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The vascular flora of Powhatan County, Virginia

Michael Austin Terry

ABSTRACT

Between August 2003 and May 2005, a floristic inventory of Powhatan County, Virginia was conducted. The goal was to produce a thorough vascular plant inventory for this largely rural county currently experiencing exurban development pressure. Plant life throughout most of the county is supported by heavy clay soils weathered from metamorphic and igneous rocks of Proterozoic to Paleozoic age and dissected by the James and Appomattox Rivers; in addition, Triassic basins occur in the eastern portion of the county. Commercial forest (mostly pine) occupies 75% of the land area and natural vegetation in the county includes various hardwood communities. The annotated checklist is based on new field collections supplemented with records from regional herbarium collections and the Atlas of the Virginia Flora. Field work sampled habitats consistent with at least 12 distinct community groups recognized in Virginia. The checklst contains 1021 taxa, representing 515 genera, and 149 families. Eighteen percent of the species are naturalized introductions. Sixteen newly collected specimens (1.5% of the total) represent rare plants on Virginia's watch lists, and 122 collections (11% of the total) represent new records for Powhatan including one state record.

THE VASCULAR FLORA OF POWHATAN COUNTY, VIRGINIA

BY

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Introduction

Floristic inventories provide baseline data for botanists, plant taxonomists, conservation biologists, wildlife biologists, and ecologists. As vegetation of a region is explored, plant specimens are deposited in herbaria, thus providing documentation of plant diversity within an area. Further, as collections accumulate across broad regions, herbarium records reveal the overall geographic distribution of plant species. Also, floristic inventories often include ecological analyses of the plant life in terms of community types and relationships of individual species to the biota at large. Both regional and nationwide biodiversity projects, e.g., The Flora of Virginia (Weakley, 2002), the Virginia Department of Natural Heritage's classification of ecological communities (Fleming et al. 2004), and NatureServe (2005), benefit from the addition of information provided by floristic inventories. It is necessary to continue to update and revise regional checklists for two reasons: species composition within any given region changes over time and, further, as the discipline of plant systematics matures, accepted names of species and their classification in higher taxa also change.

Theoretically, one may reasonably expect the distribution of plant species and plant communities across the landscape to be determined by biotic and abiotic factors of the natural environment. Ideally, then, studies of plant diversity or plant community composition could or should be approached within the limits of biologically meaningful boundaries. From a practical perspective, however, there are many reasons to adopt arbitrary political boundaries for such studies. For example, naturally defined floristic

regions can be enormous; discovery and enumeration of all plant taxa within a broad region such as the piedmont of eastern North America would be a Herculean task. Likewise, the geographic ranges for many species are extensive, covering huge areas; few experts can devote the time and energy necessary to study their taxonomic specialties in the field throughout their full geographic extent. Thus, plant systematists and plant ecologists have come to rely on the gradual accumulation of data derived from manageable regional studies. The county (or its equivalent) serves as a convenient geographic unit for such studies. The plant species of a county and its ecological characteristics can be revealed reasonably well after just a few field seasons. Counties have thus become a standard unit in recording plant distributions in monographic and revisionary studies. For example, the Atlas of the Virginia Flora (Harvill et al. 1992, Virginia Botanical Associates 2005) and similar regional atlases map plant distributions by county. Further, county-based surveys provide an important aspect of the professional training of field biologists.

With these considerations in mind, fieldwork began in September of 2003 on a floristic inventory of Powhatan County, Virginia (Figures 1, 2). Powhatan County was chosen because it is within the southern piedmont physiographic province and because it is experiencing rapid growth and loss of habitat. The project was undertaken with three main goals in mind: to provide as current and complete an account as possible of the flora of Powhatan County in the form of an annotated checklist; to integrate the information obtained from the inventory into phytogeographical and ecological generalizations currently being developed for the state of Virginia; and, to report any

significant or anomalous discoveries. There is no previous county-wide inventory of plant diversity for Powhatan County. However, Corcoran (1981) published a list of plants from the Jones and Mill Creek watershed located in the Fine Creek Mills area of northeastern Powhatan.

Geography and Land Use

Powhatan County (Figure 2) is located approximately 35 miles west of the city of Richmond and is bounded on the north by the James River, on the south by the Appomattox River, on the east by Chesterfield County, and on the west by Cumberland County. The county lies entirely within the piedmont physiographic province of Virginia. The vegetation of Powhatan is representative of the piedmont region. Statistics from the United States Department of Agriculture's Soil Conservation Service provide some background on Powhatan and the piedmont province. The piedmont of Virginia represents approximately 41% of the land area of the state. Powhatan has an area of about 272 sq. miles, or 174,000 acres. Commercial forestry and farming have been the main land uses of the county and suburban development from the Richmond metropolitan area is expanding into the county, especially the eastern portion. The highest point in the county is 490 feet above sea level in the north central portion, and the lowest point is about 120 feet above sea level in the easternmost section (United States Department of Agriculture, 1988). The main roadways are US route 60, which in its east-west course, bisects the county, state route 711, which runs east-west in the northern section, and state route 522, which runs north-south between the James River and route 60 (Figure 2).

The terrain in Powhatan is consistent with that of a moderately high plateau, with numerous streams and a large river. The relief is mostly gently to moderately sloping. Powhatan is drained by the James River, the Appomatox River, and their tributaries. Both rivers are part of the James River watershed. Information obtained from the Virginia Department of Forestry (2005) indicates that the James River watershed covers 10, 236 sq. miles of land from the mountains in the western part of Virginia to the Chesapeake Bay east of Richmond. Cultivated crops cover about 9 percent of the county and pasture, about 10 percent. Commercial forest covers at least three-fourths of the county. The largest tracts of contiguous forest (10,000 – 50,000 acres) are found in the northwestern portion along the Cumberland county border, in the northern section along the James River, and in the southern section along the Appomattox River. Most of the forested land is mixed harwood or pine forest (Virginia Department of Forestry 2005).

Geology and Soils

Metamorphic and igneous rocks, including gneiss, schist, and granite underlie about ninety percent of the county (United States Department of Agriculture 1988). Typical of the piedmont, the underlying bedrock is relatively old, having formed in Proterozoic and Paleozoic times. Bedrock for the remaining 10 percent of the county is sedimentary, localized in the eastern section. These sedimentary formations are composed of shale and sandstone that formed during Triassic time when the underlying rock began to sink, in association with rifting that opened the Atlantic Ocean basin. The soils that cover the acidic sandstone and shale commonly have a strongly to very strongly acidic subsoil.

Basic rocks, like some of the gneiss, commonly support a neutral to slightly acidic subsoil. A distinctive granite outcrop exists along Fine Creek near route 711 and Fine Creek Mills (United States Department of Agriculture 1988).

Most of the soils in Powhatan County are in the ultisol order (Flora of North America Editorial Committee 1993). These soils are characterized by their high acidity. The seven general soil associations in the county, as classified in the Soil Survey of Powhatan County (United States Department of Agriculture 1988), can be grouped into three general landscape types: soils on flood plains and terraces, soils on Triassic basin material, and soils on the piedmont plateau. The soils on flood plains and terraces, ranging from sand to clay, were formed from water-deposited sediments and comprise two recognized associations in Powhatan: the Chenneby-Forestdale-Toccoa association and the Turbeville-Dogue-Augusta association. The Chenneby-Forestdale-Toccoa association formed in recent alluvial deposits and is located along flood plains of the James and Appomatox rivers. These soils are characterized by a silty or sandy substratum and are poorly drained and subject to frequent flooding. The Turbeville-Dogue-Augusta association formed in older alluvial deposits and is characterized by clayey or loamy subsoils. These soils are located on high river terraces dissected by drainageways. They are found in the northeastern and northcentral sections of the county along route 711 and in one region near the Maidens Bridge. Vegetation for the majority of this unit is hardwood forest. The soils on Triassic basin material are located exclusively in the eastern part of the survey area and formed in material weathered from sedimentary deposits of sandstone and shale. One Triassic basin soil association is

recognized in the county: Mayodan-Creedmor-Partlow. These soils are characterized by a clayey to loamy subsoil and are generally acidic to strongly acidic. About 10 percent of this unit is in crop or pasture land and the rest is mostly native hardwood forest and residential development. The four remaining soil associations can be categorized as soils of the piedmont plateau. These are: Poindexter-Pacolet-Chewacla, Appling-Enon-Cecil, Cecil-Pacolet-Abell, and Cecil-Appling. They are found throughout the majority of the county and are formed usually on granite, gneiss, and schist, the dominant bedrock of the county (United States Department of Agriculture 1988).

Climate

The United States Department of Agriculture (1988) provides climate information for Powhatan County. The climate of Powhatan is generally mild with warm summers and mild winters. The average temperature in winter is 39 degrees F and the average daily low is 28 degrees F. The average seasonal snowfall is 15.9 inches and 4 days of the year have at least one inch of snow on the ground, on average. The average temperature in summer is 76 degrees with an average daily high of 87. The total annual precipitation is about 43 inches. Fifty-five percent of this falls between April and September. Thunderstorms occur on about 35 days each year, mostly during the summer (United States Department of Agriculture 1988).

Materials and Methods

Field research on the inventory began in September 2003. Permission was granted from two major landowners in Powhatan to collect on their properties. Belmead plantation is located just northwest of the junction of routes 609 and 623 and is under private ownership of the Sisters of the Blessed Sacrament. The property encompasses 1600 acres of varied habitat, including agricultural, oak-hickory forest, and wetlands. The northern boundary of the property is a five-mile stretch of the James River. The Virginia Department of Game and Inland Fisheries operates the Powhatan Wildlife Management Area in the central-western part of the county. Located 3 miles west of the Powhatan courthouse and divided approximately in half by route 60, the property includes 4462 acres of varied habitat. Notable features include many streams, mature and emerging forests, open fields, four ponds, and two lakes. The main water drainage is Sallee creek, which runs north to the James River. In addition, Dr. Ellis West granted permission to collect on his property, which is located in the southwestern corner of the county bordered by the Appomattox River. Other collecting areas included sites accessible to the public, such as the Watkins public boat landing and roadsides in the right-of-way.

The plants were pressed in the field or held temporarily in plastic bags for pressing at a convenient location. Notes concerning location, abundance, ephemeral characters, and associated species were taken in the field accompanying each collection. Field notes form the basis of the specimen labels of the finished herbarium specimens. Each

specimen was identified, numbered, and labeled for deposition in the herbarium of the University of Richmond. Identifications were made consulting Weakley (2002), Flora of North America (1993), Gleason and Cronquist (1991), and Radford, Ahles, and Bell (1964). In addition to new field collections, several regional herbaria were studied in an effort to locate additional plant records from Powhatan County. Using the *Atlas of Virginia Flora* (Harvill, et. al. 1992) and the *Vascular Flora of the Jones and Mill Creek Watershed, Powhatan County, Virginia* (Corcoran 1981) as guides, a list of taxa recorded as occurring in Powhatan but not appearing among collections in the URV herbarium was generated. In this way, collection data for numerous species based on specimens held by Longwood College, Virginia Commonwealth University, and the College of William and Mary were added to the checklist for the county. Distributional records were determined consulting the United States Department of Agriculture's PLANTS database (2005), the Digital Atlas of Virginia Flora (Virginia Botanical Associates 2005), and The Atlas of Virginia Flora (Harvill, et. al., 1992). Conservation status of rare taxa follows Townsend (2005).

Results

The following is an annotated list of the flora of Powhatan County. Families are listed alphabetically under the following headings: Pteridophytes, Gymnosperms, Monocots, and Dicots. Within each family, genera and species are also listed alphabetically. Nomenclature follows Weakley (2002). The list contains 1021 taxa in 515 genera and 149 families.

Entries for species collected by the author include an abbreviation of the community type where the plant was found, in capitals, and an abbreviation describing abundance, in lower case. Abbreviations for community type follow Fleming, et al. (2004):

AF – alluvial forest

AOH – acidic oak-hickory forest

BOH – basic oak-hickory forest

FF – floodplain forest

GF – granite flatrock

MF – basic mesic forest

MHF – mixed hardwood forest

PIP – piedmont prairie

PP – floodplain ponds and pools

SF – swamp forest

SGMB – sand/gravel/mud bars and shores

SI – semipermanent impoundment.

Further, abbreviations of abundance are provided, as follows: a – abundant, , la – locally abundant, c – common, lc – locally common, o – occasional, and r – rare. Entries for specimens collected by the author terminate with the voucher number; all of the author's specimens are deposited in the herbarium at the University of Richmond (URV).

Other entries are based on collections made by other botanists. Descriptions of abundance and community type are not given for specimens made by others. For these entries, the species name is followed by the collector's name, voucher number, and the herbarium housing the specimen. Herbaria are abbreviated as follows:

FARM – Longwood College

URV – University of Richmond

VCU – Virginia Commonwealth University

WILLI – William & Mary

The following collectors' names are abbreviated: Celeste M. Corcoran – CMC, Alton M. Harvill – AMH, W. John Hayden – WJH, Miles F. Johnson – MFJ, and Charles E. Stevens – CES. All specimens collected by Harvill and Stevens are at FARM, by Corcoran, at WILLI, by Hayden, at URV, and by Johnson, at VCU.

Checklist entries consisting solely of a species name, i. e., entries without collection/voucher data, are based on records for Powhatan County gleaned from Harvill et. al. (1992). Presumably, voucher specimens exist for Atlas-based records but their locations (herbaria) are presently unknown to the author.

Species names in bold face indicate a county record. An asterisk preceding a species indicates that it is introduced (non-native). If a species is state-listed by the Virginia Natural Heritage Program (Townsend 2005), brackets contain its rank, i. e., S1, S2, etc., following the voucher number.

PTERIDOPHYTES

Aspleniaceae

Asplenium platyneuron (L.) Britton, Sterns, & Poggenberg var. *platyneuron* - MHF, c; 091

Asplenium trichomanes L. – CES 2924

Azollaceae

Azolla caroliniana Willdenow – PP, la; 646

Blechnaceae

Woodwardia virginica (L.) Smith – CES 5729

Woodwardia areolata (L.) Moore - CMC 911

Dennstaedtiaceae

Dennstaedtia punctilobula (Michaux) Moore – CES 8838

Pteridium aquilinum (L.) Kuhn – CES 8828

Dryopteridaceae

Athyrium asplenioides Eaton – BOH, c; 055, 747

Cystopteris sp. – BOH, r; 090

Dryopteris carthusiana (Villars) H. P. Fuchs – CMC 1465

Dryopteris cristata (L.) Gray – CMC 679

Dryopteris marginalis (L.) Gray – CES 2925

Onoclea sensibilis L. var. *sensibilis* – BOH, o; 725

Polystichum acrostichoides (Michaux) Schott – MHF, c; 066, 490

Woodsia obtusa (Sprengel) Torrey ssp. *obtusa* – CES 4902

Equisetaceae

Equisetum arvense L. – BOH, r; 752

Equisetum hyemale L. ssp. *affine* (Engelmann) Calder & R. L. Taylor – CES 8829

Isoetaceae

Isoetes engelmannii A. Braun – BOH, r; 527

Isoetes virginica Pfeifer **[S1?]**

Lycopodiaceae

Diphasiastrum digitatum (Dillenius ex Braun) Holub – AOH, c; 496

Huperzia lucidula (Michaux) Trevisan – MHF, r; 602

Lycopodium hickeyi W. H. Wagner, Beitel, & R. C. Moran – CES 4518 **[S3?]**

Ophioglossaceae

Botrychium biternatum (Savigny) Underwood – BOH, o; 154

Botrychium dissectum Sprengel – CMC 9

Botrychium virginianum (L.) Swartz – MHF, o; 318

Ophioglossum pycnostichum (Fernald) A. & D. Love – MHF, r; 655

Osmundaceae

Osmunda cinnamomea L. – CES 14159

Osmunda regalis L. var. *spectabilis* (Willdenow) Gray – MHF, o; 344

Polypodiaceae

Polypodium virginianum L. – CMC 16

Pteridaceae

Adiantum pedatum L. – FF, o; 653

Selaginellaceae

Selaginella apoda (L.) Spring – BOH, o; 611

Selaginella rupestris (L.) Spring – CES 4900

Thelypteridaceae

Phegopteris hexagonoptera (Michaux) Fee – BOH, c; 059

Thelypteris noveboracensis (L.) Nieuwland – CES 8842

Thelypteris palustris Schott var. *pubescens* (Lawson) Fernald – CES 8840

GYMNOSPERMS

Cupressaceae

Juniperus virginiana L. var. *virginiana* – RD, a; 157

Pinaceae

Pinus strobus L. – RD, r; 554

Pinus taeda L. – CES 1597

Pinus virginiana Miller – RD, a; 577

MONOCOTS

Agavaceae

Yucca filamentosa L. - RD, c; 371

Alismataceae

Alisma subcordatum Rafinesque - SI, c; 441, 623

Sagittaria latifolia Willdenow var. *pubescens* - SI, c; 470

Sagittaria longirostra (Micheli) J. G. Smith

Alliaceae

Allium canadense L. var. ***canadense*** - RD, a; 362, 373

Allium vineale L.

Amaryllidaceae

Narcissus pseudonarcissus L. – RD, o; 755

Araceae

Arisaema dracontium (L.) Schott - FF, o; 300

Arisaema triphyllum (L.) Schott ssp. *triphyllum* - MF, c; 288

Symplocarpos foetidus (L.) Nuttall - CES 4502

Asparagaceae

**Asparagus officinalis* L. - RD, o; 502

Colchicaceae

Uvularia perfoliata L. – BOH, o; 268

Commelinaceae

Commelina communis L.

Commelina diffusa Burmann f. – RD, o; 011

Commelina erecta L. – CES 5657

Commelina virginica L. – AMH 31390

****Murdannia keisak*** (Hasskarl) Handel-Mazzetti – BOH, c; 040

Tradescantia virginiana L. – CMC 479

Convallariaceae

Maianthemum racemosum (L.) Link ssp. *racemosum* – BOH, o; 245

Polygonatum biflorum (Walter) Ell. var. *biflorum* – BOH, c; 291

Polygonatum biflorum (Walter) Ell. var. *commutatum* (J.A. & J.H. Schultes) Morong – BOH, o; 364

Cyperaceae

Bulbostylis capillaris (L.) Kunth ex C. B. Clarke – RD, o; 080, 630, 639

Carex abscondita Mackenzie – BOH, o; 451

Carex albicans Willdenow ex Sprengel – AOH, c; 192

Carex albolutescens Schweinitz – AMH 4969

Carex albursina Sheldon – CMC 232

Carex amphibola Steudel – CES 4919

Carex blanda Dewey – BOH, o; 190

Carex bromoides Willdenow ssp. ***bromoides*** – BOH, o; 392

Carex brunnescens (Persoon) Poiret var. ***sphaerostachya*** – RD, o; 225 **[SU]**

Carex caroliniana Schweinitz – BOH, c; 391, 410, 424, 745

Carex cephalophora Muhlenberg ex Willdenow – CMC 490

Carex comosa Boott – PP, o; 440

Carex complanata Torrey & Hooker – CES 4968

Carex conoidea Schkuhr ex Willdenow – BOH, o; 393, 487, 489 **[S1S2]**

Carex crinita Lamarck – SI, c; 473

Carex debilis Michaux – AMH 31339

Carex festucacea Schkuhr ex Willdenow – RD, o; 296, 461

Carex flaccosperma Dewey – CES 4971

Carex frankii Kunth – PP, o; 428

Carex gracilescens Steudel – BOH, c; 297, 450, 452, 455

Carex gracillima Schweinitz – CES 4918

Carex grayi Carey – BOH, c; 415

Carex intumescens Rudge – CES 4921

Carex laevivaginata (Kukenthal) Mackenzie – SI, c; 382

Carex leavenworthii Dewey – BOH, r; 387

Carex lupulina Muhlenberg ex Willdenow – PP, c; 439

Carex lurida Wahlenberg – PP, c; 429

Carex platyphylla Carey – CES 14147

Carex prasina Wahlenberg – CMC 591

Carex rosea Schkur ex Willdenow – CES 4916

Carex scoparia Schkur ex Willdenow var. *scoparia* – AMH 42110

Carex sparganioides Willdenow

Carex squarrosa L. – CES 4920

Carex stipata Muhlenberg ex Willdenow var. *stipata* – PP, c; 427

*Carex st*ricta Lamarck – AMH 31340

Carex swanii (Fernald) Mackenzie – RD, c; 485, 486, 499, 517

Carex tribuloides Wahlenberg – BOH, o; 390

Carex typhina Michaux – FF, o; 334

Carex vulpinoidea Michaux – AMH 4948

Cyperus bipartitus Torrey – AMH 38558

Cyperus croceus Vahl – BOH, c; 400

Cyperus echinatus (L.) Wood – RD, c; 467, 572, 590

Cyperus erythrorhizos Muhlenberg – SI, la; 728

Cyperus filiculmis Vahl – RD, c; 651

Cyperus flavescens L. – RD, o; 737

Cyperus hystricinus Fernald – RD, c; 413

Cyperus iria L. – RD, c; 107

Cyperus lancastriensis Porter – RD, c; 608

Cyperus odoratus L. – CMC 1302

Cyperus pseudovegetus Steudel – CES 5707

Cyperus retrofractus (L.) Torrey – RD, o; 609

Cyperus squarrosus L. – SGMB, o; 687

Cyperus strigosus L. – RD, c; 028, 573, 586, 593, 632, 678, 727

Dulichium arundinaceum (L.) Britton – Carol A. Kegley 60 (FARM)

Eleocharis acicularis (L.) Roemer & J.A. Schultes – SI, o; 657, 723

Eleocharis engelmannii Steudel – RD, o; 570, 571

Eleocharis microcarpa Torrey – PP, r; 442

Eleocharis obtusa (Willd.) Schultes – RD, c; 025, 123, 159

Eleocharis tenuis (Willdenow) Schultes

Fimbristylis autumnalis (L.) Roemer & Schultes – RD, c; 044, 613, 633

Fimbristylis dichotoma (L.) Vahl. – RD, o; 079

Killinga pumila Michaux – SI, la; 729

Rhynchospora capitellata (Michaux) Vahl – RD, c; 544, 610, 637

Rhynchospora globularis (Chapman) Small var. ***globularis*** – RD, r; 739

Schoenoplectus purshianus (Fernald) M.T. Strong – WJH 2541

Schoenoplectus tabernaemontani (C. C. Gmelin) Palla – CES 4925

Scirpus cyperinus (L.) Kunth – RD, o; 507

Scirpus georgianus Harper – RD, c; 332, 497, 534, 592

Scirpus polyphyllus Vahl – CMC 931

Scleria ciliata Michaux var. ***ciliata*** – RD, r; 743 **[S1]**

Scleria oligantha Michaux – RD, c; 468, 519

Scleria pauciflora Muhlenberg ex Willdenow var. ***pauciflora*** – MHF, o; 043, 620

Dioscoreaceae

Dioscorea villosa L. – MFJ 3592

Hemerocallidaceae

**Hemerocallis fulva* (L.) L. – RD, c; 328

Hyacinthaceae

****Hyacinthus orientalis*** L. – RD, r; 167

**Muscari neglectum* Gussoni ex Tenore – CMC 237

**Ornithogalum umbellatum* L.

Hydrocharitaceae

**Egeria densa* Planchon – CMC 723

Elodea canadensis Michaux – SGMB, c; 688

Hypoxidaceae

Hypoxis hirsuta (L.) Coville – RD, c; 243

Iridaceae

Iris cristata Aiton – CES 14146

****Iris germanica*** L. – RD, r; 401

****Iris sibirica*** L. – RD, r; 556

Iris virgnica L. – BOH, r; 765

Sisyrinchium angustifolium Miller – CMC 439

Sisyrinchium fuscatum Bicknell – AOH, r; 366 **[S3]**

Sisyrinchium mucronatum Michaux – RD, c; 240, 303, 460

Juncaceae

Juncus acuminatus Michaux – SI, a; 385, 591, 697

Juncus biflorus Elliot – AOH, o; 543, 567

Juncus bufonius L. var. *bufonius* – CMC 631

Juncus canadensis J. Gay ex Laharpe – Brad Meredith 7536 (VCU)

Juncus coriaceus MacKenzie – AOH, c; 418, 541, 582

Juncus dichotomous Elliot – RD, o; 587

Juncus effusus L. – MFJ 4788

Juncus scirpoides Lamarck var. *scirpoides* – AOH, c; 542, 589, 679

Juncus secundus Beauvois ex Poiret – RD, r; 638, 753

Juncus tenuis Willdenow – RD, c; 501, 513, 564

Luzula bulbosa (Wood) Smyth & Smyth – RD, o; 270

Luzula echinata (Small) Herrmann – BOH, c; 166

Luzula multiflora (Retzius) Lej. – RD, c; 189

Lemnaceae

Lemna minuta Kunth – PP, la; 443, 642 **[SU]**

**Spirodella polyrrhiza* (L.) Schleiden – PP, o; 444, 643

Wolffia borealis (Engelmann ex Hegelmann) Landolt ex Landolt & Willdi – PP, o; 644

Liliaceae

Erythronium americanum Ker-Gawler ssp. *americanum* – CES 4504

Lilium canadense L. – CMC 593a

Lilium superbum L. – CMC 1005

Medeola virginiana L. – MHF, lc; 673

Melanthiaceae

Chamaelirium luteum (L.) A. Gray – MHF, r; 763

Veratrum virginicum (L.) Aiton

Najadaceae

Najas minor Allioni – SI, o; 669

Orchidaceae

Aplectrum hyemale (Muhlenberg ex Willdenow) Torrey – BOH, r; 748

Corallorhiza odontorhiza (Willdenow) Nuttall – CMC 1459

Cypripedium acaule Aiton – AOH, r; 260

Galearis spectabilis (L.) Raf. – BOH, r; 210

Goodyera pubescens (Willdenow) Brown ex Aiton – MHF, c; 316

Liparis liliifolia (L.) Richard ex Ker-Gawler – MHF, o; 315

Malaxis unifolia Michaux – MHF, r; 730

Platanthera ciliaris (L.) Lindl. – CES 5673

Platanthera clavellata (Michaux) Luer – MHF, o; 663

Platanthera flava (L.) Lindl. – CMC 651

Platanthera lacera (Michaux) G. Don – CMC 1476

Spiranthes lacera (Raf.) Raf. var. *gracilis* (Bigelow) Luer – MHF, r; 749

Spiranthes ovalis Lindley var. *erostellata* – CMC 1493

Spiranthes praecox (Walter) S. Watson – RD, c; 676

Spiranthes tuberosa Rafinesque – CMC 1313

Spiranthes vernalis Engelmann & Gray – MFJ 2643

Tipularia discolor (Pursh) Nuttall – RD, o; 325, 607

Poaceae

**Agrostis capillaris* L. – RD, c; 304, 738

Agrostis elliotiana Schultes – CES 4908

Agrostis hyemalis (Walter) Britton, Sterns, & Poggenberg – AMH 37113

Agrostis perennans (Walter) Tuckerman – MHF, o; 675 **[SU]**

Agrostis stolonifera L. var. *stolonifera* – BOH, o; 058

**Aira caryophyllea* L. – CMC 502

**Aira elegantissima* Schur – CMC 524

Alopecurus carolinamus Walter – WJH 4778

**Alopecurus geniculatus* L.

**Alopecurus myosuroides* Hudson

Andropogon gyrans Ashe – RD, c; 101

Andropogon ternarius Michaux var. *ternarius* – CMC 1521

Andropogon virginicus L. var. *virginicus* – RD, c; 098

**Anthoxanthum odoratum* L. – RD, a; 185

Aristida dichotoma Michaux – AMH 38448

Aristida oligantha Michaux – RD, o; 706

**Arrhenatherum elatius* (L.) Presl

**Arthraxon hispidus* (Thunberg) Makino – RD, c; 103, 575

Brachyelytrum erectum (Schreber ex Sprengel) Pallisot de Beauvois – RD, o; 575

**Bromus catharticus* Vahl – RD, c; 231

**Bromus commutatus* Schrader – RD, c; 336

**Bromus japonicus* Thunberg ex Murray – MFJ 2382

Bromus latiglumis (Shear) Hitchcock – BOH, r; 414

Bromus nottowayanus Fernald – AF, r; 394

**Bromus tectorum* L.

Calamagrostis coarctata (Torrey) Eaton – CES 5676

Chasmanthium latifolium (Michaux) Yates – FF, la; 004

Chasmanthium laxum (L.) Yates – RD, o; 594

Cinna arundinacea L. – GF, o; 636, 733

**Cynodon dactylon* (L.) Persoon – AMH 38550

**Dactylis glomerata* L. – RD, c; 220

Danthonia sericea Nuttall

Danthonia spicata (L.) Palisot de Beauvois ex Roemer & J. A. Schultes – RD, c; 257

Dichanthelium acuminatum (Swartz) Gould & Clark – CES 4910

Dichanthelium boscii (Poiret) Gould & Clark – BOH, c; 319, 395

Dichanthelium clandestinum (L.) Gould – CES 5638

Dichanthelium commutatum (Schultes) Gould – RD, c; 181, 256

Dichanthelium depauperatum (Muhlenberg) Gould – RD, o; 650

Dichanthelium dichotomum (L.) Gould var. *ramulosum* (Torrey) LeBlonde – MHF, c; 498, 619

Dichanthelium laxiflorum (Lamarck) Gould – CMC 445

Dichanthelium linearifolium (Scribner) Gould – RD, o; 354

Dichanthelium ravenelii (Scribner & Merrill) Gould – FF, o; 419 **[S3]**

Dichanthelium scoparium (Lamarck) Gould – RD, o; 478, 585

Dichanthelium sphaerocarpon (Elliot) Gould – CMC 887

Dichanthelium strigosum (Muhlenberg) Freckmann var. ***leucoblepharis*** (Trinius) Freckmann – AOH, o; 546, 648

Dichanthelium yadkinense (Ashe) Mohlenbrock – MHF, r; 445 **[SU]**

Digitaria filiformis (L.) Koler var. ***filiformis*** – RD, r; 741

**Digitaria ischaemum* (Schreber) Muhlenberg – RD, a; 550

Digitaria sanguinalis (L.) Scopoli – AMH 40154

**Echinochloa crusgalli* (L.) Beauvois var. *crusgalli* – Brad Meredith 6415 (VCU)

Echinochloa muricata(Beauv.) Fernald var. ***muricata*** – RD, c; 014, 047

**Eleusine indica* (L.) Gaertner – CMC 1407

Elymus hystrix L. var. *hystrix* – BOH, c; 007, 388

Elymus villosus Muhlenberg ex Willdenow var. *villosus* – BOH, r; 412

Elymus virginicus L. var. *virginicus* – PP, o; 515, 516

Eragrostis capillaris (L.) Nees – MFJ 3490

Eragrostis cilianensis (Allioni) Vignolo ex Janchen – SGMB, o; 681

**Eragrostis curvula* (Schrader) Nees – CMC 691

Eragrostis hirsuta (Michaux) Nees – RD, o; 560

Eragrostis hypnoides (Lamarck) Britton, Sterns, & Poggenberg – CMC 1305

***Eragrostis minor** Host – WJH 2426

Eragrostis pilosa (L.) Palisot de Beauvois – RD, c; 682, 708

Eragrostis spectabilis (Pursh) Steudel – RD, c; 010

Erianthus alopecuroides (L.) Elliot – RD, c; 136

Erianthus contortus Baldwin ex Elliot – RD, c; 051, 152

Festuca octoflora Walter

Festuca subverticillata (Persoon) Alexeev – RD, c; 226, 232

Glyceria striata (Lamarck) A.S. Hitchcock var. striata – AOH, o; 261

**Holcus lanatus* L. – MFJ 2403

Hordeum pusillum Nuttall – MFJ 2381

Leersia oryzoides (L.) Swartz – Allan Carter 35(VCU)

Leersia virginica Willdenow – MHF, o; 618

Lolium perenne L. var. *ariotatum* – RD, c; 281

Melica mutica Walter – BOH, c; 205

**Microstegium vimineum* (Trinius) A. Camus – CMC 1582

Muhlenbergia schreberi Gmelin – CMC 1490

Panicum anceps Michaux var. *anceps* – RD, c; 093

Panicum capillare L. – CMC 1251

Panicum dichotimiflorum Michaux var. *dichotimiflorum* – SGMB, c; 133, 683

Panicum rigidulum Bosc. Ex Nees – SI, o; 048, 670

Panicum virgatum L. var. ***virgatum*** – RD, r; 649

Paspalum bifidum (Bertoloni) Nash – SGMB, o; 680 **[SH]**

Paspalum dilitatum Poiret – RD, o; 551

Paspalum floridanum Michaux – RD, a; 105

Paspalum fluitans (Ell.) Kunth – CMC 1540

Paspalum laeve Michaux – RD, o; 561

Paspalum setaceum Michaux – RD, c; 104, 110, 177

**Phleum pratense* L. – MFJ 4051

Piptochaetium avenaceum (L.) Parodi – BOH, o; 283

**Poa annua* L. – RD, a; 275

Poa autumnalis Muhlenberg ex Elliott – FF, o; 234

**Poa bulbosa* L. – AMH 42502

Poa chapmaniana Scribner – RD, o; 253

Poa compressa L. – RD, c; 186

Poa cuspidata Nuttall – SI, o; 169

Poa pratensis L. – RD, c; 215, 407

Poa sylvestris Gray – RD, o; 197

**Poa trivialis* L. – CMC 521

**Schedonorus arundinaceus* (Schreber) Dumontier – RD, c; 320, 712

Schizachyrium scoparium (Michaux) Nash var. *scoparium* (Nash) J. Wipff – PIP, o; 732

Secale cereale L. – RD, o; 276

**Setaria faberi* W. Herrmann – RD, a; 049

**Setaria parviflora* (Poiret) Kerguelen – AMH 34075

**Setaria glauca*(L.) Beauvois – RD, c; 005

**Setaria viridis* (L.) Beauvois – MFJ 3559

Sorghastrum nutans (L.) Nash –AMH 38555

Sorghum bicolor (L.) Moench var. *bicolor* – RD, r; 660

**Sorghum halepense* (L.) Persoon – RD, c; 092

Sphenopholis nitida (Biehler) Scribner – CMC 491

Sphenopholis obtusata (Michaux) Scribner – RD, o; 345

Sporobolus vaginiflorus (Torrey ex A. Gray) Wood – CMC 1605

Torreyochloa pallida (Torrey) Church var. ***pallida*** – BOH, o; 208, 238, 263, 298, 423

Tridens flavus (L.) Hitchcock – RD, a; 052

Tripsacum dactyloides (L.) L. – RD, r; 553

****Triticum aestivum*** L. – RD, o; 274

**Vulpia myuros* (L.) Gmelin – RD, c; 335

Pontederiaceae

Heteranthera dubia (Jacquin) MacMillan – SGMB, la; 690

Heteranthera reniformis Ruiz & Pavon – WJH 3339

Pontederia cordata L. – Phyllis Dugan 135 (VCU)

Potamogetonaceae

Potamogeton diversifolius Rafinesque – Stanford Wells 7646 (VCU)

Potamogeton epihydrus Rafinesque – Mark King 14653 (VCU)

Smilacaceae

Smilax bona-nox L. – BOH, c; 483, 484, 734

Smilax glauca Walter – CMC 357

Smilax herbacea L. – CMC 307

Smilax rotundifolia L. – RD, o; 565

Sparganiaceae

Sparganium americanum Nuttall – SI, lc; 380

Typhaceae

Typha angustifolia L. – Lane Smith 14699 (VCU)

Typha latifolia L. – RD, c; 581

Xyridaceae

Xyris torta Smith – CMC 1620

DICOTS

Acanthaceae

Justicia americana (L.) Vahl - SGMB, la; 692

Ruellia carolinensis (Gmelin) Steudel - RD, c; 402

Ruellia purshiana Fernald

Ruellia strepens L. - AMH 40159

Aceraceae

Acer negundo L. - FF, c; 178

Acer rubrum L. - MFJ 3484

Acer saccharinum L. – CMC 560

Adoxaceae

Viburnum acerifolium L. - AOH, o; 369

Viburnum dentatum L. var. *dentatum* - BOH, c; 338

Viburnum nudum L. – CMC 737

Viburnum prunifolium L. - SF, r; 472

Altingiaceae

Liquidambar styraciflua L. – CMC 1431

Amaranthaceae

Amaranthus hybridus L. - RD, c; 129

Amaranthus spinosus L. - SGMB, o; 685

Iresine rhizomatosa Standley - FF, lc; 001 **[S3]**

Anacardiaceae

Rhus copallinum L. var. *latifolia* Engler - BOH, r; 540

Rhus glabra L. - RD, c; 372

Toxicodendron radicans (L.) Kuntze – CMC 515

Toxicodendron vernix (L.) Kuntze – CMC 710

Annonaceae

Asimina triloba (L.) Dunal - FF, la; 237

Apiaceae

Angelica venenosa (Greenway) Fernald - RD, o; 510

Chaerophyllum procumbens (L.) Crantz var. *procumbens* - AF, c; 233

Chaerophyllum tainturieri Hooker - RD, c; 224

Cicuta maculata L. var. *maculata* - SF, lc; 425

**Conium maculatum* L. - RD, c; 403

Cryptotaenia canadensis (L.) DC - BOH, lc; 521

**Daucus carota* L. - RD, a; 145

Eryngium prostratum DeCandolle

Hydrocotyle ranunculoides L. - PP, c; 549, 751

Osmorhiza claytoni (Michaux) Clarke – CMC 217

Oxypolis rigidior (L.) Rafinesque – CMC 225

Sanicula canadensis L. var. *canadensis* - BOH, c; 446, 601

Sanicula smallii Bicknell - AOH, o; 306

Thaspium barbinode (Michaux) Nuttall – RD, o; 247

Apocynaceae

Ampelamus laevis (Michaux) Krings - SGMB, r; 695

Apocynum cannabinum L. - RD, a; 375

Asclepias amplexicaulis Smith - RD, o; 361

Asclepias incarnata L. ssp. *pulchra* (Ehrhart ex Willdenow) Woodson - SI, o; 691

Asclepias syriaca L. - RD, c; 514

Asclepias tuberosa L. ssp. *tuberosa* - RD, c: 352

Asclepias variegata L. - MHF, r; 324

Asclepias viridiflora Rafinesque - RD, o; 562

Matelea carolinensis (Jacquin) Woodson

Matelea gonocarpa (Walter) Shinners – CMC 1638

Vinca minor L. – RD, r; 754

Aquifoliaceae

Ilex decidua Walter var. *decidua* - BOH, c; 228, 285, 307

Ilex opaca Aiton – CMC 1596

Ilex verticillata (L.) Gray - FF, r; 456

Araliaceae

Aralia spinosa L. - RD, o; 656

Aristolochiaceae

Aristolochia serpentaria L. – CMC 239

Asarum canadense L. - CES 14126

Hexastylis virginica (L.) Small - MHF,c; 599

Asteraceae

**Achillea millefolium* L. var. *occidentalis* - RD, a; 050

Ageratina altissima King & H. E. Robinson var. *altissima* - FF, c; 122

Ageratina aromatica (L.) Spach - MHF, c; 086

Ambrosia artemisiifolia L. - RD, a; 027, 146

Ambrosia bidentata Michaux - RD, r; 111

Ambrosia trifida L. - RD, o; 022

Antennaria plantaginifolia (L.) Richardson - RD, a; 212

Antennaria solitaria Rydberg – CMC 204

Anthemis cotula L. - RD, a; 312

Arctium minus Bernh. – CMC 758

Arnica acaulis (Walter) Britton, Sterns, & Poggenberg - CES 3367

Arnoglossum atriplicifolium (L.) Robinson - RD, o; 464

Artemisia vulgaris L. - WJH 2424

Artemisia annua L. - RD, o; 128

Aster tataricus L. f. - RD, r; 286

Baccharis halimifolia L. - RD, r; 155

Bidens aristosa (Michaux) Britton – CMC 1029

Bidens bipinnata L. - RD, c; 635

Bidens frondosa L. - AMH 38578

Bidens laevis (L.) Britton, Sterns, & Poggenberg - FF, lc; 628

Bidens polylepis Blake - RD, c;109

Bidens tripartita L. - Christina McGregor 47 (VCU)

Brickellia eupatorioides (L.) Shinners

**Carduus nutans* L. - MFJ 4290

**Centaurea biebersteinii* D.C. - RD, r; 505

**Centaurea cyanus* L. - RD, r; 310

Chrysogonum virginianum L. var. *virginianum* - MHF, c; 106

Chrysopsis mariana (L.) Elliot - RD, c; 037

**Cichorium intybus* L. - MFJ 2644

Cirsium discolor (Muhlenberg ex Willdenow) Sprengel - RD, c; 025

Cirsium pumilum (Nuttall) Sprengel - RD, o; 475, 714

**Cirsium vulgare* (Savi) Tenore - RD, o; 476, 715

Conoclinium coelestinum (L.) Augustin de Candolle - RD, c; 024, 094

Conyza candadensis (L.) Cronquist - RD, o; 009

Coreopsis auriculata L. - BOH, r; 417

Coreopsis lanceolata L. - John D. Reynolds 58 (VCU)

Coreopsis verticillata L. - AOH, c; 357

Doellingeria infirma (Michaux) E. Greene – RD, o; 662

Eclipta prostrata (L.) L. - RD, c; 126

Elephantopus carolinianus Willdenow - RD, c; 031

Elephantopus nudatus Gray - MFJ 5131

Elephantopus tomentosus L. - WJH 2412

**Erechtites hieracifolia* (L.) DC - J Morris 17 (VCU)

Erigeron annuus (L.) Persoon - AOH, c; 494

Erigeron philadelphicus L. var. *philadelphicus* - RD, o; 250

Erigeron pulchellus Michaux var. *pulchellus* – BOH, r; 762

Erigeron strigosus Willdenow - MFJ 3609

Eupatoriadelphus fistulosus (Barratt) King & H. E. Robinson - MFJ 4049

Eupatoriadelphus maculatus (L.) King & H. E. Robinson var. ***maculatus*** - FF, r; 020**[S2]**

Eupatoriadelphus purpureus (L.) King & H. E. Robinson CMC 750

Eupatorium album L. – CES 5680

Eupatorium altissimum L. – AMH 38574

Eupatorium capillifolium (Lam.) Small – CMC 1560

Eupatorium godfreyanum Cronquist CMC 1150

Eupatorium hyssopifolium L. – RD, c; 137

Eupatorium mohrii Greene – RD, r; 720

Eupatorium perfoliatum L. – CM Harold 6954 (VCU)

Eupatorium pilosum Walter – MFJ 3582 (WILLI)

Eupatorium rotundifolium L. – CES 5724

Eupatorium serotinum Michaux – FF, o; 021

Eupatorium sessifolium L. var. *sessilifolium* – MHF, r; 666, 667

Eurybia divaricata (L.) Nesom – MHF, c; 085

Euthamia graminifolia (L.) Nuttall – AMH 38580

**Galinsoga quadriradiata* Ruiz & Pavon – CES 14127

Gamochaeta purpurea (L.) Cabrera – RD, c; 130

Helenium flexuosum Rafinesque - CMC 1636

Helianthus atrorubens L. – CMC 1158

Helianthus decapetalus L. – CES 5630

Helianthus giganteus L. – RD, o; 099

Helianthus mollis Lamarck – CMC 1594

Helianthus strumosus L. – CMC 1265

Helianthus tuberosus L. – CMC 1193

Heliopsis helianthoides (L.) Sweet

Hieracium gronovii L. – CES 5681

**Hieracium pilosella* L.

Hieracium scabrum Michaux – RD, o; 717

Hieracium venosum L. – AOH, c; 282

Hypochaeris radicata L. RD, c; 406

Krigia dandelion (L.) Nuttall – MHF, r; 305

Krigia virginica (L.) Willdenow – CES 4905

Lactuca canadensis L. RD, c; 533

Lactuca floridana (L.) Gaertner – MHF, c; 067

Lactuca hirsuta Muhlenberg ex Nuttall – RD, o; 358

Lactuca serriola L. – CMC 1024

**Leucanthemum vulgare* Lamarck – RD, a; 102

Liatris graminifolia Willdenow – RD, c; 115

Liatris squarrosa (L.) Michaux var. *squarrosa* – RD, c; 056, 153

Mikania scandens (L.) Willdenow – RD, o; 580

Packera anonyma (Wood) W.A. Webber & A. Love – RD, o; 698

Packera aurea (L.) A. & D. Love – FF, o; 254

Packera obovata (Muhlenberg ex Willdenow) W.A. Weber & A. Love – CES 2933

Parthenium integrifolium L. var. *integrifolium* – RD, o; 597

Pityopsis aspera (Shuttleworth ex Small) Small var. *adenolepis* (Fernald) Semple & Bowers – AMH 42944

Prenanthes altissima L. – CMC 598

Prenanthes serpentaria Pursh

Pseudognaphalium obtusifolium (L.) Hilliard & Burtt – RD, c; 081 – CMC 1328

Pyrrhopappus carolinianus (Walter) DC – RD, o; 082

Rudbeckia fulgida Aiton – Sussanah L. von Oettingen 309 (WILLI)

Rudbeckia hirta L. – RD, a; 142

Rudbeckia laciniata L. – MFJ 3620

Rudbeckia triloba L. – CMC 943

Sericocarpus asteroides (L.) Britton, Sterns, & Poggenberg – AOH, c; 349, 359, 491

Sericocarpus linifolius (L.) Britton, Sterns, & Poggenberg – CES 5685

Silphium trifoliatum L. – RD, r; 479

Smallanthus uvedalius (L.) Mackenzie ex Small – AF, r; 652

Solidago bicolor L. – RD, o; 116

Solidago caesia L. – MHF, c; 065

Solidago canadensis L. – AMH 38576

Solidago erecta Pursh – RD, c; 117

Solidago flexicaulis L. – CES 14161

Solidago gigantea Aiton – RD, c; 012

Solidago nemoralis Aiton var. *nemoralis* – RD, c; 138, 140

Solidago odora Aiton – CES 5725

Solidago pinetorum Small – RD, c; 139, 719

Solidago rugosa Miller – CMC 1622

**Sonchus asper* (L.) Hill – RD, c; 293

Symphyotrichum concolor (L.) Nesom – RD, c; 118

Symphyotrichum cordifolium (L.) Nesom – CES 14145

Symphyotrichum dumosum (L.) Nesom var. *dumosum* – RD, c; 742

Symphyotrichum grandiflorum (L.) Nesom – AMH 38569

Symphyotrichum lanceolatum (Willdenow) Nesom ssp. *lanceolatum* – MHF, c; 089

Symphyotrichum lateriflorum (L.) Love & Love – CMC 1610

Symphyotrichum patens (Aiton) Nesom – CMC 1592

Symphyotrichum pilosum (Willdenow) Nesom – BOH, o; 064

Symphyotrichum puniceum (L.) Love & Love – CMC 1499

Symphyotrichum undulatum (L.) Nesom – BOH, c; 077, 108

**Taraxacum officinale* G. H. Weber ex Wiggers ssp. *officinale* – RD, a; 758

**Tragopogon dubius* Scopoli – RD, r; 558

**Tussilago farfara* L. – AMH 38577

Verbesina alternifolia (L.) Britton ex Kearney – FF, la; 023

Vernonia glauca (L.) Willdenow – RD, o; 480, 750

Vernonia noveboracensis (L.) Michaux – MHF, o; 658

Xanthium strumarium L. – SGMB, o; 684

Balsaminaceae

Impatiens capensis Meerburg – AF, lc; 070

Impatiens pallida Nuttall

Berberidaceae

Jeffersonia diphylla (L.) Persoon – CMC 293

Podophyllum peltatum L. – D. Doumlele 095 (FARM)

Betulaceae

Alnus serrulata (Aiton) Willdenow – BOH, lc; 075

Betula nigra L. – CMC 1071

Carpinus caroliniana Walter var. *caroliniana* – BOH, c; 073

Corylus americana Walter – BOH, o; 074

Ostrya virginiana (Miller) K. Koch

Bignoniaceae

Campsis radicans (L.) Seemann ex Burcan – RD, c; 531

Catalpa speciosa (Barney) Engelmann

Boraginaceae

**Buglossoides arvensis* (L.) Johnston – RD, c; 172, 200

Cynoglossum virginianum L. var. *virginianum* – BOH, r; 764

**Echium vulgare* L. – MFJ 2535

Hackelia virginiana (L.) Johnston – CMC 1274

Myosotis macrosperma Engellmann – RD, c; 217

Myosotis verna Nuttall – CMC 252b

Brassicaceae

Alliaria petiolata (Bieberstein) Cavar & Grande – MF, a; 216

**Arabidopsis thaliana* (L.) Heynhold – WJH 4780

Arabis canadensis L. – BOH, r; 766

Arabis laevigata (Willdenow) Poiret – CMC 118

**Barbarea verna* (P. Miller) Ascherson – RD, r; 194

**Barbarea vulgaris* Brown – CMC 170

***Brassica juncea* (L.) Czern. – RD, r; 348

***Brassica napus* L. – RD, r; 559

**Calepina irregularis* (Asso) Thellung – WJH 4819

***Camelina sativa* (L.) Crantz – RD, r; 227

**Capsella bursa-pastoris* (L.) Medikus – RD, c; 131

Cardamine bulbosa (Schreber ex Muhlenberg) Britton, Sterns & Poggenberg – BOH, r; 246

Cardamine concatenata (Michaux) Schwartz – BOH, lc; 211

Cardamine hirsuta L. – RD, a; 168, 265

Cardamine parviflora L. – CMC 160

***Diplotaxis muralis* (L.) Augustin de Candolle – RD, r; 588

**Draba verna* L. – RD, lc; 171

**Erysimum cheiranthoides* L. – Tabby Henderson 8 (VCU)

**Lepidium campestre* (L.) Brown – MFJ 3315

Lepidium virginicum L. var. *virginicum* – RD, a; 241, 330

***Lunaria rediviva* L. – RD, r; 196

**Microthlaspi perfoliatum* (L.) F.K. Meyer – SGMB, r; 689

***Nasturtium officinale* R. Brown – AOH, r; 459

**Raphanus raphanistrum* L. – MFJ 2563

Rorippa palustris (L.) Besser – SGMB, r; 686

**Sisymbrium officinale* (L.) Scopoli – RD, o; 322

**Teesdalia nudicaulis* (L.) Aiton – RD, o; 258

***Thlaspi alliaceum* L. – WJH 4824

**Thlaspi arvense* L. – CMC 391

Cabombaceae

Brasenia schreberi Gmelin – MFJ 4747

Cactaceae

Opuntia humifusa (Rafinesque) Rafinesque – CMC 1373

Caesalpiniaceae

Cercis canadensis L. var. *canadensis* – BOH, c; 520

Chamaecrista fasciculata (Michaux) Greene var. *fasciculata* – RD, c; 053

Chamaecrista nictitans (L.) Moench var. *nictitans* – RD, o; 038

Gleditsia triacanthos L. – RD, o; 552

***Senna hebecarpa* (Fernald) Irwin & Barneby – RD, r; 659

Senna marilandica (L.) Link

Callitrichaceae

Callitriche heterophylla Pursh – BOH, o; 645

Campanulaceae

Lobelia cardinalis L. – MHF, o; 664

Lobelia glandulosa Walter – BOH, r; 700 **[SU]**

Lobelia inflata L. – RD, c; 147, 518, 600

Lobelia puberula Michaux – RD, o; 736

Lobelia siphilitica L. – CES 14134

Lobelia spicata Lamarck – RD, c; 469, 605

Triodanis perfoliata (L.) Nieuwland – RD, c; 365

Cannabaceae

**Humulus japonicus* Siebold & Zuccarini – FF, la; 002

**Humulus lupulus* L.

Caprifoliaceae

**Lonicera japonica* Thunberg – Louise Miles 6 (VCU)

Lonicera sempervirens L. – Merilynn M. Flynn 150 (FARM)

Symphoricarpos orbiculatus Moench – RD, la; 158

Triosteum perfoliatum L. – CMC 755

Caryophyllaceae

**Agrostemma githago* L. – CMC 478

Cerastium brachypetalum Desportes – RD, c; 272

**Cerastium glomeratum* Thuillier – RD, a; 184, 326

Cerastium nutans Rafinesque – WJH 4799

**Dianthus armeria* L. – RD, c; 353, 482, 538

**Holosteum umbellatum* L. CMC 79

**Lychnis coronaria* (L.) Desrousseaux – CMC 693

Minuartia groenlandica (Retzius) Ostenfeld – CES 4899 **[S1]**

**Petrorhagia prolifer* (L.) Ball & Heywood – CES 5672

Sagina decumbens (Elliot) Torrey & A. Gray – WJH 4140

**Saponaria officinalis* L. – RD, c; 120, 557

**Scleranthus annuus* L. – RD, o; 273

Silene antirrhina L. – RD, r; 351

Silene caroliniana Walter var. *pensylvanica* (Michaux) Fernald – BOH, r; 761

**Silene latifolia* Poiret ssp. *alba* (Miller) Greuter & Burdet RD, o; 097

Silene stellata (L.) Aiton f. – RD, o; 598

Silene virginica L. – RD, o; 239

**Silene vulgaris* (Moench) Garcke – CMC 1135

**Stellaria media* (L.) Villars – RD, c; 267

Stellaria pubera Michaux – BOH, o; 170

Celastraceae

Euonymus americana L. – MHF, a; 057

Celtidaceae

Celtis laevigata Willdenow

Celtis occidentalis L. – RD, o; 003

Chenopodiaceae

**Chenopodium album* L. var. *album* – RD, c; 125

**Chenopodium ambrosioides* L. – RD, c; 124

Cistaceae

Lechea intermedia Leggett ex Britton var. *intermedia* **[S1?]**

Lechea minor L. – AOH, o; 493

Lechea racemulosa Michaux – MFJ 3606

Lechea tenuifolia Michaux – AOH, o; 492

Clethraceae

Clethra alnifolia L. – CES 4943

Clusiaceae

Hypericum canadense L. – CES 5710

Hypericum gentianoides (L.) Britton, Sterns, & Poggenberg – SI, r; 149

Hypericum hypericoides (L.) Crantz – RD, c; 100, 525

Hypericum mutilum L. var. *mutilum* – RD, c; 161

****Hypericum perforatum*** L. – RD, o; 508

Hypericum prolificum L. – BOH, o; 537

Hypericum punctatum Lamarck – RD, o; 488

Hypericum setosum L. CES 5695 **[S1S2]**

Hypericum crux-andreae (L.) Crantz – CES 5702

Triadenum virginicum (L.) Rafinesque – CMC 1136

Triadenum walteri (Gmelin) Gleason – Brad Meredith 7575 (VCU)

Convolvulaceae

**Calystegia sepium* (L.) Brown – RD, a; 566

Calystegia spithamaea (L.) Pursh – Merilynn M. Flynn 5/11/68, no # (FARM)

**Ipomoea hederacea* Jacquin – CMC 954

Ipomoea lacunosa L. – AMH 40162

Ipomoea pandurata (L.) Meyer – CMC 871

**Ipomoea purpurea* L. – RD, c; 096

Cornaceae

Cornus amomum Miller – SI, c; 376

Cornus florida L. – MHF, c; 405

Crassulaceae

**Sedum sarmentosum* Bunge – CMC 454

Sedum ternatum Michaux – BOH, la, 321

Cucurbitaceae

Melothria pendula L. – CES 5641

Sicyos angulatus L. – CMC 1411

Cuscutaceae

Cuscuta compacta Antoine Laurent de Jussieau ex Choisy var. *compacta* – CMC 1485

Cuscuta gronovii Willdenow ex J. A. Schultes - AMH 38582

Cuscuta pentagona Engelmann – AMH 38581

Ebenaceae

Diospyros virginiana L. - MFJ 3500

Elaeagnaceae

**Elaeagnus umbellata* Thunberg – RD, a; 029

Ericaceae

Chimaphila maculata (L.) Pursh – MHF, c; 342

Chimaphila umbellata (L.) Barton var. *cisatlantica* – CES 4511

Eubotrys racemosa (L.) Nuttall – CMC 644

Gaylussacia baccata (Wangenheim) K. Koch – CMC 525

Hypopitys monotropa Crantz – AOH, o; 368

Kalmia latifolia L. – CES 14149

Lyonia ligustrina (L.) Augustin de Candolle – AMH 38584

Lyonia mariana (L.) Don – CES 3369

Monotropa uniflora L. – MHF, r; 535

Oxydendrum arboreum (L.) Augustin de Candolle – RD, o; 735

Rhododendron atlanticum (Ashe) Rehder – CES 1813

Rhododendron periclymenoides (Michaux) Shinners – AOH, o; 204

Vaccinium corymbosum L.

Vaccinium fuscatum Aiton – CMC 96

Vaccinium stamineum L. var. *stamineum* – AOH, c; 229, 454

Euphorbiaceae

Acalypha deamii (Weatherby) Ahles – WJH 3577 **[S3]**

Acalypha gracilens Gray – RD, c; 063, 746

Acalypha rhomboidea Rafinesque – RD, c; 062, 134

Acalypha virginica L.

Chamaesyce humistrata (Engelmann) Small – WJH 4052

Chamaesyce maculata (L.) Small – AMH 38586

Chamaesyce nutans (Lagasca y Segura) Small – RD, c; 069, 702

Croton glandulosus L. var. *septentrionalis* Mueller of Aargau – RD, o; 705

Croton willdenowii Webster – GF, o; 640

**Euphorbia cyparissias* L. – RD, r; 180

Euphorbia pubentissima Michaux – AOH, o; 504, 539 **[SU]**

Euphorbia spathulata Lamarck – WJH 4821 **[SU]**

Phyllanthus caroliniensis Walter ssp. *caroliniensis* – RD, o; 703

Fabaceae

Amphicarpaea bracteata (L.) Fernald var. *bracteata* – RD, o; 704

Apios americana Medikus – CMC 1074

Baptisia tinctoria (L.) Ventenat – RD, c; 356

Centrosema virginianum (L.) Bentham – CMC 1267

Clitoria mariana L. – AOH, o; 536

Crotalaria sagittalis L. – RD, c; 578

Cytisus scoparius (L.) Link – Rick Thomas 23 (VCU)

Desmodium canescens (L.) Augustin de Candolle – CMC 900

Desmodium glabellum (Michaux) DC – MHF, c; 026

Desmodium glutinosum (Muhlenberg ex Willdenow) Wood – CMC 771

Desmodium marilandicum (L.) Augustin de Candolle – WJH 2416

Desmodium nudiflorum (L.) Augustin de Candolle – MFJ 3485

Desmodium obtusum (Muhlenberg ex Willdenow) Augustin de Candolle – WJH 2418

Desmodium paniculatum (L.) Augustin de Candolle – CMC 1321

Desmodium rotundifolium Augustin de Candolle – CES 5683

Galactia volubilis (L.) Britton – AOH, c; 548

**Kummerowia stipulacea* (Maximowicz) Makino – CMC 1341a

**Kummerowia striata* (Thunberg) Schindler – RD, c; 033

**Lathyrus hirsutus* L. – RD, o; 396, 568

***Lespedeza bicolor* Turczarinow – RD, o; 054

Lespedeza capitata Michaux – WJH 3399

**Lespedeza cuneata* (Dumont-Cours) G. Don – RD, c; 035

Lespedeza hirta (L.) Hornemann

Lespedeza procumbens Michaux – RD, c; 034

Lespedeza repens (L.) Barton – AOH, o; 547

Lespedeza virginica (L.) Britton – WJH 2419

**Lotus corniculatus* L. – MFJ 2541

**Medicago lupulina* L. – CMC 596

**Medicago sativa* L. – RD, c; 006

**Melilotus albus* Medikus – RD, o; 355, 481

**Melilotus officinalis* (L.) Pallas – CMC 413

**Pueraria montana* (Loureiro) Merritt var. *lobata* (Willdenow) van der Maesen & S. Almeida – CMC 1233

Robinia hispida L. – Merilynn M. Flynn 169 (FARM)

Robinia pseudoaccacia L. – AOH, c; 266

**Securigera varia* (L.) Lassen – RD, a; 404

Strophostyles helvola (L.) Elliott – BOH, o; 060

Strophostyles umbellata (Muhlenberg ex Willdenow) Britton – CES 5686

Stylosanthes biflora (L.) Britton, Sterns, & Poggenberg – RD, o; 421

Tephrosia virginiana (L.) Persoon – AOH, o; 718

**Trifolium arvense* L. – Elsie Borich 26 (VCU)

**Trifolium campestre* Schreber – RD, c; 311

**Trifolium dubium* Sibthorp – CMC 253

**Trifolium hybridum* L. – AMH 42116

**Trifolium pratense* L. – RD, c; 143

**Trifolium repens* L. – RD, c; 144

Vicia caroliniana Walter

**Vicia hirsuta* (L.) S. F. Gray – AMH 37119

**Vicia sativa* L. ssp. *nigra* (L.) Erhart – RD, c; 280

Vicia tetrasperma (L.) Moench. – WJH 4822

**Vicia villosa* Roth ssp. *varia* (Host) Corbiere – RD, c; 503

**Vicia villosa* Roth ssp. *villosa* – RD, o; 377

**Wisteria sinensis* (Sims) de Candolle – RD, c; 289

Fagaceae

Castanea dentata (Marshall) Borkhausen – CMC 841

Castanea pumila (L.) Miller – RD, o; 448

Fagus grandifolia Erhardt var. *caroliniana* (London) Fernald & Rehder – MHF, c; 076

Quercus alba L. – RD, a; 713

Quercus coccinea Muenchhausen – CMC 1429

Quercus falcata Michaux – JRT Moore 21 (VCU)

Quercus imbricaria Michaux – Robert A. S. Wright, no # (FARM)

Quercus lyrata Walter – CES 4942

Quercus marilandica Muenchhausen var. *marilandica* – CES 4934

Quercus michauxii Nuttall – CES 4941

Quercus montana (Willdenow) – CMC 1403

Quercus palustris Muenchhausen – AMH 31398

Quercus phellos L. – MFJ 3470

Quercus prinoides Willdenow – Robert A. S. Wright 2715 (FARM) **[S1]**

Quercus rubra L. – CMC 1553

Quercus stellata Wangenheim – MFJ 3577

Quercus velutina Lamarck – MFJ 3571

Fumariaceae

Corydalis flavula (Rafinesque) de Candolle – RD, o; 177

Dicentra canadensis (Goldie) Walpers – CMC 51

Dicentra cucullaria (L.) Bernhardi

Gentianaceae

Bartonia virginica (L.) Britton, Sterns, & Poggenberg – CES 5674

Obolaria virginica L. – MHF, r; 179

Sabatia angularis (L.) Pursh – RD, o; 606

Geraniaceae

Geranium carolinianum L. var. *carolinianum* – BOH, c; 292

Geranium carolinianum L. var. *confertiflorum* Fernald – RD, c; 249

Geranium maculatum L. – CMC 384

Geranium molle L. – CMC 64

Haloragaceae

**Myriophyllum aquaticum* (Vell.) Verdc. – MFJ 4782

Proserpinaca palustris L. – CES 5728

Hamamelidaceae

Hamamelis virginiana L.

Hydrangeaceae

Hydrangea arborescens L. – CES 14153

Philadephus inodorus L.

Hydrophyllaceae

Ellisea nyctelea (L.) L. – FF, r; 236

Hydrophyllum canadense L. – CMC 797

Nemophilla aphylla (L.) Brummitt – CES 23367

Phacelia dubia (L.) Trelease – CMC 193

Iteaceae

Itea virginica L.

Juglandaceae

Carya alba (L.) Nuttall ex Elliot – WJH 3342

Carya cordiformis (Wangenheim) K. Koch – CMC 1456

Carya ovalis (Wangenheim) Sargent – CMC 1591

Carya ovata (Miller) Koch – AMH 31397

Juglans nigra L. – Rick Thomas 43 (VCU)

Lamiaceae

Agastache nepetoides (L.) Kuntze – CMC 1426

**Ajuga reptans* L. – CMC 161

Blephilia ciliata (L.) Bentham – BOH, r; 457

**Clinopodium calamintha* (L.) Stace – RD, o; 160

Clinopodium vulgare L. – RD, c; 465, 624

Collinsonia canadensis L. – WJH 4214

Cunila origanoides (L.) Britton – AOH, c; 119

**Glechoma hederacea* L. – BOH, a; 163

Hedeoma pulegioides (L.) Persoon – CMC 1040

Lamium album L. ssp. ***album*** – RD, o; 176

**Lamium amplexicaule* L. var. *amplexicaule* RD, a; 193

**Lamium purpureum* L. var. *purpureum* – RD, a; 188

**Leonurus cardiaca* L.

Lycopus americanus Muhlenberg ex W. Barton – CMC 966

Lycopus virginicus L. – SI, o; 017, 674

**Marrubium vulgare* L. – CMC 280

***Mentha x piperita* L. var. *piperita* – RD, o; 042

Monarda fistulosa L. – CMC 904

**Perilla frutescens*(L.) Britton – RD, c; 015

Prunella vulgaris L. var. *lanceolata* – RD, a; 056

Pycnanthemum incanum (L.) Michaux var. *incanum* – RD, c; 087

Pycnanthemum tenuifolium Schrader – RD, c; 341

Salvia lyrata L. – BOH, c; 230

Salvia urticifolia L.

Scutellaria elliptica Muhlenberg ex Sprengel – MHF, c; 343, 350

Scutellaria incana Biehler – RD, r; 595 **[S2]**

Scutellaria integrifolia L. – RD, c; 340, 398

Scutellaria lateriflora L. – FF, o; 625, 696

Scutellaria nervosa Pursh – BOH, r; 767

Scutellaria ovata Hill – CMC 565

Scutellaria parvula Michaux – BOH, r; 458 **[S1]**

Teucrium canadense L. – RD, a; 530, 693

Trichostema brachiatum L.

Trichostema dichotomum L. – RD, c; 078

Lauraceae

Lindera benzoin (L.) Blume var. *benzoin* – AF, la; 162, 411

Sassafras albidum (Nuttall) Nees – RD, o; 409

Lentibulariaceae

Utricularia gibba L. – PP, o; 433

Linaceae

Linum intercursum Bicknell – CES 5705

Linum medium (Planchon) Britton var. *medium* – RD, o; 367

Linum medium var. *texanum* – AOH, o; 495

Linum striatum Walter – RD, o; 596

Lythraceae

Cuphea viscosissima Jacquin

Rotala ramosior (L.) Koehne – RD, c; 574

Magnoliaceae

Liriodendron tulipifera L. – CMC 303

Magnolia virginiana L. – MFJ 3519

Malvaceae

**Abutilon theophrasti* Medikus – RD, o; 716

Hibiscus laevis Allioni – SGMB, r; 677

Hibiscus moschuetos L. ssp. *moschuetos* – PP, la; 437

**Hibiscus syriacus* L. – CMC 1245

**Malva neglecta* Wallroth – RD, r; 278

Sida spinosa L. – MFJ 3575

Tilia americana L. – CES 14151

Melastomataceae

Rhexia mariana L. – CES 5690

Rhexia virginica L. – CES 5689

Menispermaceae

Menispermum canadense L. – MHF, o; 621

Mimosaceae

**Albizia julisbrissin* Durazzini – RD, a; 532

Molluginaceae

Mollugo verticillata L. – RD, c; 127

Moraceae

Maclura pomifera (Rafinesque) C. K. Schneider – WJH 4141

Morus rubra L. – BOH, c; 555

Nymphaeaceae

Nymphaea odorata Aiton ssp. *odorata* – MFJ 4791

Nuphar advena (Aiton) R. Brown ex Aiton – SI, la; 379

Nyssaceae

Nyssa sylvatica Marshall – CMC 736

Oleaceae

Chionanthus virginicus L. – RD, o; 225, 622

Fraxinus americana L. – MFJ 3482

Fraxinus pennsylvanica Marshall – CMC 450

**Ligustrum sinense* Loureiro – RD, c; 156, 329

Onagraceae

Circaea canadensis (L.) Hill – AF, la; 701

Gaura angustifolia Michaux – RD, r; 701

Gaura biennis L. – CMC 1572

Ludwigia alterniflora L. – SI, c; 634

Ludwigia decurrens Walter – SI, c; 071

Ludwigia palustris (L.) Elliot – RD, c; 046

Oenothera biennis L. – RD, c; 141

Oenothera laciniata Hill – RD, o; 668

Oenothera speciosa Nuttall – MFJ 2396

Oenothera tetragona Roth var. ***tetragona*** – BOH, 471, 522

Orobanchaceae

Conopholis americana (L.) Wallroth – BOH, o; 244

Epifagus virginiana (L.) W. Barton – BOH, c; 068

Orobanche uniflora L. – CMC 223

Oxalidaceae

Oxalis dillenii Jacquin – AMH 37205

Oxalis florida Salisbury – CMC 670

Oxalis stricta L. – CMC 993

Oxalis violacea L. – BOH, c; 248

Papaveraceae

**Papaver dubium* L. – CMC 402

Sanguinaria canadensis L. – BOH, o; 757

Passifloraceae

Passiflora incarnata L. – Dennis Gottleib 3367 (VCU)

Penthoraceae

Penthorum sedoides L. – PP, c; 604, 672

Phrymaceae

Phryma leptostachya L. var. *leptostachya* – MHF, c; 511, 523

Phytolaccaceae

Phytolacca americana L. – RD, a; 374

Plantaginaceae

Plantago aristata Michaux – RD, c; 346

**Plantago lanceolata* L. – RD, c; 347

Plantago rugelii Decaisne – MFJ 3476

Plantago virginica L. – CMC 146

Platanaceae

Platanus occidentalis L. – BOH, c; 760

Podostemaceae

Podostemum ceratophyllum Michaux – CES 5645

Polemoniaceae

Phlox divaricata L. – CMC 228

Phlox subulata L. – CMC 88

Polygalaceae

Polygala cruciata L. – CES 5694

Polygala incarnata L. – RD, o; 584

Polygala mariana Miller – CMC 1447

Polygala nuttallii Torrey & Gray – RD, o; 114

Polygala verticillata L. var. ***verticillata*** – RD, o; 583, 617

Polygonaceae

**Fallopia convolvulus* (L.) A. Love – RD, o; 665

Persicaria amphibia (L.) S.F. Gray var. *emersa* (Michaux) Hickman – PP, o; 627

**Persicaria hydropiper* (L.) Opiz – CMC 1210c

Persicaria hydropiperoides (Michaux) Small – Allan Carter 4 (VCU)

Persicaria lapathifolia (L.) S. F. Gray – Gary Fleming 7657 (WILLI)

**Persicaria longiseta* (de Brujn) Moldenke – RD, c; 019, 030

**Persicaria maculata* (Rafinesque) S.F. Gray – PP, o; 434

Persicaria pensylvanica (L.) Gomez de la Maza – RD, c; 113, 699

Persicaria punctata(Elliot) Small – RD, c; 016

Persicaria setacea (Baldwin) Small – Lane Smith 52 (VCU)

Persicaria species 1 – J. Richardson 36(VCU)

Persicaria virginiana (L.) Gaertner – FF, c; 013

**Polygonum aviculare* L. – RD, a; 151

Polygonum sagittatum L. – SI, la; 041

**Rumex acetosella* L. – RD, a; 213

Rumex conglomeratus Murray – PP, o; 430

**Rumex crispus* L. – RD, a; 314

**Rumex obtusifolius* L. – RD, o; 654

****Rumex pulcher*** L. – RD, o; 323

Rumex verticillatus L. – PP, o; 438

Portulacaceae

Claytonia virginica (L.) var. *acutiflora* de Candolle – BOH, a; 164

**Portulaca oleracea* L. – RD, c; 711

Talinum teretifolium Pursh – GF, la; 641

Primulaceae

**Anagilis arvensis* L. var. *arvensis* – RD, o; 569

Lysimachia ciliata L. – SI, o; 381

Lysimachia nummularia L. – PP, la; 337, 426

Lysimachia quadrifolia L. **[S1]** – CMC 349

Lysimachia terrestris (L.) Britton, Sterns, & Poggenberg – CMC 660

Samolus parviflorus Rafinesque – RD, o; 135, 287, 529

Ranunculaceae

Aconitum uncinatum L. – CES 31335

Anemone virginiana L. – RD, c; 072

Anemonella thalictroides (L.) Spach – BOH, c; 165

Cimicifuga racemosa (L.) Nuttall – MF, o; 088

Clematis ochroleuca Aiton – BOH, r; 389

Clematis virginiana L. – SI, o; 726

**Consolida ajacis* (L.) Schur – MFJ 2397

Hepatica americana (Augustin de Candolle) Ker-Gawler – BOH, o; 756

Ranunculus abortivus L. – BOH, c; 207, 420

Ranunculus bulbosus L. – RD, c; 198, 218, 219

Ranunculus hispidus Michaux – CMC 171

Ranunculus micranthus Nuttall – CMC 229

**Ranunculus parviflorus* L. – CMC 163

Ranunculus pusillus Poiret – CMC 505

Ranunculus sardous Crantz – RD, o; 277

Ranunculus scleratus L. – WJH 4823

Thalictrum dasycarpum Fischer & Ave-Lallemant – MFJ 2553

Thalictrum dioicum L. – CMC 52

Thalictrum pubescens Pursh var. *pubescens* – GF, o; 631

Thalictrum revolutum DC – MHF, o; 615

Rhamnaceae

Ceanothus americanus L. var. *americanus* – BOH, o; 399

Rosaceae

Agrimonia parviflora Aiton – RD, c; 150

Agrimonia pubescens Wallroth – John Meyer 167 (VCU)

Agrimonia rostellata Wallroth – MFJ 4054

Amelanchier arborea (Michaux f.) Fernald var. *arborea* – RD, o; 182, 203

Amelanchier canadensis (L.) Medikus – CES 4939

Amelanchier stolonifera Wiegand – James Gardner 11 (URV)

Aronia arbutifolia (L.) Persoon

Aronia prunifolia (Marshall) Rehder – CES 4944

Aruncus dioicus (Walter) Fernald var. ***dioicus*** – BOH, o; 083

Crataegus uniflora Muenchhausen

Crataegus viridis L. – BOH, r; 768

**Duchesnea indica* (Andrews) Focke – RD, c; 339

Fragaria virginiana Duchesne – RD, c; 195

Geum canadense Jacquin – BOH, c; 462

Geum virginianum L. – CMC 778

Porteranthus trifoliatus (L.) Britton – CES 4937

Potentilla canadensis L. var. *canadensis* – RD, c; 214

Potentilla norvegica L. – CMC 701

**Potentilla recta* L. – SI, lc; 378

Prunus alleghaniensis Porter var. ***alleghaniensis*** – PP, o; 431 **[S3]**

**Prunus avium* L. – CMC 116

Prunus serotina Ehrhart var. *serotina* – RD, c; 294

**Pyrus communis* L. – CMC 68

Rosa bracteata Wendl – RD, o; 290, 295

Rosa carolina L. – MFJ 3489

**Rosa multiflora* Thunberg ex Murray – CMC 337b

Rosa palustris Marshall – SI, c; 148

Rosa virginiana Miller – CMC 460

Rosa wichuraiana Crepin – RD, o; 327

Rubus allegheniensis Porter – Louise Miles 48 (VCU)

Rubus argutus Link – RD, o; 271

Rubus flagellaris Willdenow – AOH, c; 269, 383

Rubus occidentalis L. – J. R. T. Moore 27 (VCU)

Rubiaceae

Cephalanthus occidentalis L. - PP, c; 432, 524

****Cruciata pedemontana*** (Belardi) Ehrand – RD, r; 242

Diodia teres Walter – RD, c; 112

Diodia virginiana L. – RD, c; 039

Galium aparine L. – RD, c; 251

Galium circaezans Michaux var. *hypomalacum* Fernald – BOH, c; 331

Galium obtusum Bigelow var. *filifolium* – MHF, o; 317

Galium pilosum Aiton var. *puncticulosum* (Michaux) Torrey & Gray – AOH, o; 545, 563

Galium tinctorium (L.) Scopoli – CMC 1050

Galium triflorum Michaux – BOH, o; 526

Houstonia caerulea L. – BOH, c; 201, 528

Houstonia longifolia Gaertner var. *compacta* Terrell – RD, o; 453

Houstonia purpurea L. var. *purpurea* – AOH, c; 262, 308, 616

Houstonia pusilla Schoepf – RD, r; 759

Mitchella repens L. – MHF, c; 724

**Sherardia arvensis* L. – RD, o; 313

Salicaceae

**Populus alba* L. – CMC 516

Populus deltoides Bartram ex Marshall var. *deltoides*

Populus grandidentata Michaux – CES 5687

Salix nigra Marshall – PP, c; 264, 435, 436

Santalaceae

Comandra umbellata (L.) Nuttall ssp. *umbellata*- CES 4928

Saururaceae

Saururus cermuus L. – SI, lc; 384

Saxifragaceae

Chrysosplenium americanum Schweinitz ex Hooker – CMC 82

Heuchera americana L. – BOH, o; 299, 416

Saxifraga virgeniensis Michaux – BOH, c; 202, 301

Scrophulariaceae

Agalinis decemloba (Greene) Pennell – RD, c; 095

Aureolaria pectinata (Nuttall) Pennell – BOH, o; 707

Aureolaria pedicularia (L.) Rafinesque – CMC 1179

Aureolaria virginica (L.) Pennell – BOH, o; 466

Chelone glabra L. – CMC 1526

Gratiola neglecta Torrey – RD, o; 614

Gratiola pilosa Michaux – CES 5696

Gratiola virginiana L. – CMC 421

Gratiola viscidula Pennell – SI, o; 671

**Kickxia elatine* (L.) Dumortier – CMC 805

Lindernia dubia (L.) Pennell var. *anagallidea* – CES 5643

Lindernia dubia (L.) Pennell var. *dubia* – RD, c; 132

Mecardonia acuminata (Walter) Small var. ***acuminata*** – RD, o; 579

Mimulus alatus Aiton – SI, o; 731

Mimulus ringens L. var. ***ringens*** – PP, lc; 629

Nuttalanthus canadensis (L.) D. A. Sutton – RD, c; 279, 740

**Paulownia tomentosa* (Thunberg) Stendel – RD, o; 309

Penstemon canescens (Britton) Britton – CMC 422

Penstemon laevigatus Aiton – AOH, o; 370

Scrophularia marilandica L. – CMC 1550

**Verbascum blattaria* L. – RD, o; 647

**Verbascum thapsus* L. – RD, c; 447

**Veronica agrestis* L. – CMC 195

**Veronica arvensis* L. – RD, c; 183

**Veronica hederaefolia* L. – RD, c; 221

Veronica officinalis L. – MFJ 3613

Veronica peregrina L. – RD, o; 252

**Veronica persica* Poiret – RD, o; 222

Simaroubaceae

Ailanthus altissima (Miller) Swingle – CMC 1430

Solanaceae

**Datura stramonium* L. – RD, o; 661

**Lycium barbarum* L. – CMC 1506

Physalis angulata L. var. ***angulata*** – RD, o; 710 **[SE?]**

Physalis longifolia Nuttall var. *subglabrata* (Mackenzie & Bush) Cronquist

Physalis virginiana Miller var. *virginiana* – CMC 427

Solanum carolinense L. var. *carolinense* – RD, c; 363

Solanum ptychanthum Dunal – SI, o; 722

Staphyleaceae

Staphylea trifolia L. – FF, 235, 709

Tetrachondraceae

Polypremum procumbens L. – FF, o; 603

Ulmaceae

Ulmus rubra Muhlenberg – MFJ 3496

Ulmus alata Michaux – RD, o; 187

Ulmus americana L. – CMC 56

Urticaceae

Boehmeria cylindrica (L.) Swart – FF, lc; 061

Laportea canadensis (L.) Weddell – CES 14132

Pilea pumila (L.) Gray – FF, o; 018

Valerianaceae

**Valerianella locusta* (L.) Lat. – RD, c; 199, 223

Vallerianella umbilicata (Sullivant) Wood – CMC 252a

Verbenaceae

Phyla lanceolata (Michaux) Greene – RD, o; 463

Verbena urticifolia L. – FF, o; 509

Violaceae

**Viola arvensis* Murray

Viola bicolor Pursh – RD, c; 173

Viola cucculata Aiton – BOH, o; 284

Viola palmata L. var. *palmata*– BOH, c; 191, 209, 259

Viola primulifolia L. – CES 4935

Viola pubescens Aiton var. *leiocarpon* (Fernald & Wiegand) Seymour – FF, r; 174

Viola pubescens Aiton var. *pubescens* – FF, c; 333

Viola sagittata Aiton – BOH, o; 206

Viola striata Aiton – RD, o; 175

Viscaceae

Phoradendron leucarpum (Rafinesque) Reveal & M. C. Johnston

Vitaceae

Parthenocissus quinquefolia (L.) Planchon – RD, c; 500

Vitis aestivalis Michaux – MFJ 3715

Vitis cinerea (Engelmann) Engelmann ex Millardet var. ***baileyana*** (Munson) Comeaux – RD, o; 408, 449, 576

Vitis rotundifolia Michaux

Discussion

Phytogeography

Family-level analysis. Good (1974) and Takhtajan (1986) provide analyses of the worldwide distribution of angiosperms that serve as a useful framework for interpretation of the plants of Powhatan County, Virginia. Table 1 lists 40 families considered by Good (1974) to be among those most widely distributed across the globe. These particularly widespread families are further subdivided as "cosmopolitan," "subcosmopolitan-temperate" and "subcosmopolitan-tropical," and they are listed in each column by decreasing prevalence (a subjective value integrating species-level diversity and breadth of geographic occurrence). Information in parentheses indicates the number of species represented by each family in the Powhatan flora. The two most cosmopolitan families, Poaceae and Asteraceae, are well represented in Powhatan; together, these two families account for 24 percent of the Powhatan flora. The high number of species for Asteraceae is consistent with the fact that many common genera of the family, though widespread, have highest concentrations of species in the North American Atlantic floristic region (Takhtajan 1986). Approximately 72 percent of the species present in Powhatan belong to families considered cosmopolitan or subcosmopolitan-temperate by Good (1974). As might be expected, the subcosmopolitan-tropical families contribute relatively few species to the Powhatan flora; the six families listed in Table 1 account for a mere 2 percent of the total.

Table 2 comprises Good's (1974) list of tropically-centered families which, because of a significant disjunction in distribution, are not considered to be globally widespread, yet reach high latitudes well into temperate regions. The number of such families (28) is not as large as the list of cosmopolitan and sub-cosmopolitan families comprising Table 1 and these families have relatively few species present in Powhatan. At a total count of 73 species, the relative contribution of the families listed in Table 2 to vegetation in the county is small (7 percent). However, a few families included in Table 2, e.g., Commelinaceae, Asclepiadaceae, and Smilacaceae, have significant impact in Powhatan in terms of abundance of individuals. Table 3 is a list of families represented in the Powhatan flora which, as characterized by Good (1974), fall between subcosmopolitan and endemic, and which reach their dominance in temperate regions. Most of these families are small, in terms of species numbers, and woody; at a total of 26 species, these families account for only 3 percent of the Powhatan flora

Considered together, the 77 families included in Tables 1, 2, and 3 constitute the families represented in the Powhatan flora that can be considered widespread throughout the world. The contribution of these 77 families to the plant diversity of Powhatan County are 52 percent at the family-level and 84 percent at the species level

Genus-level analysis. A few genera of angiosperms are enormously diverse, encompassing more than 1000 species. Except for the genus *Carex* (Cyperaceae), these mega-genera are only modestly represented in the Powhatan Flora.: *Carex* (38 species), *Croton* (2 species), *Euphorbia* (3 species), *Rhododendron* (2 species), and *Solanum* (2

species). Prior to their recent dismemberment, the list of mega-genera would have also included *Eupatorium* s.l. (now *Ageratina*, *Conoclinium*, *Eupatoriodelphus*, and *Eupatorium* sensu stricto, with a total of 17 species in the inventory) and *Senecio* s.l. (now *Packera*, with 2 species in the inventory). Considering *Eupatorium* in its wide sense, these mega-genera encompass 67 species in Powhatan, or 7% of the flora.

Any discussion of the biogeographic affinities of plants in the eastern North America must include a consideration of the large number of genera that occur as disjuncts in eastern Asia. The literature on this peculiar biogeographic pattern is extensive and has been reviewed recently by Wen (1999). Examples from the checklist include: *Apios*, *Aralia*, *Brachyelytrum*, *Campsis*, *Carya*, *Catalpa*, *Cephalanthus*, *Chionanthus*, *Cornus*, *Eubotrys* (*Leucothoe*), *Gleditsia*, *Hamamelis*, *Hydrangea*, *Itea*, *Jeffersonia*, *Lespedeza*, *Lindera*, *Liquidambar*, *Liriodendron*, *Lyonia*, *Magnolia*, *Menispermum*, *Mitchella*, *Nelumbo*, *Nyssa*, *Panax*, *Parthenocissus*, *Penthorum*, *Phryma*, *Podophyllum*, *Robinia*, *Sassafras*, *Saururus*, *Symphoricarpos*, *Symplocarpus*, *Tipularia*, *Toxicodendron*, *Triosteum*, and *Zizania*. Evidently, this biogeographic pattern, as exemplified by these and additional genera, has had multiple origins over time. Generally, though, most explanations for disjunct distributions between eastern North America and eastern Asia center on the relatively homogeneous nature of northern hemisphere forest floras into the mid-Tertiary followed by a series of localized extinctions at various times in intervening regions (Wen 1999).

Approximately 100 genera are considered endemic to the North American Atlantic floristic region, which stretches from the eastern edge of the Rocky Mountains to the

Atlantic coast of the United States (Takhtajan 1986). The following genera found in the Powhatan flora are included among these North American Atlantic endemics: *Anemonella, Asimina, Bartonia, Blephilia, Chrysogonum, Collinsonia, Hexastylis, Krigia, Liatris, Maclura, Medeola, Obolaria, Oxydendrum, Peltandra, Silphium, Strophostyles, Thaspium*, and *Uvularia*. Collectively, these North American Atlantic endemics account for 20 species, or 1.9% percent of the Powhatan flora.

Species-level analysis. An analysis of the Powhatan flora for distributional patterns throughout the North American continent was made. The overall geographic distribution for each species in the Powhatan flora was determined via the PLANTS data base (United States Department of Agriculture 2005). The geographic distribution of each species was characterized as: continent-wide, Appalachian, Atlantic/Gulf coastal plain, or northern. The Appalachian and Atlantic/Gulf coastal plain categories match floristic provinces recognized by Takhtajan (1986) for the North American Atlantic floristic region, the area between the Rocky Mountains and the Atlantic coast. The results of this analysis are illustrated in figure 7. The majority of the taxa in Powhatan (87 percent) exhibit broad distribution patterns: 34 percent are found in both the Appalachian and coastal plain provinces, 29 percent are widely distributed across the continent, and 23 percent occur throughout the North Atlantic floristic region. Only 13 percent have relatively narrow distributions, either restricted to the coastal plain province (9 percent) or to northern regions (4 percent). Notably, Takhtajan's classification of floristic provinces does not recognize the piedmont. The piedmont of Virginia is situated on the border between the Atlantic and Gulf Coastal Plain and the Appalachian Provinces of Takhtajan and hence

could be expected to share distributional affinities with both. Clearly, Virginia represents the southern extent of distribution for a small number of plants found in Powhatan; these taxa represent the southern limit of the broad transition zone between the Appalachian Province and the Canadian Province of the Circumboreal Region (Takhtajan 1986).

The boundaries of the state of Virginia are not congruent with biologically meaningful limits of floristic regions. Nevertheless, routine monitoring and management of biodiversity often transpires within political frameworks. Thus, analysis of the Powhatan flora in terms of distributional patterns within the state of Virginia was also undertaken. For this analysis, the Atlas of the Virginia flora provided the source of distributional data for each species in the Powhatan inventory. For convenience, the high elevation physiographic provinces west of the piedmont were combined into one, yielding a total of three provinces: coastal plain, piedmont, and mountains. Figure 8 illustrates the results. The majority of the flora, 772 species (76 percent), is distributed throughout the state. Of the remaining 245 taxa, nearly half (118) have distributions in the piedmont and/or coastal plain, a finding consistent with the continent-wide distribution analysis.

The two biogeographic analyses presented above (continent-wide and state-wide), focus solely on the geographic characteristics of the plants included in the Powhatan County inventory. As such, they provide a one-sided perspective of geographic affinities of the flora. Additional insights can be obtained from pair-wise comparisons of regionally-defined floras that take into account not only shared taxa, but also the presence of unique taxa in each of the two regions under comparison. The Sorenson Index of Similarity (Sorenson 1948) was used to assess similarity between the Powhatan flora and

inventories of several comparable areas conducted within the state of Virginia. The index is used to assess the compositional similarities between two data sets and is represented by the equation: IS = 2A/B + C, where A = the number of shared values (taxa) common to both lists, B = the total number of values in one list, and C = the total number of values in the other. The following table lists the results:

Flora	Floristic region	Reference	Index of similarity
Kent Branch, Fluvana County	piedmont	Diggs & Hall 1981	0.68
James River Gorge	mountains	Ramsey et al. 1993	0.65
Richmond National Battlefield Park	upper coastal plain	Hayden et al. 1989	0.64
Western Isle of Wight County	coastal plain	Plunkett & Hall 1995	0.55

The calculations indicate the strongest divergence in floristic elements is between Powhatan and Isle of Wight, a coastal plain location, whereas the similarities between Powhatan and the others are about equal.

Ecology

Of the taxa in the checklist, 190 (18%) are considered introduced (United States Department of Agriculture 2005). This is roughly equal to the estimated national average (Flora of North America 1993). An advisory list of invasive alien plant species (Virginia Department of Conservation and Recreation 2005) includes 54 taxa represented in the Powhatan flora (Virginia Department of Conservation and Recreation 2005). These are listed in Table 5. The majority of the invasive alien plants found during the current study

were collected from roadsides and early successional areas. These areas exhibit the type of disturbance regime conducive to aggressive colonization by invasives. However, based on field observations made during the study, species such as *Alliaria petiolata*, *Arthraxon hispidus*, *Microstegium vimineum*, *Poa compressa*, and *Rosa multiflora* exhibit a strong tendency to invade more or less intact, natural, habitats. *Alliaria petiolata*, for instance, achieves highest concentrations in the floodplain forests of the relatively undisturbed Belmead Plantation.

Fleming, et. al. (2004) compiled a characterization of natural community types of Virginia by which natural communities of Powhatan County were estimated. The hierarchical classification proceeds (from most inclusive to least inclusive) as follows: system, class, group, type. Two of the five systems in Virginia are represented in Powhatan: Terrestrial and Palustrine. One class under the Palustrine system (Alluvial Floodplain Communities) is represented and three under the Terrestrial system are represented (Low Elevation Mesic Forests, Low Elevation Dry Forests, Low Elevation Rock Outcrops). For each of the 605 taxa collected in Powhatan by the author, an assessment was made concerning the community group in which it occurred. No quantitative data was used apart from general field notes, and it should be noted that many species can be listed under more than one community group. In such cases, the taxon is included in the group to which it is most associated in Powhatan, based on the author's field experience. Most taxa collected on roadsides, in fallow fields, or other such habitats are classified as belonging to recently disturbed communities. The following is a summary of each group, as represented by the Powhatan flora, in order of

decreasing prevalence. Estimates were made at the group level. Possible types represented in Powhatan are listed.under the superposing group:

Recently Disturbed Sites –

Included here are communities characterized by a wide range of species and abiotic factors found throughout the county wherever there is habitat disturbance. Examples include roadsides, agricultural areas, lawns, and commercial forests, under varying levels of management. Approximately 325 taxa were collected from recently disturbed sites.

Basic Oak-Hickory Forest Group –

Overstory elements include several oaks (*Quercus* spp.), *Carya glabra, C. ovalis, C. ovata, C. alba, Fraxinus americana,* and *Liriodendron tulipifera.* Common understory species include *Cercis canadensis, Ostrya virginiana,* and *Cornus florida.* Herb layers include *Cardamine concatenata, Thalictrum thalictroides, Stellaria pubera, Claytonia virginica, Agrimonia rostellata, Clematis ochroleuca, Dichanthelium boscii, Desmodium nudiflorum, Elymus hystrix, Galium spp., Maianthemum racemosum,* and *Solidago* spp. This is probably the most common natural community group of Powhatan. An interesting subcategory of this group, growing over mafic rocks, supports less common species, such as *Clematis ochroleuca* and *Carex conoidea.* Approximately 80 taxa collected are classified under this group. Representative types within this group include:

Quercus alba – Quercus rubra – Carya alba/ Carpinus caroliniana/ Desmodium nudiflorum – Maianthemum racemosum Forest (Submesic Piedmont Type)

Quercus alba – Carya alba – Carya ovata/ Cercis canadensis Forest (Southern Piedmont Type)

Mesic Mixed Hardwood Forest Group –

Overstory elements include *Fagus grandifolia, Quercus* spp., *Liriodendron tulipifera,* and *Carya* spp. Understory elements include *Carpinus caroliniana, Cornus florida,* and *Ilex opaca.* Herbaceous elements include *Polystichum acrostichoides, Thelypteris noveboracensis, Eurybia divaricata, Mitchella repens, Hexastylis virginica,* and *Goodyera pubescens.* These are mostly mesic upland forests on nutrient-poor soils. The vegetation is not as diverse as that of the basic oak-hickory forest, and is one of the communities most diminished by commercial logging, both in terms of area and species diversity. Approximately 45 taxa collected are classified under this group. Representative types include:

Fagus grandifolia – Liriodendron tulipifera – Quercus/ Polystichum acrostichoides Forest (Piedmont/Northern Coastal Plain Type)

Fagus grandifolia –Quercus alba/ Ilex opaca – (Oxydendrum arboreum)/ Vitis rotundifolia Forest (Coastal Plain/Southern Piedmont Type)

Acidic Oak-Hickory Forest Group –

Dominant overstories include *Quercus* spp. and *Carya spp. Cornus florida* is a dominant understory and the shrub layer is often composed of *Vaccinium pallidum, V. stamineum,* and *Viburnum acerifolium.* Typical herbs are: *Antennaria plantaginifolia, Carex albicans, Coreopsis verticillata, Danthonia spicata, Cunila origanoides, Hieracium*

venosum, *Houstonia purpurea*, *Oxalis violacea*, *Penstemon canescens*, *Polygonatum biflorum*, *Solidago bicolor*, and *Symphyotrichum undulatum*. Hickories are less abundant in this group than in the basic oak-hickory forests and may occupy primarily the understory. In Powhatan, this group is well represented in uplands of the eastern section of the county, presumably supported by the acidic shale and sandstone of the Triassic basin. Approximately 35 taxa collected are classified under this group. Representative types include:

Quercus alba – Quercus coccinea – Carya glabra/ Cornus florida/ Viburnum acerifolium Forest (Northeastern Acidic Oak-Hickory Forest)

Quercus alba – Quercus rubra – Carya/ Cornus florida/ Vaccinium stamineum Forest (Piedmont Acidic Oak-Hickory Forest)

Semipermanent Impoundments Group –

These are mostly marshes which accompany man-made ponds or beaver dams. Representative herbaceous elements include *Persicaria spp.*, *Pontederia cordata*, *Peltandra virginica*, *Juncus effusus*, *Sparganium americanum*, *Carex* spp., *Saururus cernuus*, *Ludwigia* spp., *Typha latifolia*, *Alisma subcordatum*, and *Leersia oryzoides*. Because of their highly variable composition and semi-natural status, no types have been established for this group. The numbers from Powhatan could reflect a collecting bias for the Powhatan Lakes Wildlife Management Area, which contains many man-made ponds. Approximately 30 taxa collected are classified under this group.

Floodplain Forests Group –

These include Piedmont/Mountain Floodplain Forests and Coastal Plain/Piedmont Floodplain Forests. These forests are characterized by stands of *Fraxinus pensylvanica*, *Celtis* spp., *Acer rubrum*, *Liquidambar styraciflua*, *Carya cordiformis* and *Quercus phellos*. The shrub, understory, and herbaceous elements of this forest group are highly variable, and Fleming notes that most have been severely affected by man's activities and invasives. This forest group is reasonably well- represented along the James River in areas such as Watkins Landing, as well as regions along smaller streams and creeks (Coastal Plain/Piedmont Floodplain Forests). Approximately 30 taxa collected are classified under this group. Representative types include:

Acer saccharinum – Acer negundo/ Ageratina altissima – Laportea canadensis – (Elymus virginicus) Forest (Piedmont/Central Appalachian Silver Maple Forest)

Liquidambar styraciflua/ Lindera benzoin/ Arisaema triphyllum Forest (Mixed Herbs Type)

Platanus occidentalis – Liquidambar styraciflua/ Asimina triloba Forest (Sycamore-Sweetgum Type)

Floodplain Ponds and Pools Group –

Most of the information on this community group is based on field observation and it is said to be uncommon, but it appears at least one site in Powhatan may qualify as this group based on the location (near an oxbow of the James River) and the list of representative species, which include:

Cephalanthus occidentalis, *Utricularia* spp., *Lemna* spp., *Spirodela* spp., *Carex* spp., *Callitriche heterophylla*, and *Azolla caroliniana*. Approximately 20 taxa collected are classified under this group, mostly *Carex* spp. and aquatics.

Sand/ Gravel/ Mud Bars and Shores Group –

Again, few data have been collected concerning this group. Portions of the James River and its banks and shores support taxa from this group, including: *Cyperus erythrorhizos*, *Justicia americana*, *Ludwigia* spp., *Panicum dichotomiflorum*, and *Cyperus squarrosus*. Two of these taxa, *P. dichotomiflorum* and *C. squarrosus*, as well as *Hibiscus laevis*, *Heteranthera dubia*, and the state-listed *Paspalum bifidum* were encountered only along such mud bars and shores of the James, emphasizing the floristic distinctness of such communities. Approximately 15 taxa collected are classified under this group. Representative types include:

Eragrostis hypnoides – Lindernia dubia – Ludwigia palustris – Cyperus squarrosus Herbaceous Vegetation (Piedmont/Mountain Sand Bar/Rivershore)

Granitic Flatrocks Group -

These communities are characterized by exposed, flat, or gently sloping granitic rocks that are sparsely vegetated and often occupy less than an acre. These communities support a distinctive flora and are endemic to the southeastern United States from Alabama to Virginia. The granite outcrops of Powhatan are located along Fine Creek. Characteristic taxa include: *Talinum teretifolium*, *Croton willdenowii*, *Selaginella*

rupestris, and *Bulbostylis capillaris*. Five species were collected from this site. Representative types include:

Talinum teretifolium - Minuartia glabra – Diodia teres – Croton willdenowii Herbaceous Vegetation (Piedmont Granitic Flatrock Barren)

The final four community groups are included in the discussion of possibilities for Powhatan based largely on the dominant species in the community type names, and are represented by a handful of collected specimens each:

Swamp Forest Group –

Quercus palustris – Quercus bicolor – Ulmus americana/ Carex tribuloides – Carex squarrosa Forest (Piedmont/Central Appalachian Floodplain Swamp)

Alluvial Forest Group –

Liriodendron tulipifera – Platanus occidentalis – Betula lenta / Lindera benzoin / Circaea lutetiana ssp. canadensis Forest (Piedmont / Mountain Alluvial Forest)

Basic Mesic Forest Group –

Liriodendron tulipifera – Quercus rubra – Fraxinus americana / Asimina triloba / Cimicifuga racemosa – Uvularia perfoliata Forest (Inner Piedmont/Lower Blue Ridge Basic Mesic Forest)

Piedmont Prairie Group –

Schizachyrium scoparium – Sorghastrum nutans – Solidago juncea – Pycnanthemum tenuifolium Herbaceous Vegetation (Little Bluestem – Indian Grass Piedmont Grassland)

This last group is semi-natural and maintained by disturbance such as periodic mowing of power line rights-of-way.

Noteworthy Collections

Isoetes engelmannii A. Braun – Although this species is the most widespread of the quillworts in North America (Musselman, et al. 1995), it is inconspicuous, easily overlooked, and difficult to identify. Because species of *Isoetes* hybridize frequently (Gleason & Cronquist 1991), care was taken to observe and photograph the megaspores, which are reliable taxonomic characters. The pattern of reticulations and cross-partitions, as seen in figures 3-6, indicate the species.

Lobelia glandulosa Walter – This plant is known only in Virginia from a historical occurrence in the Dismal Swamp in 1901 (Virginia Botanical Associates 2005). It was found in a boggy habitat of basic oak-hickory forest in central Powhatan.

Lamium album L. ssp. *album* – This plant also is known only from historical records in Virginia (Weakley 2002). It is indicated as an occasional introduction in gardens, and waste places by Gleason and Cronquist (1991); it is common on the roadside near Watkins Public Boat Landing.

Gaura angustifolia Michaux – This represents a state record, but the occurrence in Powhatan may be the result of human agency. The plant is quite showy in flower. It was collected from a roadside area at the entrance to Belmead Plantation. Although evidently naturalized, the plants are merely a few meters distant from a small garden of ornamentals.

A total of 122of the taxa collected during the current study represent records for Powhatan County. In addition, seventeen collected during the current study are listed on Virginia's rare plants lists (Townsend 2005). State ranks are assigned to plants based on known abundance and vulnerability to extirpation. Roughly, state ranks are as follows:

S3 – rare to uncommon, with 20 to 100 occurences, somewhat vulnerable

S2 – very rare and imperiled, with 6 to 20 occurences, vulnerable

S1 – extremely rare and critically imperiled, with less than 6 occurences, especially vulnerable to extinction

SH - formerly part of the Virginia biota with expectation it might be recovered

SE – exotic

SU – status uncertain

S_? – rank uncertain

When more than one rank is listed, i. e. S1S2, the rank is taken to be intermediate between the two. The following is a list of the state-ranked taxa that were collected during the current study:

Scleria ciliata Michaux var. *ciliata* – S1

Scutellaria parvula Michaux var. *parvula* – S1

Carex conoidea Schkuhr ex Willdenow – S1S2

Eupatoriadelphus maculatus (L.) King & H. E. Robinson var. *maculatus* – S2

Scutellaria incana Biehler – S2

Paspalum bifidum (Bertoloni) Nash - SH

Dichanthelium ravenelii (Scribner & Merrill) Gould – S3

Iresine rhizomatosa Standley – S3

Prunus alleghaniensis Porter var. *alleghaniensis* – S3

Sisyrinchium fuscatum Bicknell – S3

Physalis angulata L. var. *angulata* – SE?

Agrostis perennans (Walter) Tuckerman – SU

Carex brunnescens (Persoon) Poiret var. *sphaerostachya* - SU

Dichanthelium yadkinense (Ashe) Mohlenbrock - SU

Euphorbia pubentissima Michaux – SU

Lemna minuta Kunth - SU

Lobelia glandulosa Walter - SU

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Table 1. Cosmopolitan and subcosmopolitan families of angiosperms in decreasing order of prevalence according to Good (1974). Parentheses indicate number of taxa from each family collected in Powhatan County, Virginia. For consistency with Good's analysis, Liliaceae is here treated in the traditional (broad) sense.

Cosmopolitan	Subcosmopolitan Temperate	Subcosmopolitan Tropical
Poaceae (116)	Brassicaceae (28)	Convolvulaceae (6)
Asteraceae (132)	Apiaceae (14)	Malvaceae (7)
Cyperaceae (72)	Ranunculaceae (19)	Solanaceae (7)
Orchidaceae (17)	Rosaceae (32)	Urticaceae (3)
Fabaceae	Campanulaceae (7)	Viscaceae (1)
Lamiaceae (33)	Juncaceae (14)	Rhamnaceae (1)
Scrophulariaceae (27)	Onagraceae (10)	
Liliaceae (19)	Polygonaceae (20)	
Boraginaceae (6)	Alliaceae (2)	
Gentianaceae (3)	Cuscutaceae (3)	
Ericaceae	Plantaginaceae (4)	
Rubiaceae	Clusiaceae (11)	
Euphorbiaceae	Primulaceae (6)	
Violaceae	Linaceae	
Polygalaceae	Oleaceae (4)	
Verbenaceae	Celastraceae (1)	
Lythraceae		
Caryophyllaceae (20)		

Table 2. Widespread tropical families of angiosperms that reach high latitudes in temperate North America and Europe or Asia according to Good (1974). Parentheses indicate the number of taxa from each family collected in Powhatan County, Virginia.

High Latitudes in North America and Europe	High Latitudes in North America and Asia
Aquifoliaceae (3)	Acanthaceae (4)
Araceae (3)	Agavaceae (1)
Aristolochiaceae (3)	Amaranthaceae (3)
Asclepiadaceae (6)	Anacardiaceae (4)
Cucurbitaceae (2)	Anonaceae (1)
Dioscoreaceae (1)	Apocynaceae (4)
Tiliaceae (1)	Araliaceae (1)
Ulmaceae (3)	Bignoniaceae (2)
	Buddlejaceae (1)
	Caesalpiniaceae (6)
	Commelinaceae (6)
	Ebenaceae (1)
	Lauraceae (2)
	Melastomataceae (2)
	Menispermaceae (1)
	Mimosaceae (1)
	Moraceae (2)
	Passifloraceae (1)
	Smilacaceae (4)
	Vitaceae (4)

Table 3. Widespread temperate families of angiosperms according to Good (1974). Parentheses indicate the number of taxa from each family collected in Powatan, VA

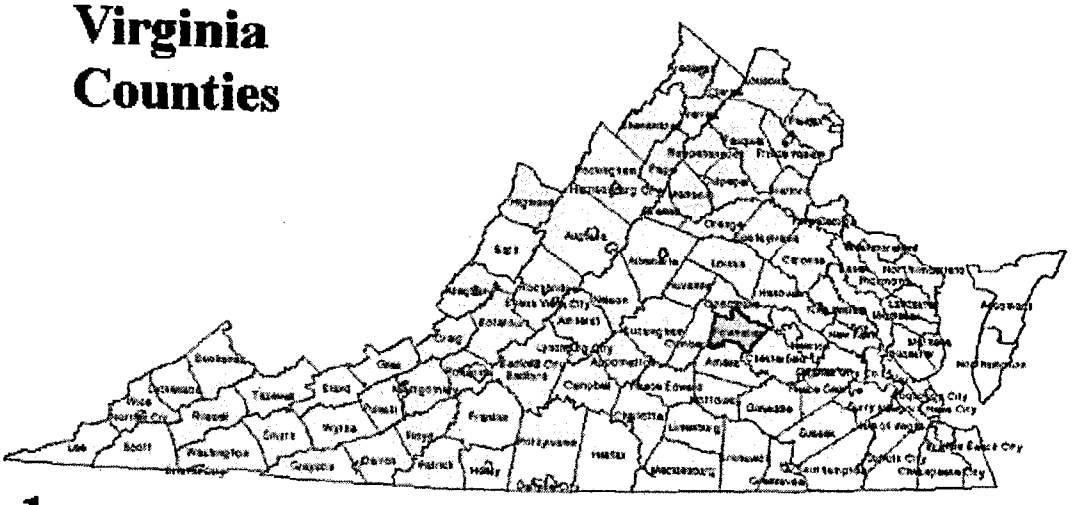
Non-endemic Temperate Climate Distribution	Exclusively North Temperate
Berberidaceae (2)	Cannabaceae (2)
Salicaceae (4)	
Fumariaceae (3)	
Aceraceae (3)	
Caprifoliaceae (4)	
Eleagnaceae (1)	
Juglandaceae (5)	
Polemoniaceae (2)	

Table 4. Families of angiosperms with disjunct worldwide distribution that are represented in the Powhatan flora. The right column indicates the areas other than North America where the families can be found. Parentheses indicate the number of taxa from each family collected in Powhatan County, Virginia

Family	Disjunct Region(s)
Papaveraceae (2)	S. America, S. Africa, Australia
Sparganiaceae (1)	Australia, New Zealand
Valerianaceae (2)	S. America, S. Africa, Malaysia
Platanaceae (1)	Western Eurasia
Hydrangiaceae (2)	Eastern Eurasia
Magnoliaceae (2)	Eastern Eurasia
Nyssaceae (1)	Eastern Eurasia
Penthoraceae (1)	Eastern Eurasia
Phrymaceae (1)	Eastern Eurasia
Saururaceae (1)	Eastern Eurasia
Staphyleaceae (1)	Eastern Eurasia
Cornaceae (2)	Asia, S. America, S. Africa, New Zealand
Fagaceae (17)	Asia, S. America, New Caledonia, New Zealand
Clethraceae (1)	Madeira, Japan to New Guinea
Iteaceae (1)	E. Africa, S. Africa

Table 5. List of Powhatan County representatives included in the Virginia Department of Conservation and Recreation's (2005) list of Invasive Alien Plant Species of Virginia. HI = highly invasive, may disrupt ecosystem processes; MI = moderately invasive, minor influence on ecosystem processes; OI = occasionally invasive, does not affect ecosystem processes, but may alter community composition.

Genus species	Classification
Centaurea biebersteinii D.C.	HI
Alliaria petiolata (Bieberstein) Cavar & Grande	HI
Lonicera japonica Thunberg	HI
Murdannia keisak (Hasskarl) Handel-Mazzetti	HI
Elaeagnus umbellata Thunberg	HI
Lespedeza cuneata (Dumont-Cours) G. Don	HI
Pueraria montana (Loureiro) Merritt var. *lobata* (Willd.) Maesen & Alm.	HI
Myriophyllum aquaticum (Vell.) Verdc.	HI
Ligustrum sinense Louriero	HI
Microstegium vimineum (Trinius) A. Camus	HI
Sorghum halepense (L.) Persoon	HI
Rosa multiflora Thunberg ex Murray	HI
Ailanthus altissima (Miller) Swingle	HI
Artemisia vulgaris L.	MI
Carduus nutans L.	MI
Cirsium vulgare (Savi) Tenore	MI
Humulus japonicus Siebold & Zuccarini	MI
Stellaria media (L.) Villars	MI
Ipomoea hederacea Jacquin	MI
Ipomoea purpurea L.	MI
Wisteria sinensis (Sims) de Candolle	MI
Egeria densa Planchon	MI
Glechoma hederacea L.	MI
Agrostis capillaris L.	MI
Arthraxon hispidus (Thunberg) Makino	MI
Dactylis glomerata L.	MI
Holcus lanatus L.	MI
Phleum pratense L.	MI
Poa compressa L.	MI
Poa trivialis L.	MI
Schedonorus arundinaceus (Schreber) Dumontier	MI
Setaria faberi W. Herrmann	MI
Persicaria longiseta (de Brujn) Moldenke	MI
Rumex acetosella L.	MI
Rumex crispus L.	MI
Populus alba L.	MI
Paulownia tomentosa (Thunberg) Stendel	MI
Veronica hederaefolia L.	MI
Conium maculatum L.	OI
Lespedeza bicolor Turczarinow	OI
Lotus corniculatus L.	OI
Melilotus albus Medikus	OI
Melilotus officinalis (L.) Pallas	OI
Securigera varia (L.) Lassen	OI
Ajuga reptans L.	OI
Perilla frutescens (L.) Britton	OI
Arrhenatherum elatius (L.) Presl	OI
Eragrostis curvula (Schrader) Nees	OI



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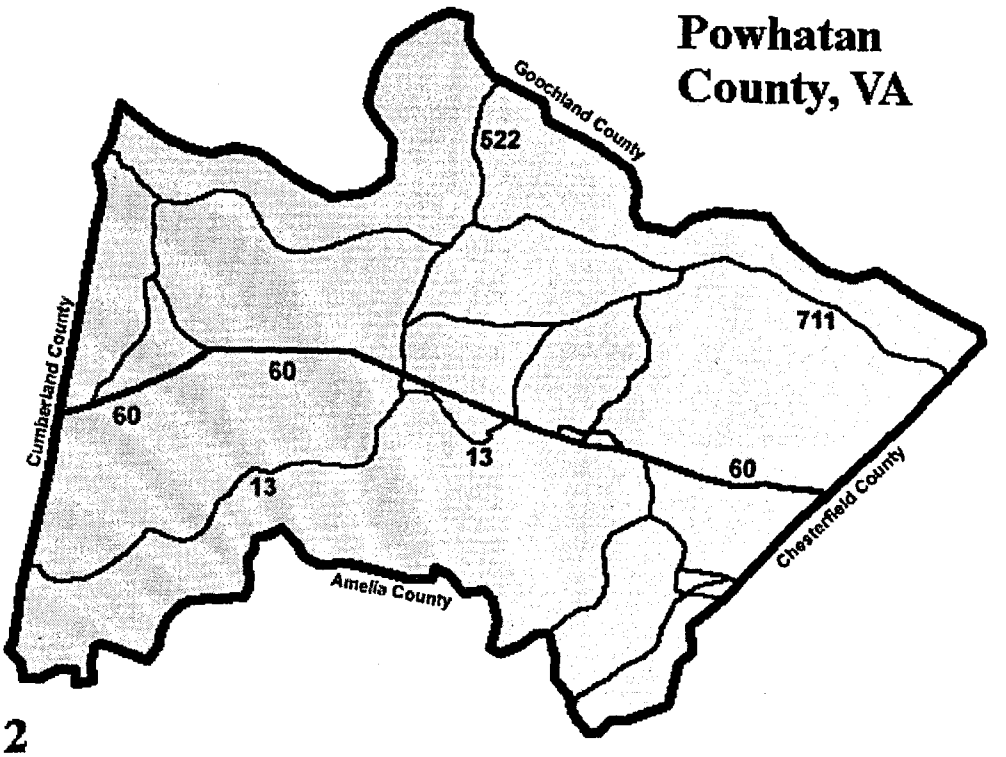

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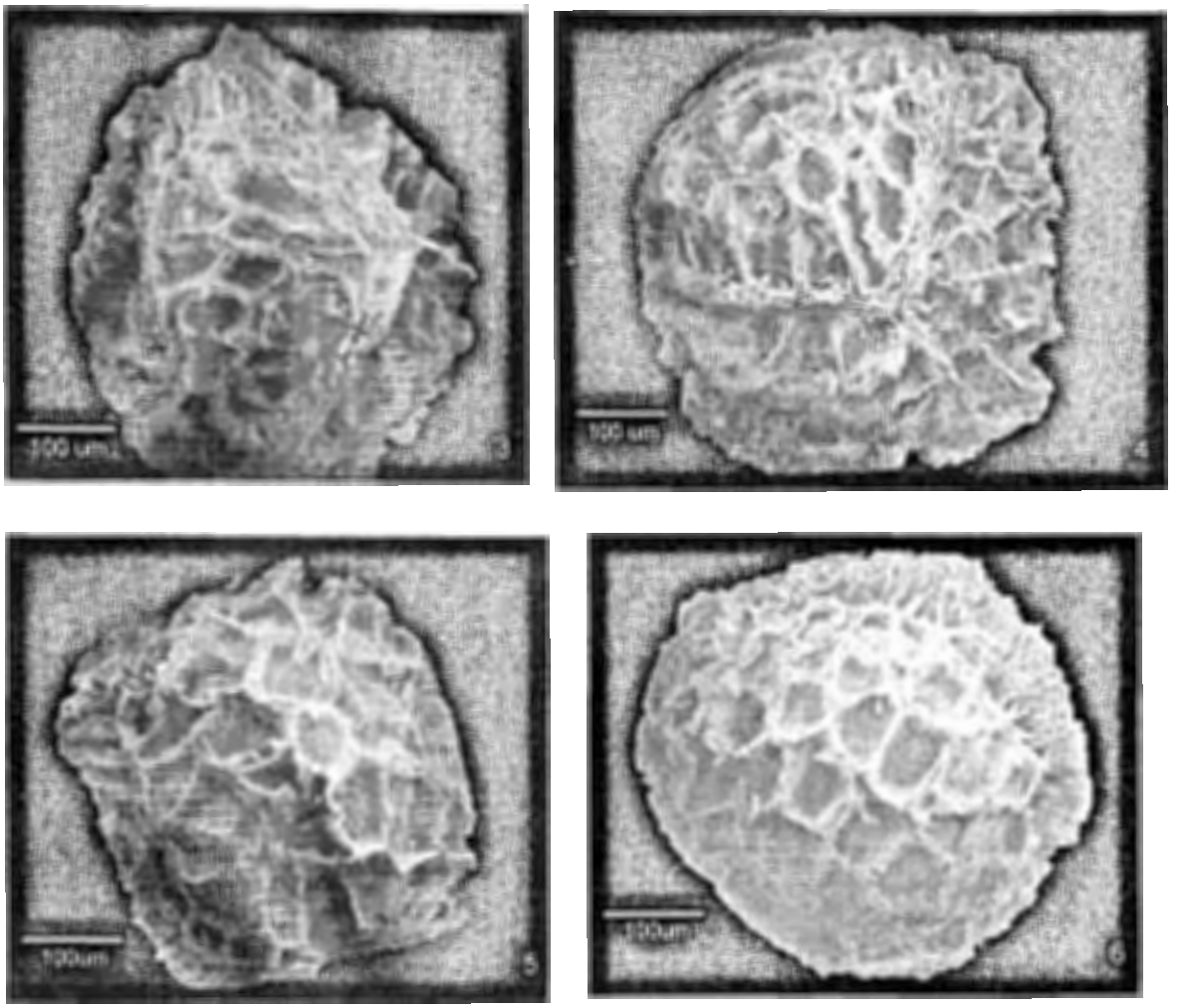
Figure 1. Map of Virginia counties; Powhatan County shaded; base map modified from Virginia Department of Natural Heritage. Figure 2. Powhatan County; base map modified from Powhatan County Public Schools



Figures 3-6. Electron micrographs of megaspores of *Isoetes engelmannii* showing characteristic reticulations and cross-partitions.

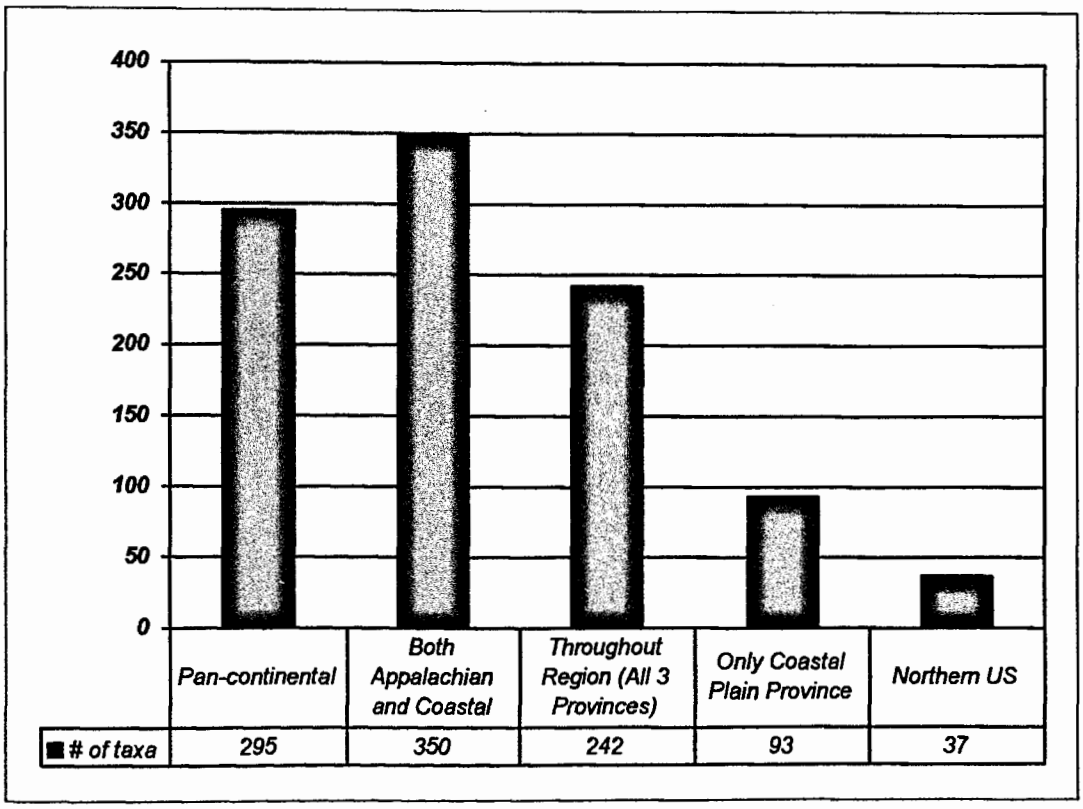


Figure 7. Categories of geographic distribution patterns throughout North America represented by taxa in the Powhatan flora.

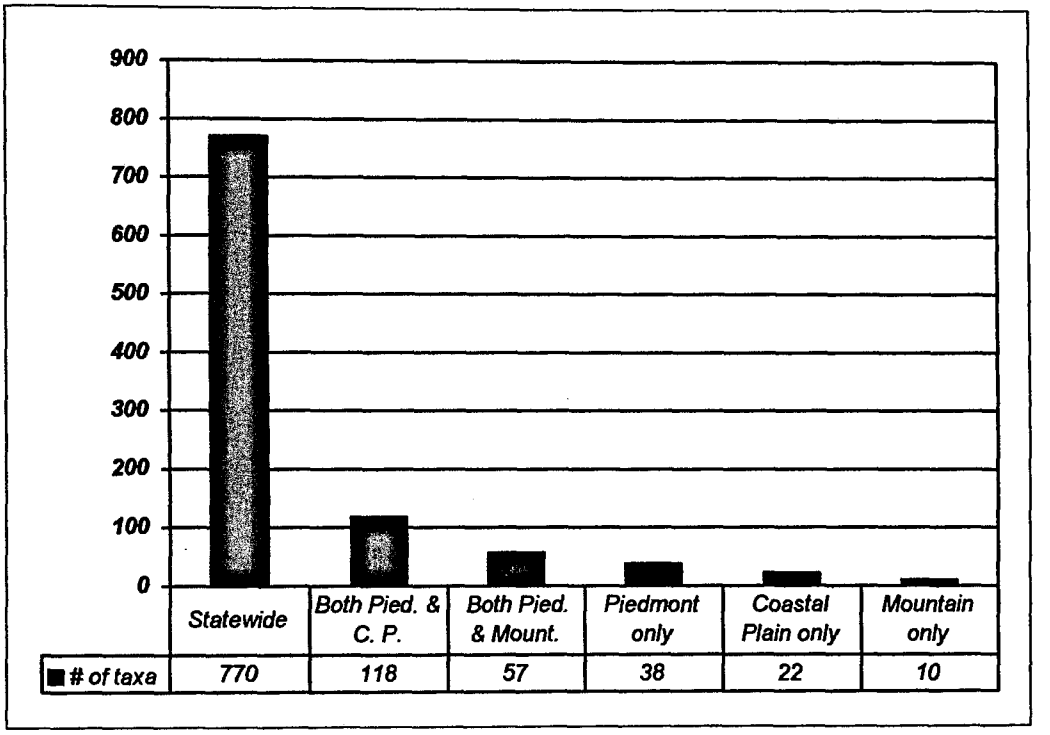


Figure 8. Categories of geographic distribution patterns within the state of Virginia of represented by taxa in the Powhatan flora.

VITA

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