadensis, A, James R. floodplain, 5a, HQ; 1176. *Pilea pumila, O, pond edge, 5a, Fl, HQ; 1577.

VALERIANACEAE: *Valerianella locusta, C, grassy area, 7, FE; 199. *V. umbilicata, O, rock outcrop, 5b; 252a.

VERBENACEAE: *Verbena urticifolia, O, mixed woods, 5a, Fl, FE, HQ; 749.

VIOLACEAE: *Viola affinis, C, creek bank, 5a, FE; 140. *V. arvensis, U, field, 7; 652. *V. cucullata, C, low woods, 5a, Fl; 233. *V. emarginata, C, roadside, 5a, Fl,FE; 153. *V. eriocarpa var. leiocarpa, A, mesic wooded slope, 5a, HQ; 110. V. fimbriatula, C, roadside, 5a, Fl, HQ; 40. *Viola palmata var. palmata, C, mixed woods, 5a, Fl, FE, HQ; 242. V. palmata var. sororia, O, roadside, 5a, Fl; 187. V. palmata var. triloba, U, roadside, 5a, Fl; 154. V. primulifolia, O, roadside, 5a, Fl, HQ; 157. *V. rafinesquii, C, pasture, 7, Fl, FE, HQ; 35. *V. striata, C, James R. floodplain, 5a; 224.

VITACEAE: *Parthenocissus quinquefolia, A, rock outcrop, 4, Fl, FE, HQ; 424. *Vitis aestivalis, O, in trees, 5a, Fl, HQ; 458. *V. baileyana, O, rocky bluff on James R., 5a; 286. *V. cinerea, O, in trees, 5a; 520. *V. labrusca, O, in trees, 6al, Fl; 453. *V. rotundifolia, O, in trees, 5c, FE; 1325. *V. vulpina, A, in tree on James R. floodplain, 5a, Fl, FE; 798.

APPENDIX A

SPECIES FOUND ONLY IN JONES AND MILL CREEK WATERSHED, IN POWHATAN COUNTY

RANGE 1

Cardamine parviflora	*Luzula multiflora*	*Rorippa islandica*
Erysimum cheiranthoides		

RANGE 3a

Carex comosa	*Dulichium arundinaceum*	*Sphenopholis intermedia*
Cyperus ferruginescens	*Scirpus validus*	*Teucrium canadense*

RANGE 4

Agrostis elliottiana	*Eriochloa gracilis*	*Potamogeton diversifolius*
Carex physorhyncha	*Hydrocotyle ranunculoides*	*Sagittaria latifolia*
Commelina erecta	*Nymphaea odorata*	*Scleria oligantha*
Desmodium glutinosum	*Panicum sphaerocarpon*	*Scutellaria ovata*
Eragrostis hypnoides	*Paspalum fluitans*	*Silene antirrhina*

APPENDIX A con't.

RANGE 5a

Acer saccharinum
Agastache nepetoides
Andropogon ternarius
Antennaria solitaria
Aristida curtissii
Asclepias amplexicaulis
Athyrium thelyperioides
Aureolaria pectinata
Carex howei
C. leavenworthii
C. muhlenbergii
Cassia marilandica
Centrosema virginianum
Chaerophyllum procumbens
Corydalis flavula
Crotonopsis elliptica
Cuscuta gronovii
Cyperus filiculmis
Cystopteris protrusa
Dicentra canadensis
Ellisia nyctelea
Erianthus alopecuroides
Erigeron philadelphicus
Erythronium americanum
Eupatorium purpureum
E. sessilifolium
Euphorbia obtusata
Gratiola viscidula
Habenaria flava
Helianthus annuus
H. mollis
Houstonia longifolia
Hypericum prolificum
H. stragalum
H. virginicum
Hydrophyllum canadense
Iris cristata
Isanthus brachiatus
Jeffersonia diphylla
Lechea tenuifolia
Lilium superbum
Lobelia siphilitica
Melanthium virginicum
Mimulus alatus
Myosotis macrosperma
Nemophila microcalyx
Opuntia compressa
Paspalum pubescens
Peltandra virginica
Phlox divaricata
Poa sylvestris
Ranunculus micranthus
Rhus vernix
Rudbeckia triloba
Ruellia purshiana
Scrophularia marilandica
Selaginella rupestris
Sicyos angulatus
Sporobolus vaginiflorus
Tradescantia virginiana
Triosteum perfoliatum
Uniola latifolia
Utricularia biflora
Viola striata
Vitis baileyana
V. cinerea

APPENDIX A con't.

RANGE 5b

Carex albursina

C. gracillima

C. grayi

C. squarrosa

Lilium canadense

Lysimachia terrestris

Valerianella umbilicata

RANGE 5c

Iresine rhizomatosa

Tilia floridana

Ulmus alata

RANGE 5e

Gratiola pilosa

Hypericum walteri

Ilex decidua

Itea virginica

Paspalum floridanum

RANGE 6a1

Arenaria groenlandica

Phacelia dubia

Talinum teretifolium

RANGE 6b

Thalictrum polygamum

RANGE 6c

Matelea suberosa

APPENDIX A con't.

RANGE 7

Abutilon theophrastii

Ajuga reptans

Alliaria petiolata

Allium cepa

Artemisia annua

Centaurea cyanus

Conium maculatum

Crotalaria mucronata

Cynodon dactylon

Dianthus prolifer

Egeria densa

Eragrostis pilosa

Geranium molle

Hibiscus syriacus

Humulus japonicus

Iris pseudacorus

Kickxia elatine

Lathyrus hirsutus

Ligustrum obtusifolium

Lychnis coronaria

Lycium halimifolium

Microstegium vimineum

Papaver dubium

Poa trivialis

Polygonum hydropiper

Portulaca grandiflora

P. oleracea

Raphanus raphanistrum

Sedum sarmentosum

Silene cucubalus

Teesdalia nudicaulis

Thlaspi arvense

Veronica agrestis

V. hederaefolia

Vicia hirsuta

Viola arvensis

RANGE 8

Cyperus aristatus

Juncus bufonius

APPENDIX B

SPECIES FOUND ONLY IN THE KENT BRANCH WATERSHED, IN FLUVANNA COUNTY (Diggs 1976)

RANGE 1

Acorus calamus	Equisetum hyemale	Festuca rubra

RANGE 3a

Carex scoparia	Comandra umbellata

RANGE 4

Aralia racemosa	Muhlenbergia capillaris	Spiranthes vernalis
Artemisia ludoviciana	Rhynchospora microcephala	

RANGE 5a

Agalinis tenuifolia	Aster dumosus	C. retroflexa
Aletris farinosa	A. simplex	C. stricta
Aristida longespica	Campanula aparinoides	C. styloflexa
A. purpurascens	Carex festucacea	Chamaelirium luteum
Asclepias purpurascens	C. incomperta	Crataegus uniflora

APPENDIX B con't.

RANGE 5a con't.

Crotalaria sagittalis
Elymus riparius
Helenium autumnale
Juncus platyphyllus
J. scirpoides
Krigia dandelion
Lespedeza capitata
Mimulus ringens
Monarda punctata
Oenothera fruticosa
Paspalum setaceum
Phyllanthus caroliniensis
Phlox carolina
P. paniculata
Physalis heterophylla
Physocarpus opulifolius
Polygala sanguinea
P. verticillata
Prunus angustifolia
Quercus bicolor
Q. palustris
Rudbeckia fulgida
Solanum rostratum
Thalictrum revolutum
Uvularia sessilifolia
Verbena simplex
Zizia aptera

RANGE 5b

Amelanchier spicata
Calystegia spithamaea
Carex annectans
C. laxiculmis
C. projecta
Hydrocotyle americana
Saxifraga pensylvanica

RANGE 5c

Carex flaccosperma
Houstonia pusilla
Wisteria frutescens

RANGE 5e

Aristida lanosa
Gymnopogon ambiguus

APPENDIX B con't.

RANGE 6a1

Agalinis obtusifolia

Sporobolus clandestinus

Xanthorhiza simplicissima

Penstemon laevigatus

RANGE 6a2

Rhynchospora chalarocephala

RANGE 6b

Cassia hebecarpa

RANGE 6c

Coreopsis auriculata

Polygala curtissii

RANGE 7

Agropyron repens

Chondrilla juncea

Convolvulus arvensis

Eragrostis cilianensis

Lathyrus latifolius

Lysimachia nummularia

Mentha piperita

Sedum spectabile

Spiraea prunifolia

Stellaria graminea

Tragopogon porrifolius

Trifolium agrarium

Triticum aestivum

APPENDIX B con't.

RANGE 8

Cyperus esculentus *Fimbristylis dichotoma*

APPENDIX C

SPECIES FOUND ONLY AT FT. EUSTIS,

IN NEWPORT NEWS (Appler 1974)

RANGE 1

Mentha arvensis *Myosurus minimus* *Ranunculus sceleratus*

RANGE 2

Aneilema keisak

RANGE 3a

Carex umbellata *Plantago heterophylla*

RANGE 3b

Draba brachycarpa

RANGE 4

Allium bivalve *Baccharis halimifolia* *Cenchrus tribuloides*

Azolla caroliniana *Callicarpa americana* *Cyperus pseudovegetus*

APPENDIX C con't.

RANGE 4 con't.

Eleocharis rostellata
Eupatorium serotinum
Hydrocotyle umbellata
H. verticillata
Kosteletskya virginica
Leptochloa fascicularis
Melothria pendula
Myrica cerifera
Myriophyllum pinnatum
Oldenlandia uniflora
Panicum agrostoides
Pluchea foetida
P. purpurascens
Proserpinaca palustris
Sabatia stellaris
Sacciolepis striata
Sagittaria falcata
Samolus parviflorus
Scirpus robustus
Setaria magna
Solidago sempervirens
Utricularia gibba
Wolffia punctata
Wolffiella floridana

RANGE 5a

Acalypha virginica
Allium canadense
Anisostichus capreolata
Bidens discoidea
Carex digitalis
C. emmonsii
C. striatula
C. typhina
Cynanchum laeve
Decodon verticillatus
Desmodium pauciflorum
Euphorbia supina
Gaylussacia frondosa
Isotria verticillata
Juncus canadensis
Luzula acuminata
Malus angustifolia
Pluchea camphorata
Pontederia cordata
Rhynchospora corniculata
Rumex verticillatus
Strophostyles helvola
Woodwardia virginica

RANGE 5c

Galium uniflorum
Juncus repens
J. roemerianus
Magnolia grandiflora
Verbesina virginica

APPENDIX C con't.

RANGE 5d

Carex hyalinolepis

RANGE 5e

Aster subulatus	*Lythrum lineare*	*Smilax laurifolia*
Carduus spinosissimus	*Persea borbonia*	*Solidago fistulosa*
Carex abscondita	*Polygonum densiflorum*	*S. microcephala*
C. gigantea	*Ptilimnium capillaceum*	*Spartina alterniflora*
C. joorii	*Quercus michauxii*	*S. cynosuroides*
Elephantopus nudatus	*Q. nigra*	*Symplocos tinctoria*
Iva frutescens	*Rhynchospora inexpansa*	*Taxodium distichum*

RANGE 6a2

Amaranthus cannabinus	*Aster tenuifolius*	*Lilaeopsis chinensis*
Amelanchier canadensis		

RANGE 6c

Dryopteris celsa	*Galax aphylla*	*Rhexia ventricosa*

APPENDIX C con't.

RANGE 7

Anthemis cotula
Chamaecyparis pisifera
Clematis dioscoreifolia
Coronopus didymus
Crepis japonica
C. pulchra
Cynosurus echinatus
Cyperus iria
Elaeagnus pungens
Foeniculum vulgare
Geranium dissectum
Hedera helix
Lespedeza bicolor
Lotus corniculatus
Lycopus europaeus
Maclura pomifera
Melia azedarach
Mentha spicata
Morus alba
Nasturtium officinale
Phyllostachys aurea
Polypogon monspeliensis
Prunus cerasus
Rumex conglomeratus
Spergularia marina
Verbena brasiliensis
Veronica anagallis-aquatica
V. persica
Weigelia japonica

RANGE 8

Cyperus odoratus
Scirpus americanus
Typha angustifolia

APPENDIX D

SPECIES FOUND ONLY IN HONE QUARRY, IN ROCKINGHAM COUNTY (Roe 1977)

RANGE 1

Asplenium trichomanes

Circaea alpina

Goodyera repens

RANGE 2

Lycopus uniflorus

RANGE 3a

Aralia nudicaulis

Aster laevis

Carex nigromarginata

Corylus cornuta

Elodea nuttallii

Melampyrum lineare

Parietaria pensylvanica

Ribes lacustre

Sambucus pubens

Scrophularia lanceolata

Viola macloskeyi

RANGE 3b

Geranium bicknellii

Veratrum viride

APPENDIX D con't.

RANGE 4

Corallorhiza maculata

Cuscuta pentagona

Houstonia tenuifolia

RANGE 5a

Acer pensylvanicum
A. spicatum
Actaea pachypoda
Allium cernuum
Aquilegia canadensis
Asclepias quadrifolia
Asplenium rhizophyllum
Aster macrophyllus
Betula lutea
Campanula americana
Carya ovata
Caulophyllum thalictroides
Comptonia peregrina
Cornus alternifolia
C. obliqua
Crataegus coccinea
C. flabellata
C. phaenopyrum
Galium concinnum
Gaultheria procumbens
Gentiana quinquefolia
Habenaria psycodes
Hydrophyllum virginianum
Juglans cinerea
Juncus secundus
Lathyrus venosus
Lysimachia lanceolata
Magnolia acuminata
Maianthemum canadense
Mitella diphylla
Monarda clinopodia
Muhlenbergia frondosa
M. tenuiflora
Oenothera tetragona
Osmorhiza longistylis
Panax quinquefolium
Panicum latifolium
P. philadelphicum
Paronychia canadensis
Polygala paucifolia
Polygonatum pubescens
Prunus pensylvanica
Sedum telephioides
Sorbus americana
Stenanthium gramineum
Tilia americana
T. heterophylla
Viola blanda
V. canadensis
V. papilionacea
V. pubescens

APPENDIX D con't.

RANGE 5b

Agastache scrophulariaefolia

Aster prenanthoides

Carex scabrata

C. virescens

Clematis verticillaris

Rhododendron roseum

Rhus typhina

RANGE 5e

Trillium pusillum

RANGE 6a1

Anemone lancifolia

Antennaria virginica

Aristolochia macrophylla

Aster acuminatus

Betula lenta

Disporum lanuginosum

Heuchera pubescens

Hieracium paniculatum

Ilex ambigua

Menziesia pilosa

Pinus rigida

P. pungens

Rubus odoratus

Solidago arguta

Trillium erectum

Viola hastata

V. rostrata

V. rotundifolia

Xerophyllum asphodeloides

RANGE 6b

Angelica triquinata

Calamagrostis porteri

Ranunculus allegheniensis

Ribes rotundifolia

APPENDIX D con't.

RANGE 6c

Anemone minima

Campanula divaricata

Pieris floribunda

Robinia hispida

Solidago curtisii

S. roanensis

Spiraea betulifolia

Thalictrum coriaceum

RANGE 7

Abies fraseri

Arrhenatherum elatius

Carduus acanthoides

C. arvensis

C. nutans

Dipsacus sylvestris

Epipactis helleborine

Festuca pratensis

Galinsoga parviflora

Geranium columbinum

Lactuca saligna

Nepeta cataria

Picea abies

Pinus resinosa

Potentilla argentea

P. intermedia

Ranunculus acris

Rubus phoenicolasius

Taraxacum erythrospermum

Trifolium hybridum

Tussilago farfara

RANGE 8

Cystopteris fragilis

Deschampsia flexuosa

Oxalis corniculata

APPENDIX E

SPECIES FOUND ONLY IN KENT BRANCH WATERSHED, FLUVANNA COUNTY (Diggs 1976) AND HONE QUARRY, ROCKINGHAM COUNTY (Roe 1977)

RANGE 2

Osmunda claytoniana

RANGE 3a

Cardamine pensylvanica

RANGE 4

Pedicularis canadensis

RANGE 5a

Amianthium muscaetoxicum
Aruncus dioicus
Bidens polylepis
Carya glabra
Dryopteris intermedia
Hamamelis virginiana
Helianthus divaricatus
Heliopsis helianthoides
Lespedeza hirta
Lyonia ligustrina
Muhlenbergia sylvatica
Panicum depauperatum
Pinus strobus
Polygonum scandens
Salix sericea
Scirpus atrovirens
Spiranthes cernua
Thaspium trifoliatum
Tsuga canadensis
Vicia caroliniana
Viola pedata
V. sagittata

APPENDIX E con't.

RANGE 5b

Sisyrinchium mucronatum

RANGE 6a1

Aureolaria laevigata
Cuphea viscosissima
Gillenia trifoliata
Iris verna
Quercus ilicifolia

RANGE 6a2

Carduus pumilus

RANGE 7

Bromus tectorum
Cerastium holosteoides
Hieracium pilosella
H. pratense
Holcus lanatus
Malus pumila
Phleum pratense
Tragopogon dubius
Veronica serpyllifolia

APPENDIX F

SPECIES FOUND ONLY IN HONE QUARRY, ROCKINGHAM COUNTY (Roe 1977) AND AT FT. EUSTIS, NEWPORT NEWS (Appler 1974)

RANGE 4

Panicum virgatum

RANGE 5a

Acer saccharum

Epigaea repens

RANGE 8

Equisetum arvense

APPENDIX G

SPECIES FOUND ONLY IN KENT BRANCH WATERSHED, FLUVANNA COUNTY (Diggs 1976) AND AT FT. EUSTIS, NEWPORT NEWS (Appler 1974)

RANGE 1

Leersia oryzoides

RANGE 4

Eleocharis quadrangulata	*Erianthus giganteus*	*Rotala ramosior*

RANGE 5a

Bartonia virginica	*Desmodium viridiflorum*	*Sorbus arbutifolia*
Cacalia atriplicifolia	*Rubus argutus*	*Valerianella radiata*

RANGE 5e

Eupatorium aromaticum	*Strophostyles umbellata*	*Uniola laxa*

APPENDIX G con't.

<u>RANGE 7</u>

Bromus commutatus | *Narcissus pseudo-narcissus* | *Ornithogalum umbellatum*

<u>RANGE 8</u>

Cyperus flavescens | *C. tenuifolius*

APPENDIX H

SPECIES FOUND ONLY IN KENT BRANCH WATERSHED, FLUVANNA COUNTY (Diggs 1976)

AND IN HONE QUARRY, ROCKINGHAM COUNTY (Roe 1977)

AND AT FT. EUSTIS, NEWPORT NEWS (Appler 1974)

RANGE 3a

Panicum lanuginosum

RANGE 4

Lindernia anagallidea

RANGE 5a

Andropogon virginicus	*Lespedeza intermedia*	*Potentilla simplex*
Erigeron pulchellus	*Oenothera biennis*	

RANGE 5e

Aster vimineus

RANGE 6a1

Solidago puberula

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