THE VASCULAR FLORA OF THREE TOP MOUNTAIN GAME LAND PRESERVE, ASHE COUNTY, NORTH CAROLINA

A Thesis
by
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FORWARD

The research detailed in this thesis will be submitted to the journal *Castanea*, the Journal of the Southern Appalachian Botanical Society, for publication. The thesis and literature cited have been prepared according to their guidelines, which are attached.

ABSTRACT

The Vascular Flora of Three Top Mountain Game Land Preserve, Ashe County, NC

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This study documented the flora of a Game Land Preserve on an isolated and rugged massif in Ashe County, North Carolina from Spring 2009 – Summer 2011 over the course of 44 field days. Over 317 taxa from 198 genera and 94 families compose the flora at Three Top Mountain Game Land Preserve. Of these 317 taxa, 22 of them are Central and Southern Appalachian endemics, while 27 taxa are listed as imperiled by the US or North Carolina, including *Liatris helleri*, *Geum radiatum*, *Houstonia montana*, *Juncus trifidus*, *Trichophorum caespitosum*, and *Campanula rotundifolia*. This flora is the only documentation of *Campanula rotundifolia* in the state of North Carolina, and the only documentation of *Trichophorum caespitosum* and *Dendrolycopodium hickeyi* in the A.M.M., which substantially adds to the overall significance of this area. In addition to the previously documented communities by Oakley (1999), a Carolina Hemlock Forest community was documented on two finger ridges along the southeast facing slopes of the main ridge. The flora of T.T.M. compares well with the other studies in the A.M.M., sharing similarities and showing variations in floristic composition across the study sites. The flora of T.T.M. compares well with the expected number of taxa based on the generated species area curve from Southern Appalachian floras. This study addressed the challenges faced by botanists

conducting floristic studies by introducing botanist and ecological effects that should be acknowledged when completing floristic studies and using floristic data. This study provides a cautionary note on the need to gather more data about floristic studies to be able to compare results appropriately, and provides a theoretical model for the completion of a floristic study and the theoretical concept of a complete flora.

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First I would like to thank Dr. Zack E. Murrell for helping me to facilitate this project from its beginnings through Appalachian State University. I would also like to thank Appalachian State University department of Biology and the Office of Student Research (OSR) for funding awarded towards the completion and presentation of this work.

I would like to extend my gratitude and appreciation to Derick Poindexter for his efforts in assisting me with the identification of specimens. Without his vast knowledge and experience with the flora of the Southern Appalachian Mountains, this project and the analysis of the floristic work that came out of it would have been much more difficult.

I would like to thank all of the volunteers in the field and in the herbarium who helped me out in the completion of this project, from collection of specimens to the mounting of herbarium vouchers, accessioning and imaging.

Finally I would like to thank my family for their unconditional commitment to my pursuits in life.

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Introduction

The flora of the Southern Appalachian Mountains is very diverse and much of this diversity can be attributed to the complex geologic history of the region. The area has existed as a refuge for biodiversity for hundreds of millions of years, unexposed to oceanic or glacial activities, while maintaining topographic relief that has provided an extensive range of microhabitats for colonization and speciation by plants (Adams 1902, 1905, Harshberger 1903, Delcourt and Delcourt 1987, Pittillo et al. 1998, Soltis et al. 2006). At least three separate orogenic events, beginning over 600 MYA, created the Southern Appalachian Mountains, defined here by the Piedmont, Blue Ridge, Ridge and Valley, and Cumberland Plateau Provinces (Prothero and Dott 2004, Tarbuck and Lutgens 2005). Continental rifting of an ancient supercontinent about 750 MYA during the Cambrian created what is now recognized as continental North America, the Piedmont micro-continent and a pre-Atlantic Ocean (Prothero and Dott 2004, Tarbuck and Lutgens 2005). Two subduction zones formed that caused the pre-Atlantic Ocean to close and an island arc to form off of the coast of Africa. One of the subduction zones forced the continental plate of North America to collide with the Piedmont microcontinent. This first Appalachian mountain building event, known as the Taconian orogeny, developed about 500 MYA. The second subduction zone caused the continental plate of North America to collide with the island arc known as the Avalonia microcontinent, forming the eastern Piedmont about 400 MYA (Tarbuck and Lutgens 2005). This event, known as the Acadian orogeny, occurred in the eastern part of North

America, creating what is now known as the Carolina Slate belt of the eastern Piedmont (see Figure 1). The third and largest of the events occurred when the supercontinents Gondwana and Laurentia collided during the creation of Pangea, causing massive faulting and uplifting. This Appalachian orogeny, also known as the Allegheny orogeny, occurred between 250 and 300 MYA and is responsible for the massive levels of metamorphism found throughout the Southern Appalachian Mountains. As Pangea began to break apart, a zone of rifting created the North Atlantic Ocean. Hundreds of millions of years of erosion, uplift, and plate tectonic movements have molded the Southern Appalachian Mountains to what they are today, a highly diverse geologic formation that is the result of multiple, long term, separate geologic processes (Abbot and Raymond 1984, Mirsa and McSween 1984, Pittillo et al. 1998, Prothero and Dott 2004, Tarbuck and Lutgens 2005).

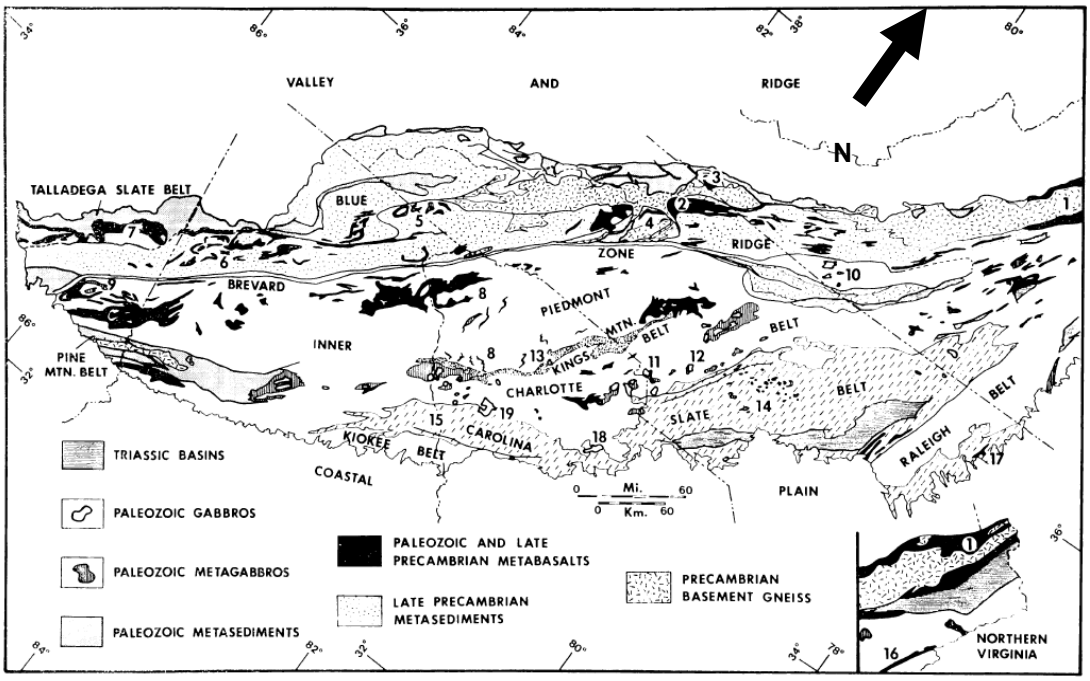

Figure 1: Metamorphic rock deposits of the Southern Appalachians. The map is modified from Mirsa & McSween 1984.

The Southern Appalachian Mountains, shown in Figure 1, are not a uniform entity. The heterogeneous geology of the Southern Appalachian Mountains is reflected in the richness of the flora and fauna, producing one of the most diverse temperate ecosystems in the world, second only to eastern Asia (Adams 1902, 1905, Whittaker 1962, White 1983, Qian and Ricklefs 1999, Shaw and Wofford 2003, Webster et al. 2005). Due to the presence of this very rich flora in the Southern Appalachian Mountains, there has been a long history of botanical interest in the region. Botanists including Andre Michaux and Asa Gray, who explored the Southern Appalachians in the 18th and 19th centuries, reported on the rich diversity and described a number of plant species new to science at the time. More recent studies have begun to describe the subregional diversity, documenting the extreme diversity of plants in the Smoky Mountains (Chafin and Jones 1989, White et al. 2001, Shaw and Wofford 2003) with a comparison of woody plants from the Blue Ridge Province and Cumberland Plateau (Shaw and Wofford 2003). Fleming and Wofford (2004) examined the floristic richness of the Cumberland Plateau region of the Southern Appalachians as part of a floristic study of Fall Creek Falls State Park in Tennessee. Many of the species that add to the richness of the whole area are found more commonly at higher latitudes and reach the southern end of their range in the Southern Appalachian Mountains. This botanical pattern has been extensively studied throughout the past century, and is thought to have been generated by two major factors – the existence of microhabitats for Pleistocene refugia and unique geologic formations that helped to generate centers of speciation that increased plant diversity in the region (Delcourt and Delcourt 1987, Pielou 1991, Broyles 1998, Shaw and Wofford 2003, Soltis et al. 2006).

The species and subregional diversity documented in the Southern Appalachian Mountains has been explained by the theory that the region served as an area of refugia for plants as their migratory patterns shifted during the warming and cooling periods of the Pleistocene Epoch (Martin and Harrell 1957, Pielou 1991, Broyles 1998). The Pleistocene Epoch was a two million year span of approximately 36 periods of cooling that resulted in glacial extensions into North America. The latest glacial period, the Wisconsin glaciation, began about 27,000 years before present, and reached its maximum around 20,000 years ago. One of the two massive glaciers covering North America during this time was called the Laurentide glacier, which spanned the eastern portion of the continent and reached an elevation of over 4,166 m (12,500 ft). Around 12,950,000 km^2 (5,000,000 mi^2) of land was covered from what is now New Jersey, Pennsylvania, West Virginia, Ohio, Indiana, Wisconsin and northward. Over 50% of the fresh water available at the time was sequestered into these glaciers, which decreased precipitation, dried up waterways, and exposed large portions of the continental shelf along the coast of eastern North America (Adams 1902, 1905, Cain 1944, Braun 1950, Wright 1981, Delcourt and Delcourt 1987, 1991, Wiser 1998, Graham 1999, Carroll et al. 2002).

The continental cooling of the Pleistocene caused a significant shift in vegetation and plant migration patterns in North America away from the glacial front. The Southern Appalachian Mountains are thought to have acted as an area of refuge as taxa migrated southward in response to the climatic change (Delcourt and Delcourt 1987, Wiser 1998, Carroll et al. 2002). As plant species migrated southwards, the NE to SW orientation of the Appalachians is thought to have allowed for migratory pathways into what is now coastal North America, Mexico and parts of Central America (Martin and Harrell 1957). As

Pleistocene cooling ended, species began to migrate back northwards, leaving relic populations isolated in areas of the Carribean Sea, the mountains of Mexico, and the Southern Appalachian Mountains (Delcourt and Delcourt 1987, 1991, Baskin and Baskin 1988, Soltis et al. 2006). This period of episodic cooling provides an explanation for the occurrence of taxa with a current northern distribution having disjunct populations throughout the Southern Appalachian Mountains (Soltis et al. 2006).

A second major factor that influenced floristic diversity in the Southern Appalachian Mountains involves centers of hybridization and speciation that are now recognized as biodiversity hotspots. A biodiversity hotspot or a center of plant diversity is an area with a relatively high number of closely related taxa inhabiting a similar habitat – i.e. several species in a genus or several varieties of a species occurring in close proximity to each other (Adams 1902, 1905, Partel 2002, Shaw and Wofford 2003, Flemming and Wofford 2004, Weakley 2008). The designation of portions of the Southern Appalachians as biodiversity hotspots is directly tied to the Pleistocene refuge concept in that ancestral taxa migrated southwards and entered environments that facilitated speciation events. An example of closely related taxa that are thought to have diverged in the Southern Appalachian Mountain region can be seen in the genus *Robinia*, with four species and four sub-specific varieties existing in the Southern Appalachians (Weakley 2008). The two processes of migration and biodiversity hotspots are difficult to separate, but are nonetheless different driving forces that generate an increase in biodiversity levels.

Evidence for the importance of these dual factors of migration and speciation can be seen throughout the Southern Appalachian Mountains. Western North Carolina is filled with isolated habitats that show evidence of serving as refugia or hotspots for speciation,

particularly in the high elevation peaks that exhibit extreme diversity in habitats and climatic regimes. Several high elevation peaks and ridges exist along the Blue Ridge of North Carolina that contains disjunct species with more northerly main range distributions. One of the more interesting areas of "sky islands" or biodiversity hotspots that has not been well studied is in the northwest corner of North Carolina. This area is geologically known as the Ashe Metamorphic Suite (Abbott and Raymond 1984, Mirsa and McSween 1984), and this is the focal region for this floristic study.

The geology in northwest North Carolina is unique for the Blue Ridge Province, which in turn facilitates the presence of a unique assemblage of plants (Oakley 1999, Kintsch 2000, Kintsch and Urban 2002, Peet et al. 1998, 2003, Gardner and Engelhardt 2008). The major parent rock material that exists in the area of central Ashe County and parts of Watauga County is a mafic metamorphic rock called amphibolite, originating from high temperatures and pressures that created sections of the Southern Appalachian Mountains in the late Proterozoic era from 250 MYA to over 500 MYA (Abbott and Raymond 1984, Baskin and Baskin 1988, Peet et al. 2003, Gardner and Engelhardt 2008). Figure 2 shows the range of amphibolite in central Ashe and Watauga counties along with the major peaks in the formation. The amphibolite found in the Ashe metamorphic suite is composed of a matrix of amphibole schist, basalt, dark colored hornblende gneiss and light colored plagioclase feldspar, with veins of quartz interspersed (Abbot and Raymond 1984, Gardner and Englehardt 2008). This metamorphic rock is high in calcium and magnesium ions. When weathered, this bedrock creates soils that are higher in pH than most other soils in the Blue Ridge, making the Amphibolite Mountains Macrosite (A.M.M.) unique in the region (Newell and Peet 1998, Peet et al. 2003).

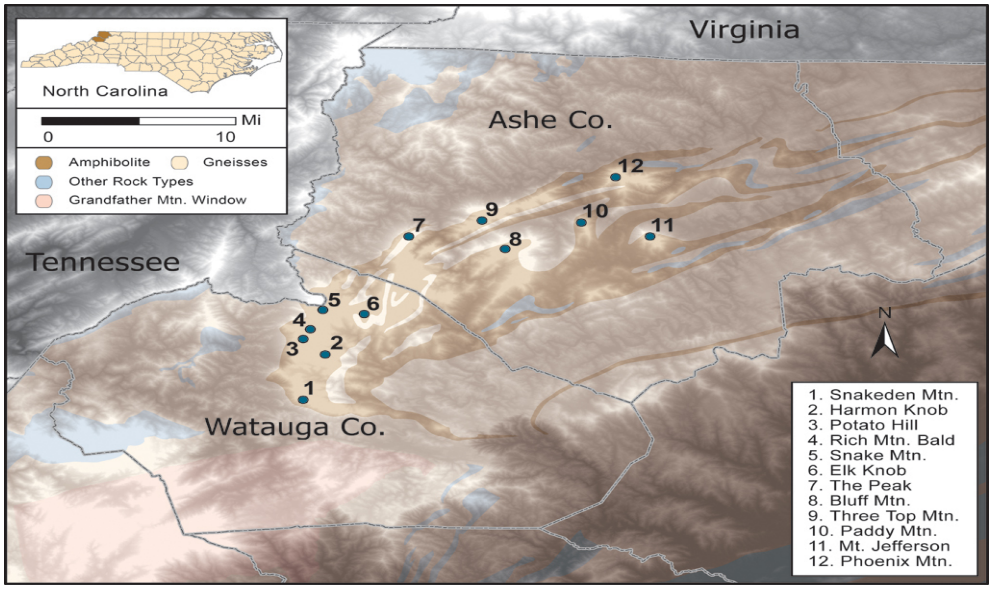

Figure 2: Map of all of the peaks in the Amphibolite Mountains Macrosite Group. Retrieved from (Larkins 2006, http://www.summitpost.org/images/medium/194382.jpg)

Floristics in the A.M.M.

There have been three floristic studies conducted in the A.M.M. (Tucker 1972, Lacy 1979, Poindexter 2006, Poindexter and Murrell 2008). These studies, along with several vegetation surveys and ecological studies, have reported on the vegetation patterns, species diversity and rare species occurrences in northwestern North Carolina (Ramseur 1960, Tucker 1972, Lacy 1979, Wiser 1994, 1998, Wiser et al. 1996, 1998, Oakley 1999, Kintsch and Urban 2002, Peet et al. 2003). Several rare vascular plant species, including Trailing Wolf's Bane, *Aconitum reclinatum* Gray, Heller's Blazing Star, *Liatris helleri* Porter, and Gray's Lily, *Lilium grayii* Watson, have all been documented within the A.M.M. In addition, the only documentation of *Campanula rotundifolia* L. in North Carolina occurs at the edge of its distribution range within the A.M.M. (Tucker 1972, Wiser 1994, Godt and Hamrick 1995, Pittillo et al. 1998, Oakley 1999, Peet et al. 2003).

All of these studies have added to the overall understanding of this biologically diverse area in the southern Appalachians. Understanding the plant biodiversity of an area

through inventory is the primary goal of floristic work, but what obstacles stand in the way of a botanist's ability to complete this task? The ability of a botanist to document the flora as completely as possible can be impacted in many ways. The level of training prior to a study of an area will impact their ability to accurately and thoroughly document the flora. Taxonomic concepts, plant distribution patterns, ploidy issues, and hybridization events are often hard to grasp for inexperienced botanists and can cause confusion in a study, leading to inaccurate results and an incomplete understanding of an area (Hill et al. 1994, Palmer et al. 2002, Plotkin and Muller-Landau 2002, Kercher et al. 2003, Bortolus 2008, Ahrends et al. 2011). While ultimately no botanist will ever be able to correctly document and identify every single plant in an area, the level of training of a botanist can affect the amount of inconsistencies and inaccuracies in their results.

In addition to issues related to the training and background of the floristician, there are also physical and logistic issues that can significantly impact the results of a floristic analysis. Areas that are difficult to access can hinder the thoroughness of a study, especially in studies that are conducted on limited funding. In addition, the level of anthropogenic pressure on an area can affect a botanist's ability to document the flora of an area by compounding the effort to classify the communities as natural or disturbed. Although this "botanist effect" can have a major impact on the number of species discovered in an area and making comparisons between floras difficult, few studies explicitly address this issue in the course of the investigation and subsequent publication of the results of the study. Various aspects of the "botanist effect" and the impact they have on the completeness of a flora will be explored in the discussion section.

The goal of this study is to conduct a floristic analysis in the A.M.M. that will add to the existing data while at the same time examining some of the issues and challenges that can impact the completeness of floristic studies in general. The floras of Bluff Mountain, Mt. Jefferson, and Phoenix Mountain, in addition to other local ecological studies, have added to our overall understanding of this unique area. This study will focus on the Three Top Mountain massif in Ashe County, in an effort to expand our knowledge of the A.M.M.

Introduction to the Study Site

Three Top Mountain (T.T.M.) is a 9.66 kilometer long massif oriented northeast to southwest in Ashe County, North Carolina. It is located within the Blue Ridge Physiographic Province along the eastern section known as the Blue Ridge Range (Oakley 1999). The North Carolina Wildlife Resource Commission has protected 866.47 hectares on T.T.M. as a Game Land Preserve since 1989, when land owners donated some portions and the Nature Conservancy purchased other properties from failed mountain developments (Oakley 1999). Figure 3 shows the property boundary of Three Top Mountain Game Land Preserve in green (NC Wildlife Resource Commission 2008). Three Top Mountain is in an isolated part of Ashe County, west of the city of West Jefferson. The size, lack of development, and protected status as a game land provides an excellent opportunity to explore the flora of the region, develop comparisons with other areas that have been studied floristically, and add to the overall understand of the A.M.M. The floristic study reported here was conducted within the boundary of the Game Land Preserve on T.T.M., and this property can serve as a proxy for estimating the overall species richness of T.T.M.

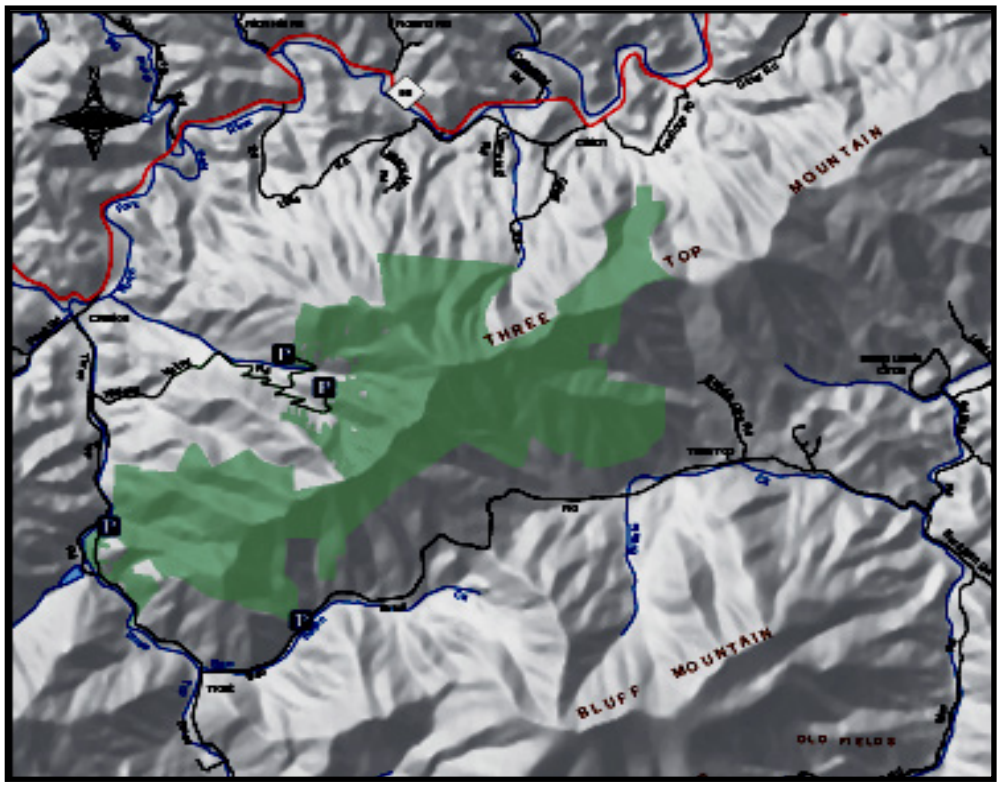

Figure 3: Map of Game Land boundaries on Three Top Mountain with designated parking areas. nSource: NC Wildlife Resource Commission Game Land Map.

Soils on T.T.M. have been classified by the USDA Soil Conservation Service into ten soil series, seven of which occur within the boundaries of the Game Land Preserve (Figure 3). Porter's Stony Loam Soil, occurring on slopes of 25° - 65°, is found throughout the massif's ridge and upper slopes. This soil, which is a stony loam of quartz, gneiss pebbles and amphibole schist with fine texture, is the dominant soil type found at T.T.M. Porters Stony Loam Soil occurs on slopes of 15° - 25° in small pockets along a valley on the northwest and the southwest sides of the massif. Tusquitee and Spivy Stony Soils are found on slopes of 25° - 45° and occur along narrow ravines and seep valleys on the northwest and southeast sides of the massif, most notably towards the southwest end. Tusquitee and Spivy Stony Soils are present on slopes of 15° - 25° and are found mainly along the lower slopes of the massif. Chandler Stony Loam Soils are present on slopes of 25° - 65° and occur in one

area near Three Top Creek along the southwest end of the massif. Evard Stony Loam Soils are found on slopes of 25° - 65° as well as on slopes of 15° - 25 that occur along the southwest end of the massif flanking Three Top Creek (Brewer 1985).

Figure 4: Map showing soil horizons at Three Top Mountain Massif. Map modified from Brewer 1985.

The description of the climate at T.T.M. is not directly available, but can be extrapolated from climate averages for Creston, NC obtained from National Oceanic and Atmospheric Administration (NOAA), and collected by the North Carolina State Climate Office (2011). The NOAA report describes the average temperature for the area as 11.58°C (52.84°F), while the average precipitation per year from January 1970 - January 2011 was 11.14 cm (4.39 in). July is on average the hottest month of the year in Creston NC, with 28°C highs (82.4°F) and 14°C lows (57.2°F), while January is the coldest month with 6°C highs (42.8°F) and -7°C lows (15.4°F). On average, Creston NC receives 13.28 cm of precipitation per month (5.23 in), with the majority of precipitation occurring in the month of

May, while heavy snowfall in the winter is a common occurrence (NC State Climate Office 2011, NOAA 2011). The varying topography of this portion of the Southern Appalachian Mountains creates a cool, high humidity environment on the slopes and a dry, hot environment along the peaks and ridges. The drastic changes in elevation help to create pockets of climate variation, which in turn facilitate development of several microhabitats that are reflected by the varying vegetation (Pittillo et al. 1998, North Carolina State Climate Office 2011, NOAA 2011).

Objectives

There were three main objectives to this study. The first objective was to collect voucher specimens for all the vascular plants growing within the 866.47 hectare Three Top Mountain Game Land Preserve. The second objective was to confirm the presence of the previously documented plant communities recognized by Wiser (1994) and Oakley (1999), and document their occurrence. The third objective was to compare the species richness of T.T.M. with that of other floristic studies conducted in the A.M.M., as well as other floristics within the southern Appalachian Mountains (Tucker 1972, Lacy 1979, Peet et al. 2003, Fleming and Wofford 2004, Poindexter and Murrell 2008, Denslow 2009).

Methods

The four aspects of this study included field work, herbarium identification, statistical analysis of resulting species lists and a comparative analysis of the species richness of T.M.M. and the three other floristic studies conducted in the A.M.M., herbarium voucher creation and digitization of specimens, and accession of specimens into the BOON herbarium. Each of these methods included several steps and these are detailed below.

The field work was conducted from Spring 2009 through Fall 2010, with supplemental collections throughout the 2011 growing season. The field work consisted of the collection of voucher specimens of vascular plants and the documentation of plant communities. Forty-one trips were taken to the study site from 2009-2010, ten of which were taken during winter months to scout access routes for hard to reach areas along the ridge. Three supplemental trips were taken in the 2011 growing season to search for taxa that had a high probability of occurring on the property, but had not been located in previous excursions. These trips account for 44 person days in the field collecting and documenting taxa and habitat types, comprising 23 person days during the 2009 growing season, 18 person days during the 2010 growing season, and 3 person days during the 2011 growing season.

Sampling methods for the field work followed the Floristic Habitat Sampling model outlined by Newmaster et al. (2005). This method focuses on sampling habitat and microhabitat types instead of randomly placed uniform plots. For this study, a habitat was

defined as a large, geographically homogenous area with similar vegetation or plant community type (e.g. Wooded Slopes, Rocky Summit, Seep Valleys). A microhabitat was defined as small areas of variation within a larger habitat (e.g. dry rocky slopes, moist rocky areas, fallen/nursery logs). The decision to use this form of sampling was based on the concept that randomly placed vegetation plots can miss taxa, specific plant communities, and habitat types (Knight and Morris 1996, Newmaster et al. 2005).

Collected plants were processed using standard field plant presses 11.5 " X 16.5 " (Simpson 2006). Collection of duplicate specimens, where appropriate, was the standard collection procedure. Site location for collections and unique plant communities was recorded using GPS technology. Sample collections followed guidelines described by Peet et al. (1998) and Simpson (2006). Specimens were only collected if there were at least 20 additional individuals in a population or 20 branches on a specimen. Imperiled plants that were discovered were documented with digital photographs and their location was recorded with a Garmin V GPS device.

In addition, the field work included a qualitative plant community assignment that followed Shafale (2002). The focus in this part of the field work was to confirm already identified plant communities and to document any communities not previously found (Wiser 1994, Wiser 1996, Peet et al. 1998, Oakley 1999).

Identification to the lowest taxonomic level took place at the I. W. Carpenter Jr. Herbarium (BOON) located in the Department of Biology at Appalachian State University. The taxonomy used followed that of Weakley (2008). Supplemental descriptions and dichotomous keys from Radford et al. (1968) and Wofford (1989) were used to augment Weakley's keys. Identification occurred throughout the Summer, Fall and Winter of 2009_

2010, and with extensive work completed through Fall 2010 and Spring 2011. Several of the identifications, including all collections of the genus *Carex*, were confirmed by Derick Poindexter, from Appalachian State University, Department of Biology.

The floristic list generated in this study was analyzed on three different levels of comparison of variation: 1) within Three Top Mountain Game Land Preserve, 2) within the Amphibolite Mountains Macrosite, and 3) within the Southern Appalachian Mountains. The results from T.T.M. were organized into percent of floristic similarity based on taxonomic levels, growth form, and native range of species. This measurement provides insight into what types of plants existed at the study site and what were their growth forms and nativity. A comparison between floristic studies was conducted on two spatial levels. On a smaller scale, the T.T.M. flora was compared to the three other studies completed within the A.M.M. {Bluff Mountain by Tucker (1972), Phoenix Mountain by Lacy (1979), and Mt. Jefferson by Poindexter and Murrell (2008)}, using Sørrenson's Community Coefficient to determine the floristic similarity among these four sites (Barbour et al. 1999, Smith & Smith 2003). On a larger scale, a taxon area curve was generated from 36 floras conducted in the Southern Appalachian Mountains using the Species Richness Model (Denslow 2009, Palmer 2011). The Species Richness Model is a common tool to estimate the biodiversity of a given area for a given taxonomic group (Lorimer 1980, Wade and Thompson 1991, Peet et al. 1998, Hellmann and Fowler 1999, Newmaster et al. 2005). This tool has generally served as an acceptable method for measuring diversity of a particular group of organisms in a particular environment, even though imperfections in its implementation have been documented (Peet et al. 1998, Hellmann and Fowler 1999, Shaw and Wofford 2003).

Drying and storage practices followed standard protocols, using a plant dryer to speed the drying process and to reduce development of fungi on the collected material. Specimens were mounted on standard-size museum quality herbarium sheets with proper labeling, including all relevant information outlined in Simpson (2006). Collections will be accessioned into the herbarium at ASU (BOON), with duplicate vouchers sent to the herbarium of the University of North Carolina at Chapel Hill (NCU). These collections will be digitized and eventually stored online in the SERNEC database to make them available to researchers throughout the academic community.

Results

Vascular Taxa

A total of 317 taxa from 198 genera and 94 families were documented at Three Top Mountain Game Land Preserve (T.T.M.) during the three year study (Table I). The flora consisted of one species of Equisetophyta, four species of Lycopodiophyta, 11 species of Polyodiophyta, four species of Pinophyta, and 294 species of Magnoliophyta; of which 73 are Liliopsida and 221 are Magnoliopsida. Of the total T.M.M. flora, 93.7% of the taxa were Anthophyta while 6.3% were non-Anthophyta. Two hundred eighty-five of the documented taxa were classified as native, while 24 of the documented taxa were classified as exotic, based on categories used by Weakley (2008).

Table 1: Total number of taxa documented from Spring 2009 – Summer 2011 based on 637 separate collections and documentations.

Taxonomic Rank (Phylum and Class)	Families	Genera	Taxa	Native Taxa	Exotic Taxa	Percent of Total Flora
Equisetophyta	1	1	1	1	0	0.3%
Lycopodiophyta	1	2	4	3	0	1.0%
Polypodiophyta (Ferns)	8	10	13	11	0	3.7%
Pinophyta	1	2	4	4	0	1.3%
Magnoliophyta (Angiosperms)	83	183	294	269	24	93.7%
- Liliopsida (Monocots)	13	38	73	63	10	21.3%
- Magnoliopsida (Eudicots)	70	160	221	196	14	72.4%
Totals:	94	198	317	293	24	100%

***The taxa are separated by taxonomic rank, nativity and percent of total flora.**

Growth Form

There were a total of 48 woody taxa, of which 25 were trees, 18 were classified as shrub-small trees, three taxa were sub-shrubs, and two taxa were lianas or woody vines. Of the 269 herbaceous non-woody taxa, 224 were forbs, 42 were grass-like graminoids, and 3 were vines. There was one documented woody alien taxa (*Rosa multiflora* Thunb.), while 23 herbaceous taxa (16 forbs and 7 graminoids) were documented as exotics.

Table 2: The flora of T.T.M. separated based on growth form and nativity.

Growth form	Total number of taxa	Number of native taxa	Number of Exotic taxa
Woody taxa	48	47	1
Tree	25	25	0
Shrub-small tree	18	18	0
Sub-shrub	3	2	1
Liana	2	2	0
Herbaceous taxa	269	246	23
Forb/herb	224	208	16
Graminoid	42	35	7
Vine	3	3	0

Floristic Similarity within the Amphibolite Mountains Macrosite

The vascular floras of Three Top Mountain, Mt. Jefferson, Bluff Mountain and Phoenix Mountain were compared, in an effort to understand the floristic composition of the A.M.M. (Tucker 1972, Lacy 1979, Poindexter and Murrell 2008). A presence/absence matrix of 1146 species binomials was compiled in an annotated list of species across all four sites using Sorensøn's Community Coefficient or Index of Similarity (Smith and Smith 2003). Infra-specific taxa were considered as a single species to maintain consistency of the matrix. The results are presented as percent similarity, with any result above 50% generally

thought to indicate similar floristic composition (Smith and Smith 2003). The results suggest that T.T.M. is floristically similar to the three other floras, but is most closely similar to Phoenix Mountain, with an Index of Similarity of 56%, and least floristically similar to Mt. Jefferson, with an Index of Similarity of 48%. Mt. Jefferson and Bluff Mountain share the highest floristic similarity at 71%, while Bluff Mountain and Phoenix Mountain are 62 % similar and Mt. Jefferson and Phoenix are 59% similar (Table 3). Appendix B lists the 1146 species, representing the taxa from all four studies that were used in the analysis of floristic similarities.

Table 3: Sorensøn's Index of Similarity results for Three Top Mountain, Phoenix Mountain, Mt. Jefferson, and Bluff Mountain.

Flora	**Mt. Jefferson**	**Bluff Mtn.**	**Phoenix Mtn.**
Three Top	0.50	0.52	0.57
Mt. Jefferson	-	0.71	0.59
Bluff Mtn.	-	-	0.62

***Data from: Tucker (1972), Lacy (1979), and Poindexter (2006)**

Species Area Curve comparisons of the Southern Appalachian Mountains

The flora of T.T.M. was compared with 36 other floras to generate a species area curve (S.A.C.) for these representative floras in the Southern Appalachian Mountains. These comparisons generated a S.A.C. for the Southern Appalachians based on variation in the physiographic province using the least definable units to distinguish taxa (Denslow 2009, Palmer 2011). Shown in Table 4, these floras were chosen for comparison because they represent a wide range of Southern Appalachian habitats and a wide range in study area sizes. These floras were chosen to generate a species area curve because they reflect the floristic

composition of the Southern Appalachian Mountains, specifically the Blue Ridge Province. This curve represents the floristic composition of the Blue Ridge Province more accurately than using the S.A.C. calculation from Wade and Thompson (1991) that was based on climax vegetation concepts of Braun (1950), in accordance with analyses conducted by Shaw and Wofford (2003).

Table 4: List of floras used to generate a Species Area Curve for the Southern Appalachian Mountains.

Flora	Short.Name	Area ha.	Taxa
Stratton & White 1987	Silers and Welch Ridge Bald	1.5	87
Stratton & White 1983	Andrews Bald	3	146
Stratton & White 1984	Gregory Bald	3	175
Stratton & White 1986	Parsons Field	3.5	90
Stratton & White 1985	Spence Field	8	139
Stratton & White 1982	Grassy Balds of the Smoky Mountians	30.5	293
Livengood 1972	Sim's Pond Area	42.36	89
Warren et al. 2004	Tulula Creek Floodplain	83	107
White 2003	Sandburg NHS	108	521
Ramseur 1960	Grandfather Mountain	109	67
Radford 1948	Olivine Deposits	117.3588	750
Ramseur 1960	Great Craggy Mountains	197	106
Poindexter 2006	Mt. Jefferson	368.26	702
Feil 1987	Chimney Rock	404.685	551
Boyd & Monroe 2010	Warren Wilson College	459	563
Michael 1969	Bullhead Mountain	484	333
Ramseur 1960	Pisgah Ridge	502	124
Taylor 1974	Tablerock Mountain	555	406
Ramseur 1960	Plott Balsam Mountains	570	107
Taggart 1973	Stone Mountain State Park	853.63	302
Jenkins&Murrell (unpublished)	**Three Top Mountain Game Land Preserve**	**866.47**	**317**
Ramseur 1960	Roan Mountain	881	112
Rodgers & Shake 1968	Bearcamp Creek Watershed	1191	447
Rohrer 1983	Hanging Rock	1238	355
Pittillo & Lee 1984	Coweeta Hydrologic Lab	1626	604
Rodgers 1969	Horsepasture Gorge	2085	568
Bradshaw 1987	Lost Cove	2308.5	431
Lacy1977	Phoenix	2330	445
Ramseur 1960	Black Mountains	2476	139
Murrell&Woffard 1987	**Big Frog**	**2843.00**	**479**
Tucker 1972	Bluff Mountain	2849	681
Ramseur 1960	Balsam Mountains	2937	265
Ramseur 1960	Great Smoky Mountains: high mountains	4895	201
Ware 1973	Thompson River Watershed	5857	547
DuMond 1970	Chattooga	8047	502
Rodgers & Shiflet 1978	Eastatoe	9530	659
McLeod 1988	Black and Craggy Mountains	35000	972
Peattie 1928	Tryon Region	67339.69	1090

***This study and Big Frog Wilderness (Murrell & Wofford 1987) (both in bold) were used for comparisons for the taxa area curve and were not factored into the regression. From Palmer (2011) http://botany.okstate.edu/floras/.**

From the regression generated from the 36 Southern Appalachian floras, an area the size of the Game Land Preserve on T.T.M. (866.47 ha) was predicted to have 337 taxa. This figure is slightly above the recorded 317 taxa and deviates by 5.9% from the expected value, but falls well within the range of the predicted number of taxa based on the prediction intervals generated by the S.A.C. Shown in Table 5 below, the floras highlighted in Figure 4 were chosen to show how they compared to the S.A.C. The documented floras of Mt. Jefferson and Bluff Mountain were both much higher than the expected floristic diversity

based on the S.A.C. for the Southern Appalachians, while the flora of Roan Mountain was expected to be around 338 taxa while only 112 taxa were documented at the time of this study.

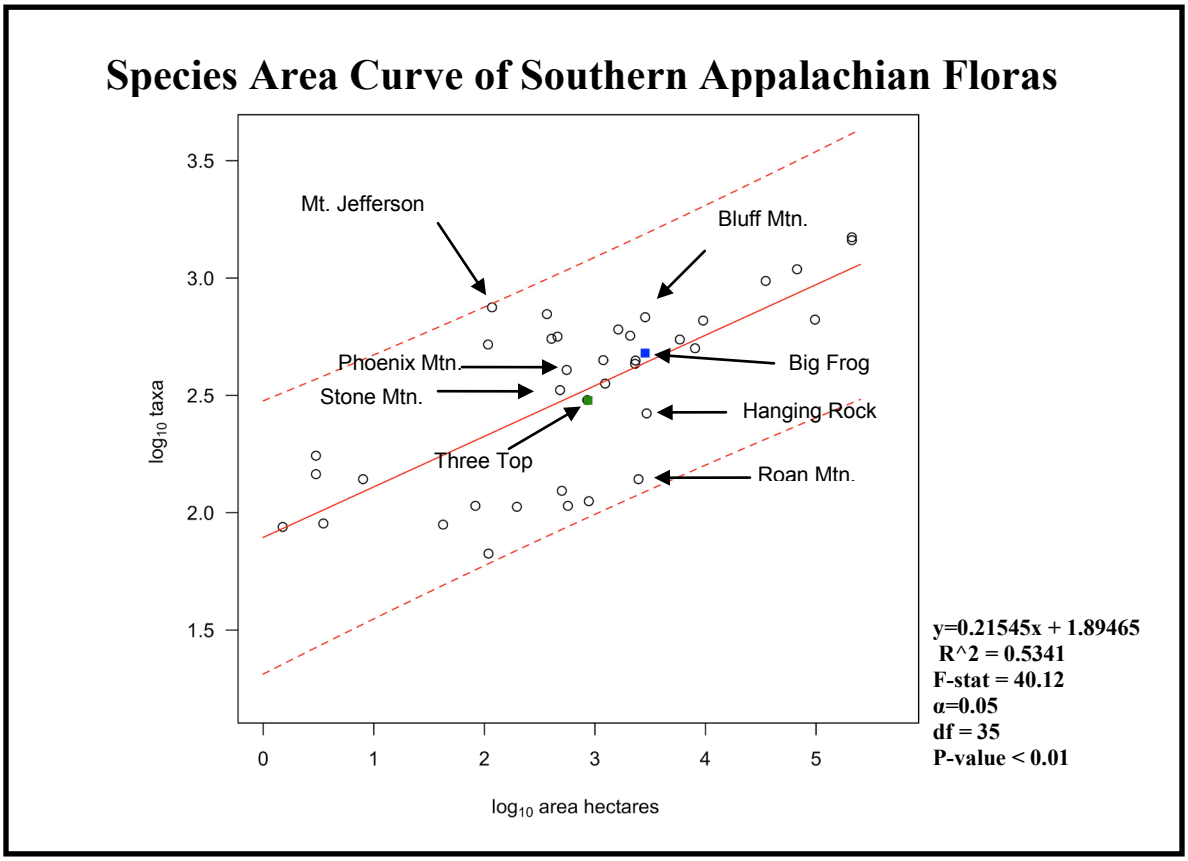

Figure 5: Graph of the regression line for the number of taxa per area based on 36 floras from the Southern Appalachian Mountains. Displayed are prediction intervals and the equation for the S.A.C. with an $\alpha = 0.05$ and a $P < 0.01$. Each of the floras highlighted are shown in detail in Figure 5 below. Three Top and Big Frog are there for comparison and were not used to compute the S.A.C.

Table 5: Deviations for selected floras used to generate a Species Area Curve for Southern Appalachian Floras.

Floras	County, location	Parent Rock Material	Area (ha)	Number of Known Taxa	Number of Predicted Taxa Southern Appalachian Floras	Percent Deviation from Predicted Southern Appalachian Floras
Roan Mtn.	Carter, TN, Mitchell, NC	Cranberry Gneiss, Beech Granite	881	112	*338*	*-201.0*
Three Top Mtn.	Ashe, NC	Amphibolite	866	317	337	-5.9
Mt. Jefferson	Ashe, NC	Amphibolite	368	701	*280*	+250.4
Bluff Mtn.	Ashe, NC	Amphibolite	1287	681	*366*	+186.1
Phoenix Mtn.	Ashe, NC	Amphibolite	2330	450	*417*	+7.9
Big Frog	Polk, NC	Slate, Phyllite, Sandstone, Residuum	2843	479	*435*	+9.1
Hanging Rock	Watauga, NC	Arkose, Green scheist, metabasalt	1238	355	*364*	*-2.5*
Stone Mtn.	Alleghany& Wilkes, NC	Granite	853	347	*336*	+3.2

*** Selected data from (Ramseur 1960, Tucker 1972, Taggart 1973, Lacy 1979, Rohrer 1983, Murrell and Wofford 1987, Poindexter 2006, and this study).**

Central and Southern Appalachian Endemics

The flora of T.T.M. consisted of 22 taxa that are known to be endemic to the Central and Southern Appalachian Mountains. These taxa are restricted in range to the central and Southern Appalachian Mountains and were either locally abundant or uncommon and rare. Table 6 lists the endemic taxa that were documented.

Table 6: Central and Southern Appalachian Mountains endemic taxa* documented at Three Top Mountain.

1. ***Ageratina altissima* King & H.E. Robinson var. *roanensis* (Small) Clewell & Wooten**
2. ***Clethera accuminata* Michaux**
3. ***Eurybia chlorolepis* (Burgess) Nesom**
4. ***Galium latifolium* Michaux**
5. ***Geum radiatum* Michaux**
6. ***Houstonia montana* Small**
7. ***Huperzia appressa* (Desvaux) A. Love & D. Love**
8. ***Hylotelephium telephioides* (Michaux) H. Ohba**
9. ***Hypericum mitchellianum* Rydberg**
10. ***Carex lucorum* Willdenow ex Link var. *austrolucorum* J. Rettig**
11. ***Ilex montana* Jacquin**
12. ***Liatris helleri* Porter**
13. ***Lilium grayii* Watson**
14. ***Meehania cordata* (Nuttall) Britton**
15. ***Micranthes petiolaris* (Rafinesque) Brouillet**
16. ***Oclemena acuminata* (Michaux) Green**
17. ***Carex bromoides* Willdenow ssp. *montana* Naczi**
18. ***Scrophularia marilandica* L.**
19. ***Sedum ternatum* Michaux**
20. ***Sibbaldiopsis tridentata* (Ainton) Rydberg**
21. ***Solidago curtisii* Torrey & A. Gray**
22. ***Tsuga caroliniana* Engelmann**

***Central and Southern Appalachian Mountain Endemics as determined by Weakley (2008).**

Imperiled Taxa documented at T.T.M.

A total of 26 taxa were documented at T.T.M. that are classified as being "imperiled" and are listed in Table 7. This designation was given to taxa that are recognized by the U.S. Fish and Wildlife Service or by North Carolina Plant Conservation Program and the North Carolina Natural Heritage Program as endangered, threatened, significantly rare, watch listed, or a species of special concern. Of these designated imperiled taxa, 19 exist at the periphery of their distribution range, while seven are Central and Southern Appalachian endemics. Taxa with a U.S. federal designation documented at T.T.M. were *Liatris helleri* Porter, *Geum radiatum* Michx., *Houstonia montana* Small, *Tsuga canadensis* L., and *Tsuga caroliniana* Englem., while the rest of the taxa are designated as imperiled by the state of North Carolina on some level.

Table 7: List of imperiled* taxa documented at T.T.M.

1. ***Aconitum reclinatum* Gray**
2. ***Allium allegheniensis* Small**
3. ***Allium burdickii* (Hanes) A. G. Jones**
4. ***Bromus nottowayanus* Fernald**
5. ***Campanula rotundifolia* L.**
6. ***Carex woodii* Dewey**
7. ***Carex lucorum* Willdenow ex Link var. *lucorum* J. Rettig**
8. ***Dicentra cucullaria* (L.) Bernhardi**
9. ***Elymus hystrix* L. var. *bigelovianus* (Fernald) Bowden**
10. ***Gentiana austromontana* Pringle & Sharp**
11. ***Geum radiatum* Michaux**
12. ***Houstonia montana* Small**
13. ***Huperzia appressa* (Desvaux) A. Love & D. Love**
14. ***Hypericum mitchellianum* Rydberg**
15. ***Juncus trifidus* L.**
16. ***Liatris helleri* Porter**
17. ***Lysimachia quadrifolia* L.**
18. ***Meehania cordata* (Nuttall) Britton**
19. ***Micranthes caroliniana* (A. Gray) Small**
20. ***Panax quinquefolius* L.**
21. ***Scirpus hattorianus* Makino**
22. ***Stellaria corei* Shinners**
23. ***Trillium grandiflorum* (Michaux) Salisbury**
24. ***Trillium sulcatum* L.**
25. ***Tsuga canadensis* L.**
26. ***Tsuga caroliniana* Englemenn**
27. ***Trichophorum caespitosum* (L.) Schur**

***Imperiled status determined by Weakley (2008), United States Fish and Wildlife Service (2011), and NCDA&CS, PID (2010).**

Communities

There were 10 communities documented at Three Top Mountain Game Land Preserve during the study, nine of which were defined as natural. These natural communities and their subtypes were determined based on the concepts of Schafele (2002). This community classification system uses interacting biotic and abiotic factors on a local scale to define community structure. Of the 10 communities documented, 8 were the communities originally confirmed by Oakley (1999). These community types and their subtypes were

identified and designated in an effort to describe the vegetation of T.T.M.; however, in several instances a formal definition for an area was not made. Several areas showed characteristics of more than one community type and in these cases they were labeled as community ecotones. These communities represent the assemblage of plants within the time frame of this study, as community dynamics are fluid and can change over spatial or temporal ranges. Each community type and subtype documented at T.T.M. is described below.

Northern Hardwood Forest (3 subtypes): This community was one of the most widespread communities documented at T.T.M. and existed along slopes from around 1,220 m (4,000 ft) to 1,430 m (4,700 ft). Below the lower elevation of the range it intergrades with Rich Cove Forests on the north-facing slopes, Rich Montane Seep communities around the heads of water run-offs, and Montane Oak Hickory Forest along the western end of the property. Above the elevation range it intergrades with areas of High Elevation Red Oak Forests and High Elevation Rocky Summit communities at around 1,524 m (5,000 ft). The **Typic subtype** is defined by the presence of canopy trees *Betula alleghaniensis* Britton, *Fagus grandifolia* Ehrh., *Aesculus flava* Aiton, with the shrub layer including *Viburnum lantanoides* Michaux, and a relatively less rich herb layer (Schafele 2002). This subtype was mostly found along the upper end of its elevation range, intermixing with High Elevation Red Oak Forests along the upper slopes and forested ridge with the best example documented between Huckleberry Rock and Big Rock. The **Rich subtype** is characterized with an herb layer similar to the Rich Cove Forest, consisting of *Caulophyllum thalictroides* (L.) Michaux, and *Laportea canadensis* (L.) Weddell, and occurring on mafic substrate at high elevations (Schafele 2002). This subtype was found bordering Rich Cove forests throughout the

property at mid to high elevation, especially along the upper slopes below the ridge near the southwest end of the property. The **Sedge Beech Gap subtype** consists of a dominant canopy of *Fagus grandifolia*, with *Carex pensylvanica* Lamarck and other graminoids in the herb layer (Schafele 2002). This high elevation community subtype was found in a few places near the ridge throughout the property, with the most well defined example along the north facing slopes just below Big Rock near a small heath bald.

Rich Cove Forest (1 subtype): This community type was documented extensively along the lower to mid elevations below 1,220 m (4,000 ft) at T.T.M., especially along the north facing slopes near the Game Lands access parking adjacent to Hidden Valley Road. This forest type borders Rich Montane Seep communities along mountain run-off streams throughout the property. The **Montane Rich subtype** was the most common Rich Cove Forest, found scattered throughout the north facing slopes below 1,220 m (4,000 ft) where it transitions into Northern Hardwood Forest. This subtype was indicated by the presence of several canopy species including *Aesculus flava, Acer saccharum* Marsh., *Fraxinus americana* L., *Tilia americana* L. var. *heterophylla* (Ventenat) Loudon*, Liriodendron tulipifera* L.*, Magnolia acuminata* L.*,* and *M. fraseri* Walter (Schafele 2002).

High Elevation Red Oak Forest (2 subtypes): This rare high elevation community occurs in small pockets at T.T.M. along the upper slopes above 1,430 m (4,700 ft) and ridges around the major peaks. This community often bordered areas of Northern Hardwood Forest, Heath Balds, and High Elevation Rocky Summit community on Big Rock. The **Herb Subtype** is distinguished by a deciduous herb layer that includes the ferns *Dennstaedtia punctilobula* (Michaux) T. Moore and *Thelypteris noveboracensis* (L.) Nieuwland. Graminoids account for less than 50% of the herb layer in this subtype (Schafele 2002). This

subtype was found mostly along the forested parts of the ridge, especially between Huckleberry Rock and Big Rock. The **Heath Subtype** is delineated by having an understory consisting of *Kalmia latifolia* L., *Rhododendron catawbiense* Michaux, and *Galax urceolata* (Poiret) Brummitt (Schafele 2002). This was somewhat of an ambiguous subtype, as it was found in small areas along two secondary finger ridges on the north facing side of T.T.M. This community subtype was also found along the ridge northeast of Huckleberry Rock, where it bordered Heath Bald communities and High Elevation Rocky Summit communities. This could have been misinterpreted as a Stunted Heath Subtype, as several trees reached over 8 m tall yet still had a stunted architecture that produced an open canopy.

Heath Bald (1 subtype): This community was found in association with High Elevation Rocky Summit communities along the major peaks of T.T.M., most notably along the ridge at Big Rock and along the south facing slopes along the ridge just north-east of Huckleberry Rock. The **Catawba Rhododendron Subtype** is distinguished by the presence of *Rhododendron catawbiense,* sometimes *Kalmia latifola*, and several *Vaccinium* species. (Schafele 2002). This was the only subtype confirmed at T.T.M., and this can be attributed to the relatively small size of this community where it occurs.

High Elevation Rocky Summit (1 subtype): This community occurred throughout the major peaks and ridge of T.T.M. where the canopy opens up to treeless rocky peaks. The **Typic Subtype** was the primary form of this community found at the major peaks and is recognized by the presence of *Sibbaldiopsis tridentata*, *Geum radiatum*, *Liatris helleri*, *Houstonia montana*, and *Menziesia pilosa* (Michaux ex Lamarck) Antoine (Schafele 2002). The presence of *Campanula rotundifolia* at two separate locations along the ridge was very

significant, as this is the southern limit for this species east of the Mississippi River and the only occurrence in North Carolina.

Rich Montane Seep (2 subtypes): These communities occurred throughout the Game Lands Preserve along run-off streams at low to mid elevations below 1370 m (4500 ft). The **High Elevation Subtype** is distinguished by the heavy dominance of *Impatiens pallida* Nuttall, *Monarda didyma* L., and *Rudbeckia laciniata* L. var. *humilis* A. Gray (Schafele 2002). This subtype was found mostly along water run-offs on the north facing slopes of T.T.M., especially along the old logging road converted trail that ascends Huckleberry Rock. The **Cove Subtype** is defined by occurring well below 1219 m (4000 ft) in elevation, and by the presence of *Diphylleia cymosa* Michaux, *Micranthes micranthidifolia* (Haworth) Small and *Laportea canadensis* (Schafele 2002). This subtype was positively documented along the run-offs at elevations below 1066 m (3500 ft) on the southwest portion of the massive.

Montane Oak-Hickory Forest (1 subtype): This community was somewhat difficult to distinguish from other communities at the lower elevations of T.T.M., but was documented to be most prevalent in the southwest portion of the Game Lands where it intermixes with subtypes of a Northern Hardwood Forest and a Rich Cove Forest. The **Basic Subtype** was determined based on the presence of canopy species *Quercus montana* Willdenow, *Q. rubra* L. var. *rubra*, *Liriodendron tulipifera* L., *Robinia pseudoacacia* L., and *Nyssa sylvatica* Marshall. The herbaceous layer is usually rich, and includes species that tend to occur on circum neutral soils including *Collinsonia canadensis* L., *Arisaema triphyllum* (L.) Schott, *Podophyllum peltatum* L., *Actea racemosa* L., *Tradescantia subaspera* Ker-Gawler, and *Adiantum pedatum* L. (Schafele 2002). The best example of this forest type was

in a lower cove off of Three Top Road along on the southwest side of T.T.M. that was accessed by an old hunting trail just below a power line cut-through.

Montane Cliff (1 subtype): This ambiguous community type was difficult to document based upon the classification characteristics used to describe it. Oakley (1999) described areas at low to mid elevation on forested slopes containing cliffs around 10 m (30 ft) high that were populated with typical rock outcrop species, such as *Heuchera villosa* Michaux and *Asplenium trichomanes* L. Schafele (2002) has a less defined description of this community type that will likely change in the future. The **Mafic Subtype** was the primary form of this community, represented by significant cover of *Heuchera villosa* on some exposed rocky cliffs along the north facing slopes, both with areas of open and closed canopies. *Asplenium trichomanes* was found on Mafic cliffs along the southern slopes, mostly with a closed canopy.

Carolina Hemlock Forest (1 subtype): This natural community was documented for the first time at T.T.M. during this study. This community type was documented on two secondary finger ridges along the south facing slopes of T.T.M. well below 1219 m (4000 ft), and both were determined not to be waifs based upon the presence of 160 *Tsuga caroliniana* Engelmann and 132 *Pinus rigida* Miller trees along one of the finger ridges. The example found at T.T.M. was more aligned with the **Pine Subtype**, based on the dominance of these tree species in the open canopy, in addition to the sparse *Quercus rubra* L.*, Q. alba* L., and *Vaccinium ssp.* (Schafele 2002). These communities can be easily seen from Huckleberry Rock with a view of the southern facing slopes. No other areas on the Game Land Preserve were found that included these two trees as the dominant canopy species, supporting the recognition of this assemblage as a definable community.

Culturally Disturbed Area (no subtypes): While not recognized as a natural community, a power line cut is present along the southwest end of T.T.M. close to the Game Land border with Three Top Road. This area was a rare example of a plant assemblage after anthropogenic disturbances and is infrequently found at T.T.M. in large part due to the sparse population surrounding the property and lack of well traveled paved roads bisecting the property. Several species were documented in this area including *Rubus ssp*., *Clematis viorna* L., *Coreopsis major* Walter var. *rigida* (Nuttall) F. E. Boynton, *Rhus typhina* L., *Typha latifolia* L., *Scrophularia marilandica* L., and *Lysimachia quadrifolia* L.

Discussion

Several taxa documented at T.T.M. are unique to the A.M.M. (*Meehania cordata*, *Carex bromoides* ssp. *montana*, and *Huperzia appressa*). In addition, many components of the flora are species that migrated south during the Pleistocene glaciation (Wiser 1998). For example, *Campanula rotundifolia* is a circumboreal species found more commonly in Eurasia and northern and western North America growing in alpine communities (Weakley 2008). Towards the southern extreme of its distribution range in the Southern Appalachian Mountains it becomes more restricted to limestone outcrops and high elevation rocky summits. The population at T.T.M. is the southern-most population in eastern North America and is the only occurrence of the species in North Carolina (Weakley 2008, NCDA&CS 2010). Populations or genets of this species were documented in two separate locations along the massif.

Several other taxa documented in the high elevation rocky summit communities at T.T.M. that are disjunct northern "relics" or are closely related to northern taxa include *Huperzia appalachiana*, *Sibbaldiopsis tridentata*, *Juncus trifidus*, *Trichophorum caespitosum*, *Liatris helleri*, and *Geum radiatum*. *Huperzia appalachiana* occurs in high elevation rocky summit communities in the Southern Appalachian Mountains and is disjunct from populations in New England, Canada, and the northern mid-west of Michigan. *Sibbaldiopsis tridentata* occurs throughout the Appalachian Mountains and extends

into Canada. *Juncus trifidus* is another circumboreal species whose disjunct southern extreme terminates in the Southern Appalachians of North Carolina and Tennessee, and is also unique to T.T.M. within the A.M.M. *Liatris helleri* is a narrowly endemic federally endangered species found on about one dozen peaks in the Southern Appalachian Mountains of NC and is thought to have had a wider distribution prior to the last glacial maximum. Although the circumscription of this species is currently debated, the new circumscription would still exhibit a more northern distribution with scattered populations in northwestern NC (Nesom 2005). *Trichophorum caespitosum* was documented at T.M.M. along the north facing slopes of Big Rock and is possibly the southernmost population, since it is the only occurrence of the taxa in the A.M.M. *Geum radiatum* is probably one of the most studied Southern Appalachian endemics, and is closely related to the northern Appalachian *G. peckii* Pursh, indicating that a possible vicariance event generated these two sister species from a common ancester. *Micranthes petiolaris* is another species suspected of being a relic of the tundra habitat that was likely present throughout the southern Appalachians 20,000 years BP, and it is now widely distributed throughout the A.M.M. as well as the southern Appalachian Mountains (Wiser 1998, Carrol et al. 2002, Weakley 2008).

The variation seen within the four documented floras of the A.M.M., based on the Index of Similarity from Table 3, suggests that other variables besides bedrock type are generating the heterogeneity in floristic composition documented for this area. While T.T.M. has an overall lower documented richness than the other peaks in the area, its isolation from major anthropogenic development is one factor that likely led to the presence and persistence of so many rare and endemic species at this site. Comparison of the flora of T.T.M. to the rest of the southern Appalachian floras, through the generated S.A.C., indicates that the flora

falls 5.9% below the expected number of species for an area the size of the T.T.M. Game Land Preserve. However, the results do fit within the variance of the predicted species numbers generated from the floras for an area the size of the Game Land Preserve on T.T.M.

The practice of defining a natural community may seem imprecise when based on floristic observations, but an understanding of ecological communities around us is a critical tool for the conservation of biodiversity and habitats (Schafale and Weakley 1990, Wiser 1994, 1996, Wiser et al. 1996, 1998, Grossman et al. 1998, Schafale 2002, Boerner 2006, Weakley 2008). My recognition of 10 community types within the T.T.M. should be recognized as an enhancement on the efforts of Oakley (1999), but a more quantitative analysis of the communities is needed to fully explore the ecological diversity on the massif. Many of the examples of communities found at T.T.M. were unambiguous, yet ecotonal areas shared similar components of adjacent community types making delineation problematic. The definition of some of the communities described at T.T.M. is controversial. For example, Oakley (1999) reported mafic cliff communities existing at T.T.M., describing some of the cliffs as being over 15 m (45 ft) high. While large cliffs do exist at T.T.M., both along the ridge as well as on the lower slopes in the forest understory, the description of plants found in that community type is very broad in that the vegetation component is described as herbaceous. This indicates that community was defined primarily on the presence of cliffs formed from mafic rock (Schafale 2002). In addition, the recognition of culturally disturbed areas and their role as natural sources of potential floristic richness is not generally appreciated. This type of area highlights the importance of evaluating how we define community structure, as these areas serve as corridors into other areas and communities and can also have a significant impact on any comparisons of floristic diversity.

The classification of communities followed the system outlined by Schafale and Weakley (1990), and Schafale (2002). This natural community classification system takes into account both species composition and environmental gradients to identify community types (Grossman et al. 1998, Schafale and Weakley 1990, Schafale 2002, Weakley 2008). Working in the A.M.M., this method is effective for the classification of natural communities on a local scale because it allows for a focus on floristic composition, while also recognizing variations and subclasses based on various environmental gradients and differences in substrate or geology. This method focuses on the set of gradients, environmental and biological, that are the most important to define a given community. This is an important concept to consider when classifying plant communities in an area like the southern Appalachian Mountains. For example, high elevation rocky summit communities are defined by a set of variables including elevation, percent exposed rock, thin soils, and a lack of a true canopy. Variations can exist within this type of community based on different sets of dominant plants, which can complicate accurate delineation of communities (White 1983, Schafale and Weakley 1990, Wiser 1994, Wiser et al. 1996, 1998, Pittillo et al. 1998, Schafale 2002, Boerner 2006).

The results from this study generate interesting questions regarding the recorded number of taxa in a floristic study. Comparisons of floristic studies are frequently used to examine regional diversity and/or to determine the completeness of any given study. How accurate are the taxa numbers that are reported and how does the experience of the floristician conducting the field work impact the overall reported richness of an area? Is there an effect scenario, or scenarios, that can cause variation in taxa numbers when conducting floristics studies? If there is an effect scenario or scenarios, then what are the

underlying causes for the effect(s)? Finally, is this effect quantifiable across studies? These questions can have significant impacts on decisions that are made regarding land management and conservation, so a careful analysis of them is warranted.

The results from this study are in line with the expected richness of the area from the species area curve I generated, yet are lower than the rest of the studies completed in the A.M.M. This phenomenon leads to the question of why there are such differences in the taxa documented at T.T.M. and other study sites in the A.M.M. Being one of the larger mountains in the A.M.M., at 9.66 km long, it was predicted that overall richness would have been comparable to or even greater than the other peaks. The opposite turned out to be the case in regard to floristic studies in the A.M.M. In comparison, Mt. Jefferson had an overall larger total richness than the other peaks, despite being an area that was smaller than the other studies. In addition, several common taxa expected to have been recorded at T.T.M. were not documented. Figure 8 shows a list of common expected taxa that were not reported at T.T.M. at the time of this study.

Table 8: Examples of common taxa that were not documented at T.T.M. during this study

Selaginella apoda (L.) Spring
Selaginella rupestris (L.) Spring
Dryopteris goldiana (Hooker ex Goldie) A. Gray
Dendrolycopodium obscurum (L.) A. Haines
Carya alba (L.) Nuttall ex Elliott
Cypripedium acaule Aiton
Cypripedium parviflorum Salisbury var. *pubescens* (Willdenow) Knight
Prenanthes roanensis (Chickering) Chickering
Quercus velutina Lamarck
Rubus allegheniensis Porter
Spiranthes ssp.
Carduus ssp.
Aruncus dioicus (Walter) Fernald

To evaluate the reason for this disparity among sites in comparison with the T.T.M. flora, we need to ask if this is due to a human-bias driven botanist effect, the effects of several ecological factors that impact biodiversity levels, or a combination of the two. Secondly, if there is a botanist effect or a result of different environmental variables impacting biodiversity levels, what could be some of the potential underlying causes of these effects in respect to the results obtained from this study? Finally, when examining the role of these effects, what does this tell us about attempts to compare floristic studies within and between regions? While both of these factors can have an impact on the knowledge of the biodiversity of an area, the source of these variables are very different.

The Botanist Effect

A botanist effect on sampling has been suspected of influencing biodiversity inventory results and floristic studies by several authors who have described and discussed errors in these studies (Hill et al. 1994, Palmer et al. 2002, Plotkin et al. 2002, Kercher et al. 2003, Agapow et al. 2004, Bortolus 2008, Ahrends et al. 2011). While taxonomic level concepts are difficult for anyone not trained in taxonomy to comprehend, these errors are compounded exponentially when proper identification of species is the primary goal or a significant portion of a study. Entire bodies of work can be undermined due to inaccuracies in taxonomic identification. One study evaluated 80 selected papers published between 2005 and 2007 and found that 50 of them gave no supporting information for the identifications of the organisms studied, and only two of the studies reported voucher specimens being deposited in an institutional repository (Bortolus 2008). Inaccuracies in taxonomic identification and lack of vouchers for confirmation by other experts can lead to a decline in the quality of floristic and/or ecological data. Therefore, an investigator's ability to

recognize taxa, including rare and endangered taxa, can be critical to the quality of the final product. There are several factors that affect a botanist's ability to record new and endangered taxa, but the three factors that explained the most variation among botanists are experience, timing, and funding (Hill et al. 1994, Kercher et al. 2003, Agapow et al. 2004, Ahrends et al. 2011).

The experience of a botanist is given in terms of number of days in the field, the number of prior studies conducted by the investigator (experiential training), access to facilities (herbaria) to examine comparative materials that are well-annotated, and the level of educational background of the investigator (formal training). These variables have the largest impact on a botanist's ability to accurately document the flora of an area. Not only is a flora's quality enhanced by efforts of an experienced botanist, but the number of subsequent taxonomic errors is also reduced. Ahrends et al. (2011) showed that a botanist's experience, measured by the number of days in the field, accounted for 96% of the variation in the number of reported taxa. In addition to experience in the field, experience via training has just as much benefit to a botanist's ability to recognize and report taxa at any given site. This botanist's effect can be further compounded by variations in morphology of taxa at a study site, which has the impact of generating greater error rates in areas that are less well studied or that are "hotspots" for hybridization, introgression or active speciation.

There were forty-four person days in the field documenting and collecting during this study, with about equal time spent during each of the first two years of the study. Much of this time was spent dealing with cryptic taxa such as *Dendrolycopodium hickii, Allium burdickii,* and the putative sexual diploid montane form of *Erigeron strigosus* var. *strigosus*. These taxa proved to be troublesome during identification due to their cryptic nature and

imperiled status, and could only be identified with the assistance of experienced botanists and with comparisons to other specimens housed in the herbarium at Appalachian State University (BOON). In addition, much of the 2009 growing season was spent becoming familiar with the variations found within the varieties, subspecies, and morphotypes in several taxonomic groups including the pteridophytes. This learning curve is likely to be similar in other studies conducted by students with similar experience.

The issue of time is a second major issue that is confounding in floristic studies conducted in temperate regions and this issue confounds in two ways. First, time plays a strong role in most floristic studies, considering that they are often limited to a one or two year time frame. This gives the researchers only a growing season or two to complete their field work, limiting the time available to document as many taxa and habitats as possible. While the tropics also experience versions of seasonality (and seasonal variability in the ability of floristicians to obtain flowering or fruiting material), it is not as significant an issue as in the temperate region. The second aspect deals with the temporal nature of plant phenology in the sense that not all plants reproduce at the same time. Within the narrow time frame of a growing season, with an average growing season from April through September, a botanist needs to spend enough time in the field to document the phenology of the flora. Because proper taxonomic identification is often difficult in cryptic taxa, reproductive organs are vital to the identification process (Hill et al. 1994, Plotkin and Muller-Landau 2002). This elevates the importance of constraints of timing when conducting a floristic study, since not only are most floristic studies given a short window for completion, but the percentage of visits that will produce high quality specimens that have adequate reproductive material is reduced. This is especially true if the size of the area under study is large. In regards to

T.T.M., it was often the case that timing constraints limited the number of trips into the field, where several taxa such as *Aralia nudicalis* and *Minuartia glabra* were only accurately identified during the second and third seasons when field days corresponded to the plant's reproductive phase.

Funding is another factor that can hinder the results of a floristic study in the sense that funding limitations lead to reductions in field or identification time, rendering the floristic study incomplete. This is the one aspect of the botanist effect that has greater weight than the other two in that even the most experienced and trained botanist cannot conduct a study without some form of funding. Floristic studies, like all scientific research, require funding to collect data, interpret findings, and present the findings. It is often the case that an increase in funding for a study will eventually lead to more days in the field during the growing season, and subsequently more field experience for a botanist. For the T.T.M. study, limited funding was provided by the Department of Biology and the Office of Student Research at A.S.U. If there had been a bigger funding resource available for this project, the number of trips to the field would have been increased with a likely increase in the number of species documented.

A final human source of discrepancy in floristic or faunistic studies can be seen in attempts (either inadvertently or purposefully) to inflate numbers of taxa present at a site. This has been documented in situations where presence or number of imperiled species has been used as leverage to halt various development projects (Wheeler and McDonald 1986). This can also occur if the investigator does not restrict collections to the area of study and goes beyond the political boundaries that delineate the study area. In addition, the recognition of variation within different individual plants in a population through

morphological plasticity, or inventory of cultivars in and around domiciles and other landscaped areas will also inflate numbers of taxa present at a site.

Taxonomic issues regarding the splitting and lumping of taxonomic concepts further complicates the reporting of results. Taxonomic concepts that are considered as "splitting" take into consideration the least recognizable units to separate taxa, while "lumping" concepts allow for variation within taxonomic concepts for ease of identification. For this study the comparison among the A.M.M. studies was done with a similarity matrix of species binomials that did not separate sub-specific taxa like subspecies and varieties from the analysis. Additionally, the species area curve that was generated for this study did recognize subspecies and varieties as separate individuals (Denslow 2009, Palmer 2011). This also raises questions regarding the accuracy of results when analyzing older floristic studies that used different taxonomic concepts, and emphasizes the need to reanalyze older studies when attempting comparisons. The process of concept mapping, including acknowledging all synonyms and older concepts, should be done instead of assuming that the equality of the names is equivalent to the equality of the taxonomic concepts.

The Ecological Factors that Impact Biodiversity Levels

The number of ecological factors and their frequency of occurrence can impact the number of taxa a botanist can report in a floristic study, separate from the human factors outlined above. There are three main groups of ecological factors that can impact the floristic diversity of an area. The first group of effects involves the idea of plant community size and the level of environmental heterogeneity within that area, where larger and more uniform communities with relatively few variations in abiotic factors can lead to less overall taxonomic diversity compared to communities with more ecological heterogeneity and

variations in abiotic factors. In addition, greater ecological heterogeneity increases the impact of community edges and ecotones. A second factor involves the presence or absence of certain natural communities in relation to the topology of an area. An increase in the topological variation of an area will increase the biodiversity by providing suitable habitat for rare or highly specific communities that need a combination of specific environmental variables to exist. The third effect, while not necessarily as much an ecological factor as the result of human disturbance on the environment, involves the presence of past or present anthropogenic disturbance, including the cultivation by humans in or near the study area. All of these groups of effects will impact the presence and distribution of plant species and communities in various ways (Miller 1986, Palik and Murphy 1990, Gehlhausen et al. 2000, Palmer et al. 2002, Qian et al. 2007).

The species area curve has been shown throughout the literature to accurately portray the increase in biodiversity as the habitat size increases. One of the shortcomings of the S.A.C. is it does not take into account the impact that environmental influences or the lack thereof within large habitats that can impact biodiversity rates. The variation in vegetation patterns between two different communities has been recognized for some time (Palik and Murphy 1990, Hargrove and Hoffman 2004, Webster et al. 2005). Larger tracts of uniform plant communities can act as buffers against plant migrations into that community. It has been observed that a combination of biotic (seed dispersal and competition) and abiotic factors (aspect, topology, soil moisture, air temperature, and light intensity) can heavily influence the ability of forest edge species to penetrate into the forest. Large unfragmented areas that have similar physiognomic characteristics can have fewer ecotones or community edges than small, highly fragmented communities (Palik and Murphy 1990, Gehlhausen et al.

2000). Three Top Mountain is one of the largest continuously forested tracts in Ashe County. The boundaries of the T.T.M. Game Land are within this forest tract on the massif, surrounded by a large buffer zone, with a single exception of one powerline cut through on the southwest facing slope. This presented the situation at T.T.M. of having little significant edge effect from anthropogenic factors within the T.T.M. Game Lands, and is correlated with the overall low percentage of recorded exotic taxa. The powerline cut through the area provided the largest edge effect seen, but accounted for little overall diversity when compared to forested natural communities.

Topology can cause variation in the presence or absence of plant communities, significantly altering the number of taxa that are expected in an area. Specific natural communities depend on certain types of topology and other abiotic factors in order to exist. Communities found in other areas of the A.M.M., such as the high elevation fen on Bluff Mountain, or the high elevation mafic glade on Mt. Jefferson, were not documented within the boundaries of the Game Land. The absence of these unique plant communities at T.T.M. was in large part due to steep slopes and long, narrow ridges that are not conducive for the development and persistence of these communities (Palik and Murphy 1990, Poindexter and Murrell 2008). In addition to the absence of these communities, the rugged terrain found within the Game Lands made it difficult to survey on many parts of the massif.

Anthropogenic effects on vegetation and species migrations can significantly alter a natural community, allowing opportunistic and invasive taxa to take over newly created niches. Humans are the most effective vectors for plant migration, and higher levels of anthropogenic disturbance in an area can cause this process to accelerate. The more a natural community or communities is impacted by human disturbance, the more likely exotic and

invasive species will exist within the community. For example, the study done by Poindexter (2006) showed an overall higher number of taxa recorded at the site than compared to T.T.M., even though Mt. Jefferson was one of the smaller areas studied in the A.M.M. and T.T.M. is one of the larger areas studied. When comparing the two sites, the level of anthropogenic factors is easily seen. A paved road bisects the Mt. Jefferson property, Christmas tree farms and suburban developments surround the property, and homes with landscaped yards are located within the Poindexter (2006) study site, as seen in Figure 5 (Poindexter and Murrell 2008).

In comparison to Mt. Jefferson, the Game Land on T.T.M. has less overall anthropogenic forces acting upon it. With only two gravel access roads accessing the edge of the Game Lands, no paved road bisecting the property, and with no large scale suburban development in or surrounding the property, there is less anthropogenic disturbance found at the study site than was found at Mt. Jefferson and this had a significant role in the floristic totals generated in these two studies. Even if this increase in exotic plant diversity is not sustained over a long period of time, at the time of the study it contributed to the overall diversity of the site.

Could these differences in anthropogenic effects explain all the differences in the number of taxa documented at T.T.M. and Mt. Jefferson? While the differences in anthropogenic pressures at the two sites are significant, there are most likely a large number of conditions that influenced the results in these studies. Both sites host unique taxa and communities that add to their overall richness, including several endemic and imperiled taxa. These two floras share similar parent rock yet show differences in habitat size and anthropogenic influences. Contiguous forests may prevent plant taxa, both native and exotic,

from migrating into microhabitats within the forests, but they can isolate and fragment plant populations as well, creating isolated habitats and communities.

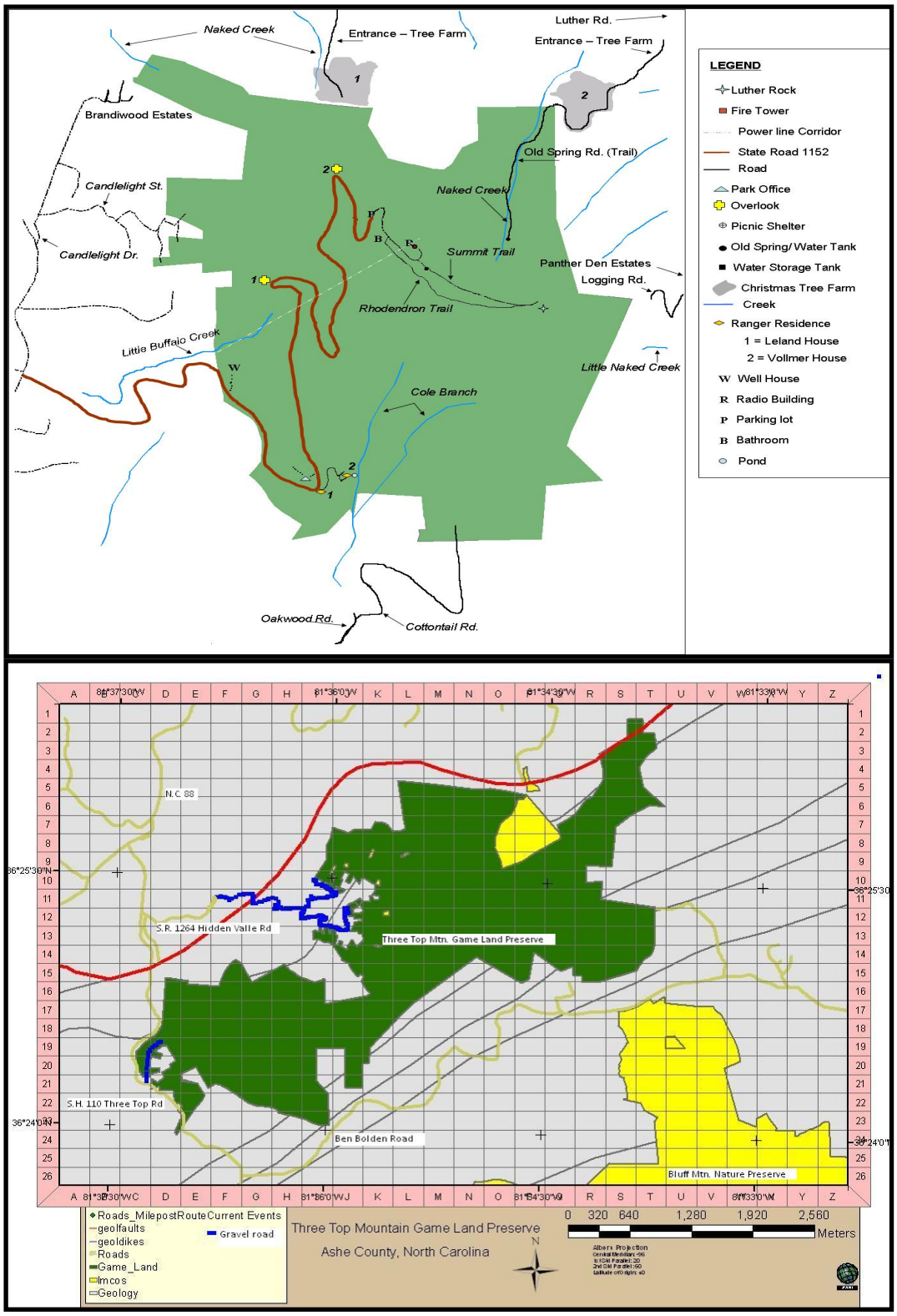

Figure 6: Maps showing the boundary lines for Mt. Jefferson State Park (above) and Three Top Mountain Game Land Preserve (below in green).

When are you finished?

It can be concluded that both botanist and ecological effects have a role in influencing the results of all floristic studies. An experienced, well-funded botanist with an adequate amount of time can document more taxa in an area than a less-experienced, underfunded botanist with less time. Even if not well-funded or given the same time constraints, a more experienced botanist will give a more accurate representation of a flora when conducting a study, when compared to a less experienced botanist. A well-trained botanist will have more experience dealing with difficult taxonomic concepts at a much higher level of confidence than an under-trained botanist, especially in a floristically diverse area as the Southern Appalachian Mountains (Bortolus 2008, Ahrends et al. 2011).

With all of these types of meta-data to consider when interpreting the results of a floristic study, the question becomes how does a botanist know when they have finished a study? How does a botanist know when their study is complete? To describe this phenomenon of interacting factors of meta-data on floristic studies, we developed the Theoretical Asymptote of Floristics (Jenkins and Murrell, manuscript in prep.). Figure 6 depicts a graph that represents this concept. An increase in time, experience with a floristic study, and an awareness of environmental and/or botanist effects will cause an increase in the number of taxa reported. However, there is a critical level that suggests that an increase in the x axis will never reach a true number of taxa in a large study area. This concept has an area component in that this asymptote becomes more evident when the area of study is larger. The actual number of taxa in an area becomes confounded with an increase in area, to the point that the knowledge of a true number of species becomes more of a theoretical goal than a potential goal because of the impracticality of being able to survey every part of a study

site, in addition to the correlating meta-data factors previously mentioned (Jenkins and Murrell, manuscript in prep.). In addition, taxonomic incongruities and difficulties of determining the smallest taxonomic unit, along with theoretical controversy surrounding the species concept, ultimately make the true biodiversity of a large area unknowable.

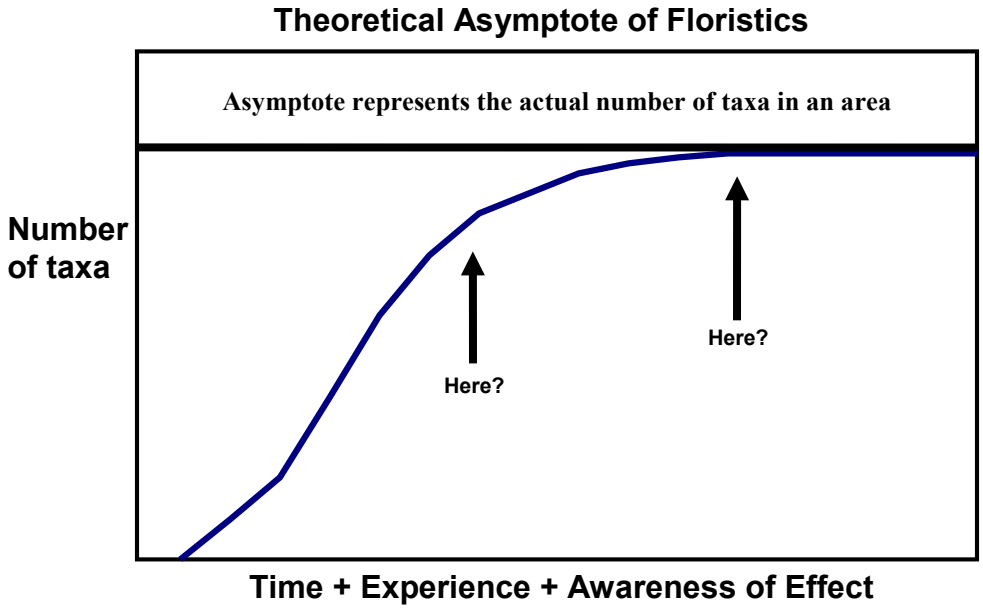

Figure 7: A representative graph of the conceptual Theoretical Asymptote of Floristics (Jenkins and Murrell manuscript in prep.)

While being conceptual in nature, the idea of a theoretical asymptote of floristics can be thought of as similar to a S.A.C. by giving a botanist a general idea of where they stand in their study. While the S.A.C. is only a tool used to estimate the effect of the size of a habitat on the number of taxa expected to be in that area, the idea of completely documenting the entire flora in a large study area is a theoretical goal. As time in the field increases, the number of new taxa a botanist documents decreases to a point where very few new taxa are recorded. As fewer new taxa are documented, the closer a botanist is to the goal of the actual number of taxa in an area, but ultimately the floristician will never reach the actual number

of species present (Jenkins and Murrell, manuscript in prep). As time increases during the study, the goals of analysis move away from a floristic documentation of a flora, and into a long term monitoring of vegetation change in an area. The limited time constraint given with floristic studies compounds the efforts to complete them. Despite this constraint they still prove their worth and utility as the baseline data needed to conduct other scientific studies and conservation management plans.

All botanists who conduct floristic studies have to deal with the concept of the completeness of their study. This notion of studies being complete or incomplete comes from the desire to understand the floristic composition of an area as fully as possible. This understanding has great value to conservation strategies and provides the baseline data to support many other types of research, yet may be difficult or impossible to obtain based upon the various factors presented above. A botanist could spend multiple years surveying every area possible and still never be completely sure of the completeness of their study, but yet come close enough to an idea of the floristic diversity at a given site to make useful comparison between sites in a region.

Conclusions

This study documented the flora of the T.T.M. Game Land Preserve, an isolated and rugged massif in Ashe County, North Carolina. The study documented 317 taxa from 198 genera and 94 families that compose the flora at Three Top Mountain Game Land Preserve. Of these 317 taxa, 22 of them are Central and Southern Appalachian endemics and 27 taxa are listed as imperiled by the US Fish and Wildlife Service or North Carolina Natural Heritage Program, including *Liatris helleri*, *Geum radiatum*, *Houstonia montana*, *Juncus trifidus*, *Trichophorum caespitosum* and *Campanula rotundifolia*. This is the only documented site for *Campanula rotundifolia* in the state of North Carolina, and the only known site for *Trichophorum caespitosum* and *Dendrolycopodium hickeyi* in the A.M.M., which substantially adds to the overall significance of this area. In addition to the communities documented by Oakley (1999), a Carolina Hemlock Forest community was discovered on two finger ridges along the southeast facing slopes of the main ridge. The flora of T.T.M. is generally similar to other floras documented in the A.M.M. and compares well with the expected number of taxa for the size of the site based upon the generated S.A.C. from other Southern Appalachian floras. This study examined the challenges faced by botanists conducting floristic studies by analyzing the "botanist effect." The "botanist effect" can have a clear impact of the completeness of a flora and "botanist effect" data should be acknowledged when floristic studies are reported and when using

floristic data comparatively. This study provides a cautionary note on the need to gather more data about floristic studies to be able to compare results appropriately.

LITERATURE CITED

Abbott, R.N. and L.A. Raymond. 1984. The Ashe metamorphic suite, northwest North Carolina: metamorphism and observations on geologic history. Amer. J. Sci. 284:350-375.

Adams, C.C. 1902. Southeastern United States as a center of geographical distribution of flora and fauna. Bio. Bull. 3:115-131.

Adams, C.C. 1905. The postglacial dispersal of the North American biota. Bio. Bull. 9:53-71.

Agapow, P.M., E. Bininda, R.P. Olaf, K.A. Crandall, J.L. Gittleman, G.M. Mace, C.J. Marshall and A. Purvis. 2004. The impact of species concept on biodiversity studies. Q. Rev. Biol. 79:161-179.

Ahrends, A., C. Rahbek, M.T. Bulling, N.D. Burgess, P. J. Platts, J.C. Lovett, V.W. Kindemba, N. Owen, A.N. Sallu, A.R. Marshall, B.E. Mhoro, E. Fanning and R. Marchant. 2011. Conservation and the botanist effect. Biol. Conser. 144:131-140.

Barbour, M.G., J.H. Burk, W.D. Pitts, F.S. Gulliam and M.W. Schwartz. 1999. Terrestrial plant ecology, 3rd edition. Benjamin/Cummings, Inc., Menlo Park, California.

Baskin, J. M. and C.C. Baskin. 1988. Endemism in rock outcrop plant communities of englaciated eastern United States: an evaluation of the roles of the edaphic, genetic and light factors. J. Biogeography 15:829-840.

Boerner, R.E.J. 2006. Unraveling the gordian knot: interactions among vegetation, topography, and soil properties in the central and southern Appalachians. J. Torrey Bot. Soc. 133:321-361.

Bortolus, A. 2008. Error cascades in the biological sciences: The unwanted consequences of using bad taxonomy in ecology. Ambio. 37: 114-118.

Braun, E.L. 1950. Deciduous forests of eastern North America. Hafner Publishing Co., New York, NY.

Brewer, E.O. 1985. Soil survey of Ashe County, North Carolina. United States Department of Agriculture, Soil Conservation Service, Washington, D.C.

Broyles, S.B. 1998. Postglacial migration and the loss of allozyme variation in northern populations of *Asclepias exaltata* (Asclepiadaceae). Am. J. Bot. 85:1091-1097.

Cain, S.A. 1944. Foundations of plant geography. Hafner Publishing Co., New York, New York.

Carroll, W.D., P.R. Kapeluck, R.A. Harper, and D.H. Van Lear. 2002. Background Paper: Historical overview of the southern forest landscape and associated resources. p. 583-605. *In*: Wear, D.N., and J.G. Greis (eds.). Southern forest resource assessment. Gen. Tech. Rep. SRS-53. Department of Agriculture, Forest Service, Southern Research Station, Asheville, North Carolina.

Chafin, L.G. and S.B. Jones. 1989. Community structure of two Southern Appalachian boulderfields. Castanea 54:230-237.

Delcourt, P.A. and H.R. Delcourt. 1987. Long-Term forest dynamics of the temperate zone. Vol. 63. Springer-Verlag, New York, New York.

Delcourt, P.A. and H.R. Delcourt. 1991. Quaternary Ecology: A paleoecological perspective. Chapman & Hall, New York, New York.

Denslow, M.W. 2009. Bibliography, spatial distribution and richness patterns of North Carolina floras. M.S. thesis, Appalachian State University, Boone, NC.

Fleming, C.A. and B.E. Wofford. 2004. The vascular flora of Fall Creek Falls State Park, Van Buren and Bledsoe Counties, Tennessee. Castanea 69:64-184.

Gardner, R.H. and K.A.M. Engelhardt. 2008. Spatial processes that maintain biodiversity in plant communities. Perspectives in Plant Ecology, Evolution and Systematics 9:211-228.

Gehlhausen, S.M., M.W. Schwartz and C.K. Augspurger. 2000. Vegetation and microclimatic edge effects in two mixed-mesophytic forest fragments. Plant Ecology 147:21-35.

Graham, A. 1999. Late Cretaceous and Cenezoic history of North American vegetation north of Mexico. Oxford University Press, New York.

Grossman, D.H., D. Faber-Langendoen, A.S. Weakley, M. Anderson, P. Bourgeron, R. Crawford, K. Goodin, S. Landaal, K. Metzler, K. D. Patterson, M. Pyne, M. Reid and L. Sneddon. 1998. International classification of ecological communities: terrestrial vegetation of the United States. Volume 1. The Nature Conservancy, Arlington, Virginia.

Godt, M. J.W. and J.L. Hamrick. 1995. The mating system of *Liatris helleri* (Asteraceae), a threatened plant species. Heredity 75:398-404.

Hargrove, W.W. and F.M. Hoffman. 2004. The potential of multivariate quantitative methods for delineation and visualization of ecoregions. Environ. Manag. 34:S39-S60.

Harshberger, J.W. 1903. An ecologic study of the flora of mountainous North Carolina. Bot. Gaz. 36:241-258.

Hellmann, J.J. and G.W. Fowler. 1999. Bias, precision, and accuracy of four measures of species richness. Ecol. Appl. 9:824-834.

Hill, J.L., P.J. Curran and G.M. Foody. 1994. The effect of sampling on the species-area curve. Global Ecol. and Biogeogr. 4:97-106.

Kercher, S.M., C.B. Frieswyk and J.B. Zedler. 2003. Effects of sampling teams and estimation methods on the assessment of plant cover. J. Veg. Sci. 14:899-906.

Kintsch, J.A. 2000. Amphibolite mountains site conservation plan. Report to the North Carolina Nature Conservancy, Durham, North Carolina.

Kintsch, J.A. and D.L. Urban. 2002. Focal species, community representation, and physical proxies as conservation strategies: a case study in the amphibolite mountains, North Carolina, U.S.A. Conserv. Biol. 16:936-947.

Knight, T.W. and D.W. Morris. 1996. How many habitats do landscapes contain? Ecology 77:1756-1764.

Lacy, V.H. 1979. A floristicy study of Phoenix Mountain, Ashe County, North Carolina. M.A. Thesis. Appalachian State University, Boone, North Carolina.

Larkins, P. 2006. Map of Watauga County and Ashe County showing major rock formations (http://www.summitpost.org/images/medium/194382.jpg, 9 February 2009). Summit Post.org.

Lorimer, C.G. 1980. Age structure and disturbance history of a Southern Appalachian virgin forest. Ecology 61:1169-1184.

Martin, P.S. and B.E. Harrell. 1957. The Pleistocene history of temperate biotas in Mexico and eastern United States. Ecology 38:468–480.

Miller, R.I. 1986. Predicting rare plant distribution patterns in the Southern Appalachians of the south-eastern U.S.A. Journal of Biogeography 13:293-311.

Mirsa, K.C. and H.Y. McSween. 1984. Mafic and ultramafic rocks of the Southern Appalachian orogen – an introduction. Amer. J. Sci. 284:290-293.

Murrell, Z.E. and B.E. Wofford. 1987. Floristics and phytogeography of Big Frog Mountain, Polk County, Tennessee. Castanea 52:262-290.

Nesom, G.L. 2005. Broadened concept of *Liatris helleri* (Asteraceae: Eupatorieae). SIDA 21:1323-1333.

Newell C.L. and R.K. Peet. 1998. Vegetation of Linville Gorge Wilderness, North Carolina. Castanea 63:275-322

Newmaster, S.G., R.J. Belland, A. Arsenault, D.H. Vitt and T.R. Stephens. 2005. The ones we left behind: comparing plot sampling and floristic habitat sampling for estimating bryophyte diversity. Divers. Distrib. 11:57-72.

NCDA&CS, PID. 2010. Section .0300 - Endangered plant species list: threatened plant species list: list of species of special concern (http://www.ncagr.gov/plantindustry/plant/plantconserve/plist.htm, 30 June 2011). North Carolina Department of Agriculture and Consumer Service, Plant Industry Division, Raleigh, North Carolina.

NCSCO. 2011. Monthly climate statistics for Station NC-AS-2 - Creston 2.8 SW (http://www.nc-climate.ncsu.edu/cronos/?station=NC-AS-2&temporal=monthly, 15 March 2011). North Carolina State Climate Office, Raleigh, North Carolina.

NCWRC. 2008. Three Top Mountain Game Land Preserve boundaries (http://www.ncwildlife.org/hunting/GameLand_Maps/Mountain/Three_Top.pdf, 9 February 2009). North Carolina Wildlife Resource Commission, Raleigh, North Carolina.

NOAA. 2011. Climate of North Carolina (http://hurricane.ncdc.noaa.gov/climatenormals/clim60/states/Clim_NC_01.pdf, 9 February 2010). National Climate Data Center, Asheville, North Carolina.

Oakley, S.C. 1999. An inventory of the significant natural areas of Ashe County, North Carolina. North Carolina Natural Heritage Program, Raleigh, North Carolina.

Palik, B.J. and P.G. Murphy. 1990. Disturbance versus edge effects in sugar-maple/beech forest fragments. Forest Ecol. Manag. 32:187-202.

Palmer, M.W., P.G. Earls, B.W. Hoagland, P.S. White and T. Wohlgemuth. 2002. Quantitative tools for perfecting species lists. Environmetrics 13:121-137.

Palmer, M.W. 2011. FloraS of North America Project. http://botany.okstate.edu/floras/. Department of Botany, Oklahoma State University, Stillwater Oklahoma.

Partel, M. 2002. Local plant diversity patterns and evolutionary history at the regional scale. Ecology 83:2361-2366.

Peet, R., J. Fridley and J. Gramling. 2003. Variation in species richness and species pool size across a pH gradient in forests of the southern Blue Ridge Mountains. Folia Geobot. 38:391-401.

Peet, R.K., T.R. Wentworth and P.S. White. 1998. A flexible, multipurpose method for recording vegetation composition and structure. Castanea 63:262-274.

Pielou, E.C. 1991. After the Ice Age. The University of Chicago Press, Chicago, Illinois.

Pittillo, J.D., R.D. Hatcher and S.W. Buol. 1998. Introduction to the environment and vegetation of the Southern Blue Ridge Province. Castanea 63:202-216.

Plotkin, J.B. and H.C. Muller-Landau. 2002. Sampling the species composition of a landscape. Ecology 83:3344-3356.

Poindexter, D.B. 2006. Vascular Flora of Mount Jefferson State Park and surrounding enivrons. M.S. Thesis, Appalachian State University, Boone, North Carolina.

Poindexter, D.B. and Z.E. Murrell. 2008. Vascular flora of Mount Jefferson State Natural Area and environs, Ashe County, North Carolina. Castanea 73:283-327.

Prothero, D.R. and R.H. Dott, Jr. 2004. Evolution of the earth, 7th ed. McGraw Hill, New York, New York.

Qian, H. and R.E. Ricklefs. 1999. A comparison of the taxonomic richness of vascular plants in China and the United States: The University of Chicago Press for the American Society of Naturalists.

Qian, H., J. D. Fridley and M. W. Palmer. 2007. The latitudinal gradient of species area relationships for vascular plants of North America. Amer. Nat. 170:690-701

Radford, A.E., H. Ahles and C.R. Bell. 1968. Manual of the vascular flora of the Carolinas. The University of North Carolina Press, Chapel Hill, North Carolina.

Ramseur, G.S. 1960. The vascular flora of high mountain communities of the Southern Appalachians. J. Elisha Mitchell Sci. Soc. 76:82-112.

Rohrer, J. 1983. Vegetation pattern and rock type in the flora of the Hanging Rock Area, North Carolina. Castanea 48:189-205.

Schafale, M.P. and A.S. Weakley. 1990. Classification of the natural communities of North Carolina: Third approximation. North Carolina Natural Heritage Program, Raleigh, North Carolina.

Schafale, M.P. 2002. Fourth approximation guide. High mountain communities. North Carolina Natural Heritage Program, Raleigh, North Carolina.

USFWS. 2011. Species report on endangered plants of the United States (http://ecos.fws.gov/tess_public/SpeciesReport.do?groups=Q&listingType=L&mapstat us=1, 30 June 2011). US Fish and Wildlife Service, Washington D.C., 20240-1000.

Shaw, J. and B.E. Wofford. 2003. Woody plants of Big South Fork National River and Recreation Area, Tennessee and Kentucky and Floristic comparison of selected Southern Appalachian woody floras. Castanea 68:119-134.

Simpson, M.G. 2006. Plant systematics. Elsevier Academic Press, Burlington, Massachusetts.

Smith, R.L. and T.M. Smith. 2003. Elements of ecology, 5th ed. Benjamin Cummings, San Francisco, California.

Soltis, D.E., A.B. Morris, J.S. McLachlan, P.S. Manos and P.S. Soltis. 2006. Comparative phylogeography of unglaciated eastern North America. Mol. Ecol. 15:4261-4293.

Taggart, J. 1973. Floristic survey and vegetational analysis of Stone Mountain State Park in North Carolina. M.S. thesis, North Carolina State University, Raleigh, North Carolina.

Tarbuck, E.J. and F.K. Lutgens. 2005. Earth: an introduction to physical geology, 8th ed. Prentice Hall, Upper Saddle River, New Jersey.

Tucker, G.E. 1972. The vascular flora of Bluff Mountain, Ashe County, North Carolina. Castanea 37:2-26.

Wade, G.L. and R.L. Thompson. 1991. The species-area curve and regional floras. Trans. Ky. Acad. Sci. 52:21-25.

Weakley, A.S. 2008. Flora of the Carolinas, Virginia, Georgia, and surrounding areas, working draft of 7 April 2008. University of North Carolina Herbarium, N.C. Bot. Garden, Chapel Hill, North Carolina.

Webster, C.R., M.A. Jenkins, and J.H. Rock. 2005. Twenty years of forest change in the woodlots of Cades Cove, Great Smoky Mountains National Park. J. Torrey Bot. Soc. 132:280-292.

Whittaker, R.H. 1962. Classification of natural communities. Bot. Rev. 28:1-239.

Wheeler, W.B. and M.J. McDonald. 1986. TVA and the Tellico Dam, 1936-1979: a bureaucratic crisis in post-industrial America. University of Tennessee Press, Knoxville, Tennessee.

White, P.S. 1983. Eastern Asian-Eastern North American floristic relations: the plant community level. Ann. Mo. Bot. Gard. 70:734-747.

Wiser, S.K. 1994. High-Elevation cliffs and outcrops of the Southern Appalachians: vascular plants and biogeography. Castanea 59:85-116.

Wiser, S.K. 1998. Comparison of Southern Appalachian high-elevation outcrop plant communities with their Northern Appalachian counterparts. J. Biogeography 25:501-513.

Wiser, S.K., R.K. Peet and P.S. White. 1996. High-Elevation rock outcrop vegetation of the Southern Appalachian Mountains. J. Veg. Sci. 7:703-722.

Wiser, S. K., R. K. Peet and P. S. White. 1998. Prediction of rare-plant occurrence: A Southern Appalachian example. Ecological Applications 8:909-920.

Wright, H.E. 1981. Vegetation east of the Rocky Mountains 18,000 years ago. Quaternary Res. 15:113-125.

Wofford, B.E. 1989. Guide to the vascular plants of the Blue Ridge. The University of Georgia Press, Athens, North Carolina.

Appendix A

Annotated List of Vascular Plants Documented at Three Top Mountain Game Land Preserve, Ashe County, North Carolina

Vascular Flora of Three Top Mountain Game Land Preserve, Ashe County, NC.

The annotated list of taxa is arranged alphabetically by family, genus, and species in the Equisetophyta, Lycopodiophyta, Pteridophyta, and Magnoliophyta (including Liliopsida and Magnoliopsida). All taxonomy used for this study strictly follows that of Weakley (2008). Scientific names are italicized and are followed by the taxonomic authority.

Common names follow authority name and they are displayed in parentheses. When no common name existed for a particular taxon, a generic name was put in its place like (Aster) or (Sedge). The taxon's status as a native or exotic is indicated with "native" or "exotic" appearing after the common name. The date(s) of collection are listed after the native status, with multiple collection dates for that taxon separated by a comma. The collection number(s) follow collection date(s), with multiple collection numbers separated by a semi colon.

An asterisk appears before two separate taxa, *Liatris helleri* and *Geum radiatum*, indicating that these taxa were not collected due to their U.S. endangered status and were documented with a photo voucher.

Seedless Vascular Plants

Equisetophyta

Equisetaceae Richard ex de Candolle 1805 (Horsetail Family)

Equisetum arvense L. (Field Horsetail). Native, 6/6/2009, #79; #80

Lycopodiophyta

Lycopodiaceae Mirbel 1802 (Clubmoss Family)

Diaphasiastrum digitatum (Dillenius ex A. Braun) Holub (Common Running-cedar). Native, 6/30/2009, #215; #216

Huperzia appressa (Desvaux) A. Love & D. Love (Fir Clubmoss). Native, 7/22/2010, #608

Huperzia lucidula Trevisan (Michaux) (Clubmoss). Native, 6/3/2009; 5/15/2010, #23; #515

Dendrolycopodium hickeyii W. H. Wagner, Beitel & R. C. Moran (Ground Pine). Native 5/22/2011, #666

Polypodiophyta

Aspleniaceae Frank 1877 (Spleenwort Family)

Asplenium platyneuron (L.) Britton, Sterns & Poggenburg (Ebony Spleenwort). Native, 7/9/2009, #251

Asplenium montanum Willdenow (Mountain Spleenwort). Native, 10/17/2010, #642

Asplenium trichomanes L. (Maidenhair spleenwort). Native, 6/13/2011, #689

Dennstaedtiaceae Pichi Sermolli 1970 (Bracken Family)

Dennstaedtia punctilbula (Michaux) T.Moore (Hay-scented fern). Native, 6/3/2009, 8/30/2009, #20; #21; #383

Pteridium aquilinum (L) Kuhn var. *latiusculum* (Desvaux) Underwood ex Heller (Eastern Bracken Fern). Native, 7/14/2009, #293

Dryopteridaceae* Ching 1965 (Wood-fern Family*)

Dryopteris intermedia (Muhlenberg ex Willdenow) A. Gray (Fancy Fern). Native, 6/10/2009, 8/30/2009, #85; #86; #87; #88; #384

Polystichum acrostichoides (Michaux) Schott (Christmas fern). Native, 5/30/2009, #7; #8

***Ophioglossaceae* (R. Brown) Agardh 1822 (Adder's-tongue Family)**

Botrypus virginianus (L.) Holub (Rattlesnake fern). Native, 6/29/2009, #175; #176; #177

***Polypodiaceae* Berchtold & J.C. Presl 1820 (Polypody Family)**

Polypodium virginianum L. (Complex) (Rock polypody). Native, 6/3/2009, 7/21/2009, #26; #27; #597; #331

***Pteridaceae* Reichenbach 1837 (Maidenhair Fern Family)**

Adiantum pedatum L. (Northern Maidenhair Fern). Native, 5/29/2010, #548

***Thelypteridaceae* Pichi Sermolli 1970 (Marsh Fern Family)**

Thelypteris noveboracensis (L.) Nieuwland (New York fern). Native, 6/3/2009, 9/13/2009, 9/25/2009, #25; #400; #442

***Woodsiaceae* Herter 1949 (Lady Fern Family)**

Athyrium asplenioides (Michaux) A. A. Eaton (Southern Lady Fern). Native, 9/25/2009, 7/19/2010, #437; #598

Deparia acrostichoides (Swartz) M. Kato (Silvery Spleenwort). Native, 9/25/2009, #435

Pinophyta

***Pinaceae* Lindley 1836 (Pine Family)**

Pinus rigida Miller (Yellow Pine). Native, 9/12/2010, 6/13/2011, #633; #680

Pinus strobus L. (White pine). Native, 6/3/2009, #37

Tsuga canadensis L. (Canadian Hemlock). Native, 5/30/2009, 9/12/2010, #4; 10; #636; U.S. Species of Concern

Tsuga caroliniana Englemann (Carolina Hemlock). Native, 8/22/2009, 6/13/2011, #375; #685, U.S. Species of Concern

Angiosperms

Magnoliophyta—Liliopsida

Alliaceae J. Agardh 1858 (Onion Family)

Allium burdickii (Hanes) A. G. Jones (White Ramps). Native, 6/10/2009, #89, NC Rare

Allium allegheniensis Small (Alleghany Onion). Native, 7/21/2009, 8/22/2009, #320; #376, NC Rare

Allium tricoccum Ainton (Red Ramps). Native, 7/21/2009, #301

Araceae A.L de Jussieu 1789 (Arum Family)

Arisaema triphyllum ssp. *triphyllum* (L.) Schott (Jack-in-the-pulpit). Native, 4/25/2010, 5/27/2010, #476; #528; #532

Colchicaceae A.P. de Candolle 1805 (Meadow Saffron Family)

Uvularia grandiflora J. E. Smith (Large flower Bellwort). Native, 4/25/2010, 5/29/2010, #465; #557

Uvularia perfoliata L.(Perfoliate Bellwort). Native, 5/15/2011, #657

Uvularia sessilifolia L. (Sessileleaf Bellwort). Native, 5/8/2010, #464

Commelinaceae R. Brown 1810 (Spiderwort Family)

Tradescantia subaspera Ker-Gawler (Wide-leaved Spiderwort). Native, 7/21/2009, #308

Cyperaceae A.L. de Jussieu 1789 (Sedge Family)

Carex aestivalis M. A. Curtis ex A. Gray (Summer Sedge). Native, 6/3/2009, 6/6/2009, 9/13/2009, 5/27/2010, #24; #61; #62; #63; #413; #537

Carex appalachica J. Webber & P. W. Ball (Appalachian Sedge). Native, 6/3/2009, 9/13/2009, 7/22/2010, 5/15/2011, #28; #420; #603; #660

Carex bromoides Willdenow ssp. *montana* Naczi (Blue Ridge Brome Sedge). Native, 5/15/2010, #519, NC Watch list

Carex gynandra Schweinitz (Nodding Sedge). Native, 6/3/2009, #19

Carex laxiflora Lamarck (Sedge). Native, 4/25/2010, 5/5/2010, #474; #490

Carex lucorum Willdenow ex Link var. *lucorum* J. Rettig (Appalachian Woodland Sedge). Native, 5/15/2011, #655, NC Rare

Carex lurida Wahlenberg (Sedge). Native, 6/29/2009, #185; #186; #187

Carex pensylvanica Lamarck (Sedge). Native, 5/22/2011, #668; #677

Carex plantaginea Lamarck (Plantainleaf Sedge). Native, 4/25/2010, #487

Carex scabrata Schweinitz (Eastern Rough Sedge). Native, 5/29/2010, #545

Carex vulpinoidea Michaux (Fox Sedge). Native, 6/3/2009, 6/23/2009, #39; #40, #157; #158

Carex woodii Dewey (Wood's Sedge). Native, 4/25/2010, #486, NC Rare

Scirpus expansus Fernald (Woodland Bulrush). Native, 6/10/2010, 6/25/2010, #582; #588

Scirpus hattorianus Makino (Northern Bullrush). Native, 7/9/2009, 6/25/2010, #239; #240; #585

Scirpus polyphyllus Vahl (Leafy Bullrush). Native, 7/9/2009, 9/25/2009, #237; #238; #434

Trichophorum caespitosum (L) Schur ssp. *caespitosum* (Deerhair Bulrush). Native, 5/22/2011, #667, NC Rare

***Dioscoreaceae* R. Brown 1810 (Yam Family)**

Dioscorea quaternata J.F Gmelin (Fourleaf Yam). Native, 7/21/2009, 5/29/2010, #343; #544

***Iridaceaee* A.L. de Jussieu 1789 (Iris Family)**

Iris cristata Ainton (Crested Iris). Native, 5/5/2010, 5/15/2010, #489; #847

Sisyrinchium angustifolium P. Miller (Irisette). Native, 5/29/2010, #549

***Juncaceae* A.L. de Jussieu 1789 (Rush Family)**

Juncus coriaceus Mackenzie (Rush). Native, 6/30/2009, #225; #226; #227; #228

Juncus effusus ssp. *solutus* (Fernald & Wiegand) Hamet-Ahti (Lamp Rush). Native, 7/22/2010, #602

Juncus trifidus L. (Highland Rush). Native, 8/22/2009, 7/22/2010, #370; #604, NC Rare

Luzula accuminata Rafinesque var. *carolinae* (Watson) Fernald (Wood-rush). Native, 5/27/2010, #541

Luzula echinata (Small) F. J. Hermann (Hedgehog woodrush). Native, 5/15/2011, #661

***Liliaceae* A.L. de Jussieu 1789 (Lily Family)**

Clintonia umbellulata (Michaux) Morong (Speckled Wood-lily). Native, 5/15/2010, #517

Lilium grayii Watson (Gray's Lily). Native, 6/16/2009, #118; #119

Lilium superbum L. (Canadian Lily). Native, 7/9/2009, #245

Medeola virginiana L. (Indian Cucumber). Native, 6/6/2009, #51; #52

Prosartes lanuginosa (Michaux) D. Don (Yellow Mandrake). Native 6/3/2009, 5/27/2010, #29; #527; #860

***Melanthiaceae* Batsch 1802 (Bunchflower Family)**

Veratrum parviflorum Michaux (Appalachian bunchflower). Native, 7/22/2010, #615

Veratrum viride Ainton (White-hellebore, Indian Poke). Native, 5/27/2010 #534

***Orchidaceae* A.L. de Jussieu 1789 (Orchid Family)**

Galearis spectabilis (L.) Rafinesque (Showy Orchid). Native, 5/8/2010, #496

Platanthera psycodes (L.) Lindley (Small Purple Fringed Orchid). Native, 6/25/2010, 6/13/2011, #592; #679

Goodyera pubescens (Willdenow) R. Brown (Downy Rattlesnake Plantain). Native, 6/13/2011, #688

***Poaceae* (R. Brown) Barnhart 1895**

Andropogon gerardii Vitman (Big Bluestem, Turkeyfoot). Native, 8/20/2010, #624

Anthoxanthum aristatum Boissier (Annual Vernal grass). Exotic, 6/3/2009, 5/5/2010, 5/29/2010, #38; #499; #550

Avenella flexuosa (L) Drejer (Wavy Hairgrass). Native, 7/21/2009, 8/30/2009, 9/13/2009, 7/19/2010, #323; #391; #423; #594; #595; #599

Brachyelytrum erectum (Schreber ex Sprengel) Palisot de Beauvois (Common Shorthusk). Native, 7/21/2009, #300

Bromus catharticus var. *catharticus* Vahl (Rescue grass). Exotic, 6/29/2009 #188; #189; #190; #191

Bromus nottowayanus Fernald (Satin Brome). Native, 7/21/2009, #314, NC Rare

Dactylis glomerata L. (Orchard Grass). Exotic, 6/3/2009, 6/25/2010, #33; #587

Danthonia sericea Nuttall (Silky Oat Grass). Native, 6/29/2009, 8/30/2009, 7/19/2010, #180; #181; #182; #596

Dichanthelium accuminatum var. *accuminatum* (Swartz) Gould & Clark (Woolly Witch Grass). Native, 6/23/2009, #167; #168; #169; #170

Dichanthelium boscii (Poiret) Gould & Clark (Bosc's Witch Grass). Native 6/10/2010, #574

Dichanthelium clandestinum (L.) Gould (Deer-tongue Witch Grass). Native, 6/23/2009, 7/14/2009, #159; #160; #266; #267; #268; #269

Dichanthelium commutatum var. *commutatum* (Schultes) Gould (Variable Witch Grass). Native, 5/29/2010, #552

Elymus hystrix L. var. *bigelovianus* (Fernald) Bowden (Northern Bottlebrush Grass). Native, 6/30/2009, #231; #232; #233; #234 North Carolina Rare

Elymus hystrix var. *hystrix* L. (Common Bottlebrush). Native, 6/15/2009, #112; #113

Festuca subverticillata (Persoon) Alexeev (Nodding Fescue). Native, 7/21/2009, #315

Holcus lanatus L. (Common Velvetgrass). Exotic, 6/23/2009, 6/25/2010, #165; #166; #586

Muhlenbergia tenuifolia (Willdenow) Britton, Sterns & Poggenburg (Slender Muhly). Native, 7/28/2009, 9/25/2009, 10/3/2009, 9/12/2010, #346; #440; #446; #625; #626; #627

Phleum pratense ssp. *pratense* L. (Timothy). Exotic, 7/14/2009, 8/20/2010, #284; #285; #286; #287; #622

Poa compressa L. (Canadian Bluegrass). Native, 5/27/2010, #525

Poa cuspidata Nuttall (Bluegrass). Native, 6/10/2009, 6/23/2009, #90; #91; #163; #164

Poa pratensis ssp. *pratensis* L. (Kentucky Bluegrass). Exotic, 7/21/2009, 8/22/2009, #317; #322; #856

Schedonorus arundinaceus (Schreber) Dumortier (Tall Fescue). Exotic, 5/29/2010, #556

Schizachyrium scoparium var. *scoparium* (Michaux) Nash (Common Little Bluestem). Native, 8/22/2009, 9/13/2009, 10/3/2009, #372; #425; #450

***Ruscaceae* M. Roemer 1840 (Ruscus Family)**

Convallaria majuscula Green (American Lily-of-the-Valley). Native, 5/15/2010, #512

Maianthemum canadense Desfontaines (False Lily-of-the-Valley). Native, 5/27/2010, #531

Maianthemum racemosum ssp. *racemosum* (L.) Link (False Solomon's Seal). Native, 6/30/2009, #202; #203

Polygonatum biflorum var. *biflorum* (Walter) Elliot (Smooth Solomon's Seal). Native, 4/25/2010, #480

***Smilacaceae* Ventenat 1799 (Greenbrier Family)**

Smilax herbacea L. (Common Carrion flower). Native, 5/22/2011, #678

Smilax rotundifolia L. (Common Greenbrier). Native, 9/13/2009, #433

***Trilliaceae* Lindley 1846 (Trillium Family)**

Trillium grandiflorum (Michaux) Salisbury (Large Trillium). Native, 4/25/2010, #481

Trillium sulcatum L. (Red Trillium). Native, 4/25/2010, 5/5/2010, 5/15/2011, #460; #488; #500; #652

Trillium undulatum Willdenow (Painted Trillium). Native, 5/15/2011, #658

***Typhaceae* A.L. de Jussieu 1789 (Cattail Family)**

Typha latifolia L. (Common Cattail). Native, 6/25/2010, #589

Magnoliophyta—Magnoliopsida

***Adoxaceae* Trautvetter 1853 (Moschatel Family)**

Sambucus canadensis L. (Common Elderberry). Native, 6/15/2009, #105; #106; #107

Sambucus racemosa var. *pubens* (Michaux) Koehne (Red Elderberry). Native, 4/25/2010, #473

Viburnum acerifolium L. (Mapleaf viburnum). Native, 6/6/2009, #45; #46; #47

Viburnum cassinoides L. (Withe-rod). Native, 7/22/2010, #612

Viburnum lantanoides Michaux (Hobblebush). Native, 8/30/2009, 4/25/2010, #386; #469

***Anacardiaceae* Lindley 1830 (Cashew Family)**

Rhus typhinia L. (Staghorn Sumac). Native, 6/30/2009, #213; #214

***Apiaceae* Lindley 1836 (Carrot Family)**

Angelica triquinata Michaux (Mountain Angelica). Native, 8/22/2009, #355

Cryptotaenia canadensis (L.) A. P. de Candolle (Honewort). Native, 7/21/2009, #307

Osmorhiza claytonia (Michaux) C. B. Clark (Bland Sweet Cicely). Native, 6/30/2009, 7/21/2009, 5/27/2010, #196; #197; #198; #199; #311; #312; #533

Osmorhiza longistylis (Torrey) A. P. de Candolle (Smooth Sweet Cicely). Native, 7/21/2009, #311

Sanicula canadensis var. *canadensis* L. (Canadian Sanicle). Native, 7/21/2009, #310

Thaspium barbinode (Michaux) Nuttall (Harry-jointed Meadow Parsnip). Native, 6/6/2009, 7/21/2009, 5/27/2010, #64; #65; #66; #67; #316; #538

Thaspium trifoliatum var. *trifoliatum* (L.) A. Gray (Purple meadowparsnip). Native, 5/5/2010, #494

Zizia trifoliata (Michaux) Fernald (Mountain Golden-Alexander). Native, 5/15/2011, #653

***Apocynaceae* A.L. de Jussieu 1789 (Dogbane Family)**

Asclepias quadrifolia Jacquin (Four-leaved milkweed). Native, 5/30/2009, #14

***Aquifoliaceae* Bartling 1830 (Holly Family)**

Ilex montana Torrey & A. Gray ex A. Gray (Mountain Holly). Native, 6/16/2009, 4/25/2010, 5/15/2010, 10/17/2010, #120; #121; #122; #123; #477; #514; #640

***Araliaceae* A.L. de Jussieu 1789 (Ginseng Family)**

Panax quinquefolius L. (American Ginseng). Native, 9/25/2009, #436

Aralia nudicalis L. (Wild Sarsparilla). Native, 5/15/2011, 5/22/2011, #662; #670

***Aristolochiaceae* A. L. de Jussieu 1789 (Birthwort Family)**

Asarum canadense var. *canadense* L. (Wild Ginger). Native, 4/25/2010, 5/15/2010, #462; #504

Isotrema macrophyllum (Lamarck) C.F. Reed (Dutchman's-pipe). Native, 5/30/2009, 7/14/2009, 5/15/2011, #16; #258; #259; #664

***Asteraceae* Dumortier 1822 (Aster Family)**

Achillea millefolium L. (Yarrow). Exotic, 6/30/2009, 7/21/2009, #221; #222; #337

Ageratina altissima var. *altissima* King & H.E. Robinson (White Snake Root). Native, 7/21/2009, 7/28/2009, 8/22/2009, #328; #348; #354; #378

Ageratina altissima King & H.E. Robinson var. *roanensis* (Small) Clewell & Wooten (Appalachian White Snakeroot). Native, 8/22/2009, #364

Arctium minus Bernhardi (Common Burdock). Native, 8/30/2009, #397

Arnoglossum reniforme (Hooker) H. E. Robinson (Great Indian-plantain). Native, 7/21/2009, 10/3/2009, #303; #444

Coreopsis major Walter var. *rigida* (Nuttall) F. E. Boynton (Tickseed). Native, 7/9/2009, 7/21/2009, 8/22/2009, 8/30/2009, 9/13/2009, #246; #247; #326; #373; #388; #427

Doellingeria umbellata (Miller) Nees (Tall Flat-topped White Aster). Native 8/22/2009, #359

Erigeron annuus (L.) Persoon (Eastern daisy fleabane). Native, 6/3/2009, 6/15/2009, 6/23/2009, 6/30/2009, #32; #99; #100; #140; #141; #200; #201

Erigeron strigosus var. *strigosus* Muhlenberg ex Willdenow (Fleabane). Native, 8/30/2009, 6/13/2011,#387; #692

Eurybia chlorolepis (Burgess) Nesom (Blue Ridge White Heart-leaved Aster). Native, 8/22/2009, #358

Eurybia macrophylla (L.) Cassini (Big Leaf Aster). Native, 8/22/2009, 9/13/2009, 8/20/2010, #363; #401; #620; #846; #857

Eutrochium fistulosum (Barrett) E. E. Lamont (Joe-pye-weed). Native, 8/22/2009, #367

Galinsoga quadriradiata Ruiz & Pavon (Common Peruvian Daisy). Exotic, 6/30/2009, #192; #193; #194; #195

Heliopsis helianthoides var. *helianthoides* (L.) Sweet (Eastern Oxeye). Native, 8/22/2009, 8/30/2009, #350; #382

Hieracium paniculatum L. (Leafy Hawkweed). Native, 8/22/2009, #353; #851

Hieracium pilosella L. (Mouse ears). Exotic, 6/10/2010, 5/22/2011, #573; #676

Krigia montana (Michaux) Nuttall (Mountain Dwarf-Dandelion). Native, 7/22/2010, #607

Lactuca floridana L. (Woodland Lettuce). Native, 7/9/2009, #243; #244

Leucanthemum vulgare Lamarck (Ox-eyed daisy). Exotic, 7/9/2009, 6/10/2010, #235; #236; #572

**Liatris helleri* Porter (Heller's Blazing star). Native, 7/22/2010, #606, (*photo)

Oclemena acuminate (Michaux) Green (Whorled Aster). Native, 8/22/2009, #360

Packera aurea (L.) A & D Love (Golden Ragwort). Native, 4/25/2010, #483

Rudbeckia hirta L. var. *pulcherrima* Farwell (Weedy Black-Eyed Susan). Native, 6/10/2010, #577

Rudbeckia lancinata L. var. *humilis* A. Gray (Blue Ridge Cutleaf Coneflower). Native, 7/28/2009, 8/22/2009, #344; #365

Solidago altissima var. *altissima* L. (Tall Goldenrod). Native, 10/3/2009, #451; #849

Solidago arguta Ainton var. *caroliniana* A. Gray (Vasey's Goldenrod). Native, 8/22/2009, 8/30/2009, 8/20/2010, 9/12/2010, #356; #379; #621; #631

Solidago bicolor L. (White goldenrod). Native, 8/22/2009, 9/13/2009, #357; #429

Solidago curtisii Torrey & A. Gray (Curtis's Goldenrod). Native, 8/22/2009, 9/25/2009, 10/3/2009, 9/12/2010, #352; #366; #441; #443; #628

Solidago erecta Pursh (Golden Rod). Native, 8/22/2009, #349

Solidago roanensis Porter (Roan Mountain Goldenrod). Native, 9/12/2010, #632

Solidago rugosa P. Miller var. *aspera* (Ainton) Fernald (Golden Rod). Native, 10/3/2009, #449; #848

Symphyotrichum cordifolium (L.) Nesom (Aster). Native, 10/17/2010, #644

Symphyotrichum pilosum var. pilosum (Willdenow) Nesom (Aster). Native, 10/3/2009, #452

Symphyotrichum prenanthoides (Muhlenberg ex Willdenow) Nesom (Zigzag Aster). Native, 8/20/2010, 10/3/2009, 10/17/2010, #623; #643, #445

Symphyotrichum undulatum (L.) Nesom (Aster). Native, 9/12/2010, #637

Verbesina alternifolia (L.) Britton ex. Kearney (Common Wingstem). Native, 8/30/2009, #398

***Balsaminaceae* A. Richard 1822 (Touch-me-not Family)**

Impatiens capensis Meerburg (Spotted Touch-me-not). Native, 7/14/2009, #260; #261

Impatiens pallida Nuttall (Pale Touch-me-not). Native, 6/30/2009, 8/30/2009, #229; #230; #399

Berberidaceae* A.L. de Jussieu 1789 (Barberry Family*)

Caulophyllum giganteum (Farwell) Loconte & Blackwell (Northern Blue Cohosh). Native, 7/21/2009, 5/15/2011, #304; #656

Caulophyllum thalictroides (L.) Michaux (Common Blue Cohosh). Native, 4/25/2010, #502

Diphylleia cymosa Michaux (Umbrella-leaf). Native, 5/15/2010, #516

Podophyllum peltatum L. (May-apple). Native, 5/15/2010, #503

***Betulaceae* S.F. Gray 1821 (Birch Family)**

Alnus serrulata (Ainton) Willdenow (Hazel alder). Native, 8/30/2009, #385

Betula alleghaniensis Britton (Yellow Birch). Native, 9/12/2010, #634

Betula lenta var. *lenta* L. (Sweet Birch). Native, 7/22/2010, 6/10/2010, #616; #861

Carpinus caroliniana var. *virginiana* L. (American hornbeam). Native, 6/3/2009, 6/15/2009, #31; #108; #109; #110; #111

Ostrya virginiana (Miller) K. Koch (Ironwood). Native, 7/14/2009, 7/22/2010, #272; #273; #613

Betula alleghaniensis Brittion (Yellow Birch). Native, 9/12/2010, #634

Betula lenta var. *lenta* L. (Sweet Birch). Native, 7/22/2010, 6/10/2010, #616; #861

***Brassicaceae* Burnett 1835 (Mustard Family)**

Brassica rapa var. *rapa* L. (Field mustard). Exotic, 5/5/2010, #493

Cardamine concatenata (Michaux) Schwarz (Cutleaf Toothwort). Native, 4/25/2010, #470

***Campanulaceae* A.L. de Jussieu 1789 (Bellflower Family)**

Campanulastrum americanum (L.) Small (Tall Bellflower). Native, 7/21/2009, 8 /22/2009, #306; #853

Campanula divaricata Michaux (Southern Hairbell). Native, 7/21/2009, 8/22/2009, 9/12/2010, #330; #361; #629

Campanula rotundifolia L. (Bluebell bellflower). Native, 7/21/2009, 8/22/2009 #321; #371, NC Endangered

Lobelia inflata L. (Indian tobacco). Native, 8/22/2009, #368

Lobelia siphilitica var. *siphilitica* L. (Great Blue Lobelia). Native, 7/19/2010, #859

***Caryophyllaceae* A.L. de Jussieu 1789 (Pink Family)**

Dianthus armeria ssp. *armeria* L. (Deptford Pink). Exotic, 6/25/2010, 6/30/2009 #591; #850

Minuartia glabra (Michaux) Mattfield (Minuartia) Native, 5/22/2011, #669

Paronychia argyrocoma (Michaux) Nuttall (Silvery Nailwort). Native, 7/14/2009, 7/21/2009, #282; #283; #327

Silene stellata (L.) Ainton (Starry Campion) Native, 7/21/2009, #299

Silene virginica L. (Fire-pink). Native, 6/15/2009, #101; #102; #103; #104

Stellaria corei Shinners (Tennessee Starwort). Native, 4/25/2010, #454

Stellaria neglecta Weihe (Greater Chickweed). Exotic, 5/29/2010, #553

Stellaria pubera Michaux (Star Chickweed). Native, 5/15/2011, #654

***Clethraceae* Klotzsch 1851 (Clethra Family)**

Clethera accuminata Michaux (Mountain White-alder). Native, 8/22/2009, 6/13/2011, #374; #684

***Convolvulaceae* A.L. de Jussieu 1789 (Morning Glory Family)**

Cuscuta gronovii Willdenow ex Shultz (Common Dodder). Native, 7/28/2009, #345

***Cornaceae* (Berchtold & J. Presl) Dumortier 1829 (Dogwood Family)**

Cornus florida L. (Flowering Dogwood). Native, 6/23/2009, 4/25/2010, #150; #151; #152; #153; #484

Cornus alternifolia L. (Alternate leaf dogwood). Native, 7/22/2010, #611

***Crassulaceae* A.P. de Candolle 1825 (Stonecrop Family)**

Hylotelephium telephioides (Michaux) H. Ohba (Alleghany Live-for-ever). Native, 7/14/2009, 7/21/2009, 8/22/2009, 8/30/2009, #294; #295; #332; #362; #394

Sedum ternatum Michaux (Mountain Stonecrop). Native, 6/6/2009, #72; #73; #74

***Diapensiaceae* (Link) Lindley 1836 (Diapensia Family)**

Galax urceolata (Poiret) Brummitt (Galax). Native, 7/22/2010, #609

***Diervillaceae* (Rafinesque) Pyck 1998 (Bush-honeysuckle Family)**

Diervilla lonicera Miller (Northern Bush Honeysuckle). Native, 7/14/2009, 7/21/2009, 288; 289; 329

***Eericaceae* A.L. de Jussieu 1789 (Heath Family)**

Epigaea repens L. (Trailing Arbutus). Native, 6/13/2011, #687

Eubotrys recurva (Buckley) Britton (Mountain Fetterbush). Native, 6/13/2011, #683

Kalmia latifolia L. (Mountain-Laurel). Native, 6/6/2009, 10/17/2010, #58; #59; #60; #638

Menziesia pilosa (Michaux ex Lamarck) Antoine (Minniebush). Native, 5/15/2010, 5/27/2010, #509; #535

Monotropa uniflora L. (Indian pipe). Native, 8/22/2009, #377

Rhododendron calendulaceum (Michaux) Torrey (Flame Azalea). Native, 6/6/2009, #53; #54

Rhododendron catawbiense Michaux (Catawba Rhododendron). Native, 6/6/2009, 5/15/2010, 10/17/2010, #55; #56; #57; #511; #639

Rhododendron maximum L. (Great laurel). Native, 5/30/2009, 6/23/2009, #6; #138; #139

Vaccinium corymbosum L. (Smooth Highbush Blueberry). Native, 6/6/2009 #48; #49; #50

Vaccinium erythrocarpum Michaux (Mountain Cranberry). Native, 8/30/2009, 9/13/2009, #396; #421

***Fabaceae* Lindley 1836 (Legume Family)**

Medicago lupulina L. (Yellow Trefoil). Exotic, 6/25/2010, #584

Robinia pseudoacacia L. (Black Locust). Native, 6/10/2010, #567

Securigia varia (L.) Lassen (Crown-vetch). Exotic, 6/15/2009, #92; #93

Trifolium pratense L. (Red Clover). Exotic, 6/23/2009, #161; #162

Vicia caroliniana Walter (Carolina Vetch). Native, 5/5/2010, #497

***Fagaceae* Dumortier 1829 (Beech Family)**

Castanea dentata (Marshall) Borkhausen (American chestnut). Native, 6/10/2010, #575

Fagus grandifolia Ehrh. (American Beech). Native, 6/3/2009, 7/21/2009, 10/17/2010, #22; #339; #641

Quercus alba L. (White Oak). Native, 5/15/2011, #659

Quercus montana Willdenow (Chestnut Oak). Native, 6/10/2010, #578

Quercus rubra var. *ambigua* L. (Red Oak). Native, 5/15/2010, #506

Quercus rubra var. *rubra* L. (Red Oak). Native, 6/10/2010, #560; #568

***Fumariaceae* A.P. de Candolle 1821 (Fumitory Family)**

Dicentra canadensis (Goldie) Walpers (Squirrel corn). Native, 4/25/2010, #461

Dicentra cucullaria (L.) Bernhardi (Dutchman's Britches). Native, 4/25/2010, #468, NC Rare

***Gentianaceae* A.L. de Jussieu 1789 (Gentian Family)**

Gentiana austromontana Pringle & Sharp (Blue Ridge Gentian). Native, 9/13/2009, 9/12/2010,#430; #432, #630

Gentianella quinquefolia var. *quinquefolia* (L.) Small (Eastern Agueweed). Native,10/3/2009, #447

***Geraniaceae* A.L. de Jussieu 1789 (Geranium Family)**

Geraniuim maculatum L. (Spotted Geranium). Native, 5/30/2009, 5/27/2010 #17; #526

***Grossulariaceae* A.P. de Candolle 1805 (Currant Family)**

Ribes cynosbati L. (Prickly Gooseberry). Native, 6/15/2009, 7/21/2009, #114; #115; #302

***Hamamelidaceae* Brown 1818 (Witch Hazel Family)**

Hamamelis virginiana var. *virginiana* L. (Witch hazel). Native, 6/3/2009, 9/13/2009, 7/22/2010,#30; #424; #610

***Hydrangeaceae* Dumortier 1829 (Hydrangea Family)**

Hydrangea arborescens L. (Smooth Hydrangea). Native, 6/29/2009, 6/30/2009, #178; #179; #219; #220

***Hydrophyllaceae* R. Brown 1817 (Waterleaf Family)**

Hydrophyllum canadense L. (Mapleleaf Waterleaf). Native, 6/15/2009, #116; #117

***Hypericaceae* A.L. de Jussieu 1789 (St. John's-wort Family)**

Hypericum mitchellianum Rydberg (Blue Ridge St. John's-wort). Native, 6/30/2009, #223; #224

***Juglandaceae* A. Richard ex Kunth 1824 (Walnut Family)**

Carya cordiformis (Wangenheim) K. Koch (Bitternut Hickory). Native, 6/10/2010, #570; #576

Carya glabra var. *glabra* (P. Miller) Sweet (Pignut Hickory). Native, 6/10/2010, #579

***Lamiaceae* Lindley 1836 (Mint Family)**

Collinsonia canadensis L. (Richweed). Native, 8/22/2009, #369

Meehania cordata (Nuttall) Britton (Meehania). Native, 6/6/2009, 5/27/2010, #68; #69; #70; #71; #522

Monarda clinopodia L. (Basil Bergamot). Native, 7/9/2009, 7/14/2009, #241; #242; #264; #265

Monarda didyma L. (Bee Balm). Native, 7/14/2009, #262; #263

Prunella vulgaris L. var. *lanceolata* (W. Barton) Fernald (American Self-heal). Native, 6/23/2009, #146; #147; #148; #149

Stachys latidens Small (Broadtooth hedgenettle). Native, 6/15/2009, 7/14/2009, 7/21/2009, #97; #98; #274; #275; #276; #313

***Lauraceae* A.L. de Jussieu 1789 (Laurel Family)**

Sassafras albidum (Nuttall) Nees (Sassafras). Native, 6/23/2009, 9/13/2009, 6/10/2010, #142; #143; #428; #565

***Magnoliaceae* A.L. de Jussieu 1789 (Magnolia Family)**

Liriodendron tulipifera L. (Tulip poplar). Native, 6/3/2009, 6/10/2010, #41; #42; #569

Magnolia acuminata L. (Cucumber-tree). Native, 5/30/2009, #11; #12

Magnolia fraseri Walter (Frasier's Magnolia). Native, 5/30/2009, 6/10/2010, 5/22/2011, #5; #561; #675

***Malvaceae* A.L. de Jussieu 1789 (Mallow Family)**

Tilia americana var. *americana* L. (American basswood). Native, 6/25/2010, #593

Tilia americana L. var. *heterophylla* (Ventenat) Loudon (Basswood). Native, 6/3/2009, #34; #35; #36

***Myrsinaceae* R. Brown 1810 (Myrsine Family)**

Lysimachia quadrifolia L. (Whorled loosestrife). Native, 6/15/2009, 6/30/2009 #94; #95; #96; #217; #218

***Nyssaceae* A.L. de Jussieu ex Dumortier 1829 (Tupelo Family)**

Nyssa sylvatica Marshall (Black Gum). Native, 5/29/2010, #546

***Oleaceae* Hoffmansegg & Link 1813 (Olive Family)**

Fraxinus americana var. *americana* L. Native, 7/22/2010, 5/15/2011, #619; #663

***Onagraceae* A.L. de Jussieu 1789 (Evening-primrose Family)**

Oenthera fruticosa var. *fruticosa* L. (Evening primrose). Native, 6/29/2009, 8/22/2009, #171; #172; #173; #174; #852

Oenthera tetragona var. *tetragona* Roth (Northern Sundrops). Native, 6/10/2010, #580; #581

***Orbanchaceae* Ventenat 1799 (Broomrape Family)**

Aureolaria laevigata (Rafinesque) Rafinesque (Appalachian Oak-leech). Native, 7/28/2009, 7/19/2010, #347; #601

Conopholis americana (L.) Wallroth (Squawroot). Native, 5/15/2011, #651

Epifagus virginiana (L.) W. Barton (Beech Drops). Native, 8/22/2009, #351

***Papaveraceae* A.L. de Jussieu 1789 (Poppy Family)**

Sanguinaria canadensis L. (Bloodroot). Native, 4/25/2010, #485

***Plantaginaceae* A.L. de Jussieu 1789 (Plantain Family)**

Chelone lyonii Pursh Aooakacguab (Turtlehead). Native, 8/30/2009, #381

Plantago lanceolate L. (English plantain). Exotic, 5/29/2010, #551

Plantago major L. (Common Plantain). Exotic, 8/22/2009, #854

Veronica serpyllifolia var. *serpyllifolia* L. (Thymeleaf Speedwell). Exotic, 5/29/2010, #554

***Polemoniaceae* A.L. de Jussieu 1789 (Jacob's-ladder Family)**

Phlox stolonifera L. (Creeping Phlox). Native, 4/25/2010, #482

***Polygonaceae* A.L. de Jussieu 1789 (Smartweed Family)**

Fallopia convolvulus (L.) A. Love (Bindweed). Native, 7/21/2009, #324

Persicaria punctata (Elliot) Small (Dotted smartweed). Native, 8/22/2009, #855

Rumex acetosella L. (Common sheep sorrel). Native, 7/21/2009, 9/13/2009, 5/15/2010, #318; #419; #513

Rumex obtusifolius L. (Bitterdock). Native, 8/22/2009, #858

***Portulacaceae*.L. de Jussieu 1789 (Purslane Family)**

Claytonia caroliniana Michaux (Carolina Spring beauty). Native, 4/25/20, #459; #479

***Ranunculaceae* A.L. de Jussieu 1789 (Buttercup Family)**

Aconitum reclinatum Gray (White Monk's hood). Native, 7/14/2009, #270; #271; NC Rare

Actea pachypoda Elliot (White Baneberry). Native, 5/15/2011, #650

Actea racemosa L. (Common Black-cohosh). Native, 6/30/2009, 8/30/2009, 9/25/2009, 5/15/2010,#204; #380; #439; #520

Anemone acutiloba (A.P. deCandolle) G. Lawson (Sharp-lobed hepatica). Native, 4/25/2010, #475

Anemone canadensis L. (Canadian Anemone). Native, 5/29/2010, #543

Anemone quinquefolia var. *quinquifolia* L. (Wood Anemone). Native, 4/25/2010, #453

Anemone virginiana var. *virginiana* L. (Tall Anemone). Native, 6/25/2010, #590

Aquilegia canadensis L. (Columbine). Native, 5/22/2011, #671

Clematis virginiana L. (Virgin's-bower). Native, 10/3/2009, #448

Clematis virona L. (Leather vasevine). Native, 7/9/2009, 7/21/2009, #248; #249 #250; #340

Delphinium tricorne Michaux (Dwarf Larkspur). Native, 4/25/2010, #463

Ranunculus hispidus Michaux (Bristly Buttercup). Native, 5/5/2010, #495
Ranunculus recurvatus var. *recurvatus* Poiret (Hooked Buttercup). Native, 5/27/2010, #523

Thalictrum clavatum A.P. de Candolle (Mountain Meadow-Rue). Native, 5/15/2010, #518

Thalictrum dioicum L. (Early Meadow-Rue). Native, 5/30/2009, 7/21/2009, 4/25/2010, 5/29/2010, #15; #298; #467; #555

***Rosaceae* A.L. de Jussieu 1789 (Rose Family)**

Agrimonia rostellata Wallroth (Wood Agrimony). Native, 7/21/2009, #325

Amelanchier arborea (Michaux) Fernald (Serviceberry). Native, 5/27/2010, #536

Amelanchier canadensis (L.) Medikus (Eastern Service Berry). Native, 5/22/2011, #674

Aronia prunifolia (Marshall) Rehder (Black Chokeberry). Native, 5/15/2010, 5/27/2010, 5/15/2011,#505; #542; #665

Crataegus macrosperma Ashe (Hawthorn). Native, 7/22/2010, #614

Crataegus pruinosa (Wendl.) K. Koch (Frosted Hawthorn). Native 5/15/2010, 5/27/2010, #510; #540

Crataegus punctata Jaquin (Dotted Hawthorn). Native, 7/9/2009, #254; #255; #256; #257

Geum canadense Jacquin (Avens). Native, 7/21/2009, #309

**Geum radiatum* Michaux (Appalachian Avens). Native, 7/22/2010, #605, (photo)

Gillenia trifoliata (L.) Moench (Mountain Indian-physic). Native, 6/10/2010, #562

Physocarpus opulifolius var. *opulifolius* (L.) Maximowicz (Common Ninebark). Native, 7/14/2009, 7/21/2009, #280; #281; #336

Potentilla canadensis var. *canadensis* L. (Dwarf Cinquifoil). Native, 5/30/2009, #18

Potentilla canadensis L.var. *villosissima* Fernald (Hairy Five-fingers). Native, 7/21/2009, #342

Prunus pensylvanica L. (Pin cherry). Native, 7/14/2009, 7/21/2009, #290; #291; #319

Rosa carolina ssp. *carolina* L. (Carolina Rose). Native, 5/22/2011, #673

Rosa multiflora Thunberg ex Murray (Multiflora Rose). Exotic, 5/30/2009, 5/29/2010, #13; #558

Rubus argutus Link (Southern Blackberry). Native, 6/10/2010, #566

Rubus canadensis L. (Thornless Blackberry). Native, 5/27/2010, #539

Rubus odoratus L. (Purple flowering raspberry). Native, 6/23/2009, #144; #145

Rubus trivialis Michaux (Southern Dewberry). Native, 7/21/2009, #341

Sibbaldiopsis tridentata (Ainton) Rydberg (Mountain-cinquefoil). Native, 6/16/2009, #124; #125

Sorbus americana Marshall (American Mountain Ashe). Native, 7/14/2009, 7/21/2009, #296; #297; #334

***Rubiaceae* A.L. de Jussieu 1789 (Madder Family)**

Galium latifolium Michaux (Wideleaf bedstraw). Native, 6/30/2009, #210; #211; # 212

Galium triflorum Michaux (Sweet-scented Bedstraw). Native, 7/21/2009, 5/27/2010, #305; #524

Houstonia caerulea L. (Common Bluet). Native, 8/30/2009, #393

Houstonia montana Small (Roan Mountain Bluet). Native, 8/30/2009, #389. U.S. endangered, N.C. endangered.

Houstonia purpurea var. *purpurea* L. (Summer Bluet). Native, 5/30/2009, 5/29/2010, 6/10/2010, 6/13/2011, #9; #559; #564; #691

Houstonia pusilla Schoepf (Tiny Bluet). Native, 4/25/2010, #478

Mitchella repens L. (Partridge-berry). Native, 9/12/2010, #635

***Salicaceae* de Mirbel 1815 (Willow Family)**

Salix humilis Marshall (Upland Willow). Native, 8/30/2009, 9/13/2009, 5/22/2011, #392; #431; #672

***Sapindaceae* A.L. de Jussieu 1789 (Soapberry Family)**

Acer pensylvanicum L. (Striped Maple). Native, 5/30/2009, 6/6/2009, 5/5/2010, #1; #2; #3; #43; #44; #501

Acer rubrum L. (Red Maple). Native, 6/23/2009, 5/15/2010, #154; #155; #156; #507

Acer saccharum Marshall (Sugar Maple). Native, 5/29/2010, 7/22/2010, #547; #617; #618

Acer spicatum Lamarck (Mountain Maple). Native, 6/6/2009, #75; #76; #77; #78

Aesculus flava Solander (Yellow Buckeye). Native, 5/5/2010, #491

***Saxifragaceae* A.L. de Jussieu 1789 (Saxifrage Family)**

Heuchera villosa var. *villosa* Michaux (Hairy alumroot). Native, 7/9/2009, 7/21/2009, #252; #253; #335

Micranthes caroliniana (A. Gray) Small (Carolina Saxifrage). Native, 6/10/2009, #81; #82; #83; #84, NC Rare

Micranthes micranthidifolia (Haworth) Small (Lettuceleaf). Native, 5/5/2010, #492

Micranthes petiolaris (Rafinesque) Brouillet (Michaux's saxifrage). Native, 6/16/2009, 7/14/2009, 7/19/2010, 7/21/2009, #126; #127; #277; #278; #279; #338; #600

Mitella diphylla L. (Two-leaf miterwort). Native, 4/25/2010, #466

Tiarella cordifolia L. var. *collina* Wherry (Heartleaf Foamflower). Native, 5/5/2010, 5/27/2010, #498; #530

***Scrophulariaceae* A.L. de Jussieu 1789 (Snapdragon Family)**

Scrophularia marilandica L. (Eastern figwort). Native, 6/30/2009, #205; #206; #207; #208; #209

***Urticaceae* A.L. de Jussieu 1789 (Nettle Family)**

Laportea canadensis (L.) Weddell (Canadian Woodnettle). Native, 6/29/2009, #183; #184

***Violaceae* Batsch 1802 (Violet Family)**

Viola blanda Willdenow (Sweet White Violet). Native, 4/25/2010, 5/27/2010, #457; #529

Viola canadensis var. *canadensis* L. (Canadian White Violet). Native, 4/25/2010, 5/27/2010, #458; #521

Viola cucullata Aiton (Blue Marsh Violet). Native, 4/25/2010, #455

Viola pubescens Aiton var. *scabriuscula* Schweinitz ex Torrey

(Downy Yellow Violet). Native, 4/25/2010, #456

***Vitaceae* A.L. de Jussieu 1789 (Grape Family)**

Vitis aestivalis var. *aestivalis* Michaux (Summer Grape). Native, 6/10/2010, #571

Appendix B

Index of Similarity Matrix

Below is the matrix used to generate the Sørrenson's Index of Similarity for the floristic studies conducted in the Amphibolite Mountains Macrosite (A.M.M.). The matrix was compiled from data from Tucker (1972), Lacy (1979), Poindexter (2006), Denslow (2009) and Palmer (2011), and is composed of 1,145 taxa.

The table is organized with the family name to the right arranged by phylum with Equisetophya, Lycopodiophyta, Pteridophyta, Pinophyta, and Magnoliophyta (Liliopsida and Magnoliopsida). Following the family, the native status of the taxon is indicated with an "N" for native and an "E" for exotic. The genus name is in the next column followed by the specific epithet. The following four columns are labeled "M", "T", "B", and "P" which are abbreviations that stand for Mount Jefferson, Three Top Mountain, Bluff Mountain, and Phoenix Mountain, respectively. A "1" was used to indicate that specific taxon was documented at that site, while a "0" was used to indicate the taxon was not documented. The notes column was used to indicate if any synonyms exist, if varieties of species were found at a particular site, or if the voucher for a specific taxon was not found in the Appalachian State University Herbarium.

Family	Native	Genus	Specific epithet	M	T	B	P	NOTES
Equisetaceae	N	*Equisetum*	*arvense*	1	1	1	1	
Isoetaceae	N	*Isoetes*	*engelmannii*	0	0	1	0	
Lycopodiaceae	N	*Dendrolycopodium*	*obscurum*	1	0	1	0	(=L. obscurum)
Lycopodiaceae	N	*Diphasiastrum*	*digitatum*	1	1	1	1	(=L. flabelliforme)
Lycopodiaceae	N	*Diphasiastrum*	*tristachyum*	0	0	1	0	
Lycopodiaceae	N	*Huperzia*	*appressa*	1	1	1	0	
Lycopodiaceae	N	*Huperzia*	*lucidula*	1	1	1	1	
Lycopodiaceae	N	*Lycopodium*	*clavatum*	0	0	0	0	
Lycopodiaceae	N	*Lycopodium*	*hickeyi*	0	1	0	0	(=Dendrolycopodium hickeyi)
Selaginellaceae	N	*Selaginella*	*apoda*	1	0	1	1	
Selaginellaceae	N	*Selaginella*	*rupestris*	1	0	1	1	
Aspleniaceae	N	*Asplenium*	*montanum*	1	1	1	1	
Aspleniaceae	N	*Asplenium*	*platyneuron*	1	1	1	0	
Aspleniaceae	N	*Asplenium*	*trichomanes*	1	1	0	0	
Dennstaediaceae	N	*Pteridium*	*aquilinum*	1	1	1	1	
Dennstaediaceae	N	*Dennstaedtia*	*punctilobula*	1	1	1	1	
Dennstaediaceae	N	*Athyrium*	*asplenioides*	1	1	1	1	Woodsiaceae in Weakley flora
Dennstaediaceae	N	*Cystopteris*	*protrusa*	1	0	0	1	
Dennstaediaceae	N	*Deparia*	*acrostichoides*	1	1	1	0	(=Athyrium thelypteroides), Woodsiaceae in Weakley
Dryopteridaceae	N	*Diplazium*	*pycnocarpon*	0	0	0	0	(=Athyrium pycnocardon)
Dryopteridaceae	N	*Dryopteris*	*campyloptera*	0	0	0	0	
Dryopteridaceae	N	*Dryopteris*	*goldiana*	1	0	0	0	
Dryopteridaceae	N	*Dryopteris*	*intermedia*	1	1	1	1	
Dryopteridaceae	N	*Dryopteris*	*marginalis*	1	0	1	1	
Dryopteridaceae	N	*Gymnocarpium*	*appalachianum*	0	0	1	0	
Dryopteridaceae	N	*Onoclea*	*sensibilis*	0	0	1	1	
Dryopteridaceae	N	*Polystichum*	*acrostichoides*	1	1	1	1	
Dryopteridaceae	N	*Woodsia*	*ilvensis*	1	0	1	0	
Dryopteridaceae	N	*Woodsia*	*scopulina*	0	0	0	1	(=Phoenix list, no voucher found in BOON)
Dryopteridaceae	N	*Woodsia*	*obtusa*	1	0	1	0	
Ophioglossaceae	N	*Botrypus*	*virginianus*	1	1	1	0	
Ophioglossaceae	N	*Sceptridium*	*biternatum*	1	0	0	0	
Ophioglossaceae	N	*Sceptridium*	*dissectum*	1	0	1	1	(=Botrychium dissectum)
Ophioglossaceae	N	*Sceptridium*	*jenmanii*	0	0	0	0	
Osumdaceae	N	*Osmunda*	*claytoniana*	1	0	1	1	
Osumdaceae	N	*Osmunda*	*cinnamomea*	0	0	1	1	
Osumdaceae	N	*Osmunda*	*regalis*	0	0	1	1	(=var. spectabilis), Phoenix
Polypodiaceae	N	*Polypodium*	*appalachianum*	1	0	0	0	
Polypodiaceae	N	*Polypodium*	*virginianum*	0	1	1	1	
Pteridaceae	N	*Adiantum*	*pedatum*	1	1	1	1	
Pteridaceae	N	*Pellaea*	*atropurpurea*	1	0	0	0	
Thelypteridaceae	N	*Phegopteris*	*hexagonoptera*	1	0	1	0	(=Thelypteris)

Thelypteridaceae	N	*Thelypteris*	*noveboracensis*	1	1	1	1	
Cupressaceae	N	*Juniperus*	*virginiana*	1	0	0	0	
Pinaceae	N	*Abies*	*fraseri*	1	0	0	0	
Pinaceae	N	*Picea*	*rubens*	0	0	0	0	
Pinaceae	N	*Pinus*	*pungens*	0	0	0	0	
Pinaceae	N	*Pinus*	*rigida*	0	1	0	0	
Pinaceae	N	*Pinus*	*strobus*	1	1	1	1	
Pinaceae	N	*Pinus*	*virginiana*	0	0	1	0	
Pinaceae	N	*Tsuga*	*canadensis*	1	1	1	1	
Pinaceae	N	*Tsuga*	*caroliniana*	1	1	1	1	
Agavaceae	N	*Yucca*	*filamentosa*	0	0	1	0	
Alismataceae	N	*Sagittaria*	*latifolia*	0	0	0	0	
Alliaceae	N	*Allium*	*allegheniense*	0	1	1	0	
Alliaceae	N	*Allium*	*burdickii*	0	1	0	0	Found at Three Top
Alliaceae	N	*Allium*	*tricoccum*	1	1	1	1	
Alliaceae	E	*Allium*	*vineale*	1	0	0	0	
Amaryllidaceae	E	*Narcissus*	*jonquilla*	0	0	0	0	
Amaryllidaceae	E	*Narcissus*	*×medioluteus*	1	0	0	0	
Amaryllidaceae	E	*Narcissus*	*poeticus*	1	0	0	0	
Amaryllidaceae	E	*Narcissus*	*psuedonarcissus*	0	0	0	0	
Araceae	N	*Acorus*	*calamus*	0	0	1	0	
Araceae	N	*Arisaema*	*triphyllum*	1	1	1	1	
Araceae	N	*Symplocarpus*	*foetidus*	0	0	1	1	
Asparagaceae	E	*Asparagus*	*officinalis*	0	0	1	0	
Asphodelaceae	E	*Kniphofia*	*uvaria*	1	0	0	0	
Colchicaceae	N	*Uvularia*	*grandiflora*	0	1	1	1	
Colchicaceae	N	*Uvularia*	*perfoliata*	1	1	1	1	
Colchicaceae	N	*Uvularia*	*puberula*	1	0	1	1	(=U. pudica)
Colchicaceae	N	*Uvularia*	*sessilifolia*	0	1	0	0	
Commelinaceae	E	*Commelina*	*communis*	1	0	1	1	
Commelinaceae	N	*Tradescantia*	*ohioensis*	0	0	0	0	
Commelinaceae	N	*Tradescantia*	*subaspera*	1	1	1	1	
Cyperaceae	N	*Bulbostylis*	*capillaris*	1	0	1	1	
Cyperaceae	N	*Carex*	*aestivalis*	1	1	1	1	
Cyperaceae	N	*Carex*	*albicans*	0	0	0	0	(=C. artitecta)
Cyperaceae	N	*Carex*	*albursina*	1	0	1	0	
Cyperaceae	N	*Carex*	*allegheniensis*	0	0	0	0	(=C. debilis var.pubera, >C.d.var rudgei)
Cyperaceae	N	*Carex*	*amphibola*	1	0	0	0	
Cyperaceae	N	*Carex*	*appalachica*	1	1	0	0	
Cyperaceae	N	*Carex*	*argyrantha*	1	0	0	0	
Cyperaceae	N	*Carex*	*atlantica*	0	0	1	0	(C. incomperta)
Cyperaceae	N	*Carex*	*austrocaroliniana*	0	0	0	0	
Cyperaceae	N	*Carex*	*baileyi*	0	0	1	1	
Cyperaceae	N	*Carex*	*blanda*	0	0	1	0	
Cyperaceae	N	*Carex*	*bromoides*	0	1	1	0	ssp. montana
Cyperaceae	N	*Carex*	*brunnescens*	1	0	0	0	
Cyperaceae	N	*Carex*	*bushii*	0	0	1	0	
Cyperaceae	N	*Carex*	*buxbaumii*	0	0	1	0	
Cyperaceae	N	*Carex*	*caroliniana*	0	0	1	0	

Cyperaceae	N	*Carex*	*cephalophora*	1	0	0	0	
Cyperaceae	N	*Carex*	*communis*	1	0	1	1	
Cyperaceae	N	*Carex*	*conoidea*	0	0	1	0	
Cyperaceae	N	*Carex*	*crebriflora*	0	0	0	0	
Cyperaceae	N	*Carex*	*crinita*	0	0	0	0	
Cyperaceae	N	*Carex*	*debilis*	1	0	0	0	
Cyperaceae	N	*Carex*	*digitalis*	1	0	1	0	
Cyperaceae	N	*Carex*	*festucacea*	0	0	0	0	
Cyperaceae	N	*Carex*	*gracillima*	1	0	1	0	
Cyperaceae	N	*Carex*	*gracilescens*	0	0	1	0	
Cyperaceae	N	*Carex*	*gynandra*	0	1	1	0	(=C. crinita var. gynandra)
Cyperaceae	N	*Carex*	*hirsutella*	1	0	0	0	
Cyperaceae	N	*Carex*	*intumescens*	0	0	1	0	
Cyperaceae	N	*Carex*	*laevivaginata*	0	0	1	0	
Cyperaceae	N	*Carex*	*laxiculmis*	1	0	1	0	
Cyperaceae	N	*Carex*	*laxiflora*	1	1	1	0	
Cyperaceae	N	*Carex*	*leptalea*	0	0	1	0	
Cyperaceae	N	*Carex*	*lucorum*	1	0	0	0	
Cyperaceae	N	*Carex*	*lurida*	1	1	1	0	
Cyperaceae	N	*Carex*	*misera*	0	0	1	0	
Cyperaceae	N	*Carex*	*muhlenbergii*	0	0	1	0	
Cyperaceae	N	*Carex*	*nigromarginata*	0	0	0	1	(=Phoenix, can't find voucher, suspect)
Cyperaceae	N	*Carex*	*normalis*	1	0	0	0	
Cyperaceae	N	*Carex*	*plantaginea*	0	1	0	0	Collected Three Top
Cyperaceae	N	*Carex*	*pensylvanica*	1	0	1	1	
Cyperaceae	N	*Carex*	*prasina*	0	0	1	0	
Cyperaceae	N	*Carex*	*purpurifera*	0	0	0	1	(=Phoenix, can't find voucher)
Cyperaceae	N	*Carex*	*roanensis*	1	0	1	0	
Cyperaceae	N	*Carex*	*rosea*	1	0	1	1	
Cyperaceae	N	*Carex*	*ruthii*	0	0	0	0	
Cyperaceae	N	*Carex*	*scabrata*	0	1	1	0	
Cyperaceae	N	*Carex*	*scoparia*	1	0	1	0	
Cyperaceae	N	*Carex*	*sparganiodes*	0	0	1	0	
Cyperaceae	N	*Carex*	*stipata*	1	0	1	0	
Cyperaceae	N	*Carex*	*stricta*	0	0	1	0	
Cyperaceae	N	*Carex*	*styloflexa*	0	0	1	0	
Cyperaceae	N	*Carex*	*torta*	0	0	0	0	
Cyperaceae	N	*Carex*	*tribuloides*	0	0	0	0	
Cyperaceae	N	*Carex*	*virescens*	1	0	1	0	
Cyperaceae	N	*Carex*	*vulpinoidea*	1	1	1	1	
Cyperaceae	N	*Carex*	*woodii*	1	1	1	0	
Cyperaceae	N	*Cladium*	*mariscoides*	0	0	1	0	
Cyperaceae	N	*Cymophyllus*	*fraserianus*	0	0	0	0	
Cyperaceae	N	*Cyperus*	*filiculmis*	0	0	0	0	
Cyperaceae	N	*Cyperus*	*flavescens*	1	0	1	0	
Cyperaceae	N	*Cyperus*	*strigosus*	1	0	1	0	
Cyperaceae	N	*Eleocharis*	*obtusa*	1	0	1	0	
Cyperaceae	N	*Eleocharis*	*tenuis*	1	0	1	0	

Cyperaceae	N	*Eriophorum*	*virginicum*	0	0	1	0	
Cyperaceae	N	*Fimbristylis*	*autumnalis*	0	0	1	0	
Cyperaceae	N	*Kyllinga*	*gracillima*	1	0	0	0	
Cyperaceae	N	*Rhynchospora*	*alba*	0	0	1	0	
Cyperaceae	N	*Rhynchospora*	*capitellata*	0	0	1	0	
Cyperaceae	N	*Scirpus*	*atrovirens*	1	0	1	1	
Cyperaceae	N	*Scirpus*	*cyperinus*	0	0	0	1	
Cyperaceae	N	*Scirpus*	*expansus*	0	1	0	1	
Cyperaceae	N	*Scirpus*	*hattorianus*	0	1	0	0	
Cyperaceae	N	*Scirpus*	*polyphyllus*	0	1	1	0	
Cyperaceae	N	*Scirpus*	*purshianus*	0	0	1	0	
Cyperaceae	N	*Scirpus*	*validus*	0	0	1	0	
Cyperaceae	N	*Scleria*	*triglomerata*	0	0	0	0	
Cyperaceae	N	*Trichoporum*	*ceaspitosum*	0	1	0	0	
Dioscoreaceae	N	*Dioscorea*	*polystachya*	0	0	0	0	
Dioscoreaceae	N	*Dioscorea*	*quaternata*	1	1	1	1	(likely villosa); (Phoenix = villosa)
Hemerocallidaceae	E	*Hemerocallis*	*fulva*	1	0	1	0	
Hostaceae	E	*Hosta*	*lancifolia*	1	0	0	0	
Hostaceae	E	*Hosta*	*ventricosa*	1	0	0	0	
Hyacinthaceae	E	*Hyacinthoides*	*hispanica*	1	0	0	0	
Hyacinthaceae	E	*Ornithogalum*	*umbellatum*	1	0	0	0	
Hypoxidaceae	N	*Hypoxis*	*hirsuta*	1	0	1	1	
Iridaceae	N	*Iris*	*cristata*	1	1	1	1	
Iridaceae	E	*Iris*	*germanica*	1	0	0	1	
Iridaceae	E	*Iris*	*pallida*	1	0	0	0	
Iridaceae	E	*Iris*	*sanguinea*	0	0	0	0	
Iridaceae	N	*Iris*	*verna*	0	0	0	0	
Iridaceae	N	*Sisyrinchium*	*albidum*	0	0	0	0	
Iridaceae	N	*Sisyrinchium*	*angustifolium*	1	1	0	0	
Iridaceae	N	*Sisyrinchium*	*atlanticum*	0	0	1	1	(=S. mucronatum var. atlanticum)
Iridaceae	N	*Sisyrinchium*	*mucronatum*	0	0	0	0	
Juncaceae	N	*Juncus*	*acuminatus*	1	0	1	0	
Juncaceae	N	*Juncus*	*brevicaudatus*	0	0	0	1	
Juncaceae	N	*Juncus*	*canadensis*	0	0	1	0	
Juncaceae	N	*Juncus*	*coriaceus*	0	1	0	0	
Juncaceae	N	*Juncus*	*effusus*	1	1	1	1	
Juncaceae	N	*Juncus*	*gymnocarpus*	0	0	0	0	
Juncaceae	N	*Juncus*	*marginatus*	1	0	1	0	
Juncaceae	N	*Juncus*	*scirpoides*	0	0	0	0	
Juncaceae	N	*Juncus*	*subcaudatus*	0	0	0	0	
Juncaceae	N	*Juncus*	*tenuis*	1	1	1	0	
Juncaceae	N	*Luzula*	*acuminata*	1	1	1	1	
Juncaceae	N	*Luzula*	*echinata*	1	1	1	1	
Liliaceae	N	*Clintonia*	*borealis*	0	0	0	0	
Liliaceae	N	*Clintonia*	*umbellulata*	1	1	1	1	
Liliaceae	N	*Erythronium*	*americanum*	0	0	1	1	
Liliaceae	N	*Lilium*	*grayi*	0	1	1	1	
Liliaceae	N	*Lilium*	*michauxii*	1	0	1	1	
Liliaceae	N	*Lilium*	*philadelphicum*	0	0	1	0	

Liliaceae	N	*Lilium*	*superbum*	1	1	1	1	
Liliaceae	N	*Medeola*	*virginiana*	1	1	1	1	
Liliaceae	N	*Prosartes*	*lanuginosa*	1	1	1	1	(=Disporum l.)
Liliaceae	N	*Streptopus*	*lanceolatus*	0	0	0	0	(=S. roseus)
Liliaceae	E	*Tulipa*	*gesneriana*	1	0	0	0	
Melanthiaceae	N	*Amianthium*	*muscaetoxicum*	0	0	1	1	
Melanthiaceae	N	*Chamaelirium*	*luteum*	0	0	1	0	
Melanthiaceae	N	*Stenanthium*	*leimanthoides*	0	0	1	0	(=Zigadenus)
Melanthiaceae	N	*Veratrum*	*latifolium*	0	0	0	0	
Melanthiaceae	N	*Veratrum*	*parviflorum*	1	1	1	1	
Melanthiaceae	N	*Veratrum*	*viride*	0	1	1	1	
Melanthiaceae	N	*Veratrum*	*virginicum*	0	0	1	0	
Melanthiaceae	N	*Xerophyllum*	*asphodeloides*	0	0	0	0	
Nartheciaceae	N	*Aletris*	*farinosa*	1	0	1	0	
Orchidaceae	N	*Aplectrum*	*hyemale*	1	0	1	1	
Orchidaceae	N	*Coeloglossum*	*viride*	0	0	1	0	
Orchidaceae	N	*Corallorhiza*	*maculata*	0	0	1	0	
Orchidaceae	N	*Corallorhiza*	*odontorhiza*	0	0	1	0	
Orchidaceae	N	*Cypripedium*	*acaule*	1	0	1	1	
Orchidaceae	N	*Cypripedium*	*parviflorum*	0	0	1	0	(=C. calceolus var. pubescens)
Orchidaceae	N	*Dactylorhiza*	*viridis*	0	0	0	1	(=Habenaria viridis var. bracteata)
Orchidaceae	N	*Galearis*	*spectabilis*	1	1	1	1	(=Orchis spectabilis)
Orchidaceae	N	*Goodyera*	*pubescens*	1	1	1	1	
Orchidaceae	N	*Goodyera*	*repens*	1	0	1	1	
Orchidaceae	N	*Isotria*	*verticillata*	0	0	0	0	
Orchidaceae	N	*Liparis*	*liliifolia*	1	0	1	0	
Orchidaceae	N	*Listera*	*smallii*	1	0	1	0	
Orchidaceae	N	*Malaxis*	*unifolia*	0	0	1	0	
Orchidaceae	N	*Platanthera*	*x andrewsii*	0	0	1	0	
Orchidaceae	N	*Platanthera*	*ciliaris*	0	0	0	0	
Orchidaceae	N	*Platanthera*	*clavellata*	1	0	1	1	
Orchidaceae	N	*Platanthera*	*flava*	0	0	0	0	
Orchidaceae	N	*Platanthera*	*grandiflora*	0	0	1	0	
Orchidaceae	N	*Platanthera*	*lacera*	1	0	1	0	
Orchidaceae	N	*Platanthera*	*orbiculata*	1	0	1	1	(see also P. macrophylla)
Orchidaceae	N	*Platanthera*	*psycodes*	1	1	0	0	
Orchidaceae	N	*Spiranthes*	*cernua*	1	0	1	1	
Orchidaceae	N	*Spiranthes*	*lacera*	1	0	1	1	(=S. gracilis {Bigelow} Beck.)
Orchidaceae	N	*Spiranthes*	*ochroleuca*	1	0	0	0	
Orchidaceae	N	*Spiranthes*	*vernalis*	1	0	0	0	
Orchidaceae	N	*Tipularia*	*discolor*	1	0	0	0	
Orchidaceae	N	*Triphora*	*trianthophora*	0	0	1	0	
Poaceae	E	*Agrostis*	*capillaris*	0	0	1	0	(=A. tenuis)
Poaceae	N	*Agrostis*	*elliottiana*	0	0	0	0	
Poaceae	E	*Agrostis*	*gigantea*	1	0	0	0	
Poaceae	N	*Agrostis*	*perennans*	1	0	1	0	
Poaceae	N	*Agrostis*	*scabra*	1	0	0	1	
Poaceae	E	*Agrostis*	*stolonifera*	0	0	1	1	

Poaceae	E	*Alopecurus*	*pratensis*	1	0	0	0	
Poaceae	N	*Andropogon*	*elliottii*	1	0	0	0	
Poaceae	N	*Andropogon*	*gerardii*	1	1	1	0	
Poaceae	N	*Andropogon*	*ternarius*	0	0	0	0	
Poaceae	N	*Andropogon*	*virginicus*	1	0	0	1	
Poaceae	E	*Anthoxanthum*	*odoratum*	1	1	1	0	
Poaceae	N	*Aristida*	*dichotoma*	1	0	0	0	
Poaceae	N	*Aristida*	*longespica*	0	0	1	0	
Poaceae	E	*Arthraxon*	*hispidus*	1	0	0	0	
Poaceae	E	*Arrhenatherum*	*elatius*	1	0	1	0	
Poaceae	N	*Arundinaria*	*gigantea*	0	0	0	0	
Poaceae	N	*Brachyelytrum*	*aristosum*	0	0	1	0	
Poaceae	N	*Brachyelytrum*	*erectum*	0	1	1	0	
Poaceae	N	*Bromus*	*ciliatus*	0	0	1	0	
Poaceae	E	*Bromus*	*cartharticus*	0	1	0	0	var. cartharticus
Poaceae	E	*Bromus*	*commutatus*	1	0	1	1	
Poaceae	E	*Bromus*	*hordeaceus*	1	0	0	0	
Poaceae	E	*Bromus*	*inermis*	1	0	0	0	
Poaceae	E	*Bromus*	*japonicus*	1	0	0	0	
Poaceae	N	*Bromus*	*pubescens*	1	1	1	0	(<B. purgans); (B. nottowayanus)
Poaceae	E	*Bromus*	*sterilis*	1	0	0	0	
Poaceae	E	*Bromus*	*tectorum*	1	0	0	0	
Poaceae	N	*Calamagrostis*	*canadensis*	0	0	1	0	
Poaceae	N	*Calamagrostis*	*cinnoides*	0	0	1	0	
Poaceae	N	*Cinna*	*arundinacea*	0	0	1	0	
Poaceae	E	*Dactylis*	*glomerata*	1	1	1	1	
Poaceae	N	*Danthonia*	*compressa*	1	0	1	1	
Poaceae	N	*Danthonia*	*sericea*	0	1	0	1	
Poaceae	N	*Danthonia*	*spicata*	1	1	1	1	
Poaceae	N	*Deschampsia*	*flexuosa*	1	1	0	0	(Avenella flexuosa)
Poaceae	N	*Dichanthelium*	*acuminatum*	1	1	1	1	(P. lanuginosum); D. acuminatum var. acuminatum
Poaceae	N	*Dichanthelium*	*angustifolium*	0	0	0	0	
Poaceae	N	*Dichanthelium*	*boscii*	1	1	1	0	
Poaceae	N	*Dichanthelium*	*clandestinum*	1	1	0	1	
Poaceae	N	*Dichanthelium*	*commutatum*	1	1	0	0	
Poaceae	N	*Dichanthelium*	*depauperatum*	1	0	1	1	
Poaceae	N	*Dichanthelium*	*dichotomum*	1	0	1	1	
Poaceae	N	*Dichanthelium*	*latifolium*	1	0	1	0	(=P. lat.)
Poaceae	N	*Dichanthelium*	*laxiflorum*	0	0	0	1	(=P. lax)
Poaceae	N	*Dichanthelium*	*linearifolium*	1	0	0	1	
Poaceae	N	*Dichanthelium*	*meridionale*	1	0	0	0	
Poaceae	N	*Dichanthelium*	*villosissimum*	1	0	0	0	
Poaceae	N	*Digitaria*	*filiformis*	0	0	1	0	
Poaceae	E	*Digitaria*	*ischaemum*	1	0	1	1	
Poaceae	E	*Digitaria*	*sanguinalis*	1	0	1	0	
Poaceae	E	*Echinochloa*	*crusgalli*	1	0	1	1	
Poaceae	E	*Eleusine*	*indica*	1	0	0	0	
Poaceae	N	*Elymus*	*glabriflorus*	1	0	0	0	

Poaceae	N	*Elymus*	*hystrix*	1	1	1	0	(=Hystrix patula); E. hystrix var. hystrix & E.h. var. bigelovianus
Poaceae	E	*Elymus*	*repens*	1	0	1	0	
Poaceae	N	*Elymus*	*riparius*	0	0	0	1	
Poaceae	N	*Elymus*	*virginicus*	1	0	0	0	
Poaceae	N	*Elymus*	*villosus*	1	0	1	0	
Poaceae	N	*Eragrostis*	*capillaris*	1	0	1	1	
Poaceae	N	*Eragrostis*	*hirsuta*	0	0	0	0	
Poaceae	N	*Festuca*	*rubra*	1	0	0	0	
Poaceae	N	*Festuca*	*subverticillata*	1	1	1	0	(=F. obtusa)
Poaceae	E	*Festuca*	*trachyphylla*	1	0	0	0	
Poaceae	N	*Glyceria*	*laxa*	0	0	0	0	(=G. canadensis var. laxa)
Poaceae	N	*Glyceria*	*striata*	1	0	1	0	
Poaceae	E	*Holcus*	*lanatus*	1	1	1	1	
Poaceae	E	*Hordeum*	*vulgare*	0	0	0	1	
Poaceae	N	*Leersia*	*oryzoides*	1	0	1	0	
Poaceae	N	*Leersia*	*virginica*	1	0	1	0	
Poaceae	E	*Lolium*	*perenne*	1	0	0	0	
Poaceae	E	*Microstegium*	*vimineum*	1	1	0	0	
Poaceae	E	*Miscanthus*	*sinensis*	0	0	1	1	
Poaceae	N	*Muhlenbergia*	*frondosa*	1	0	1	0	
Poaceae	N	*Muhlenbergia*	*glomerata*	1	0	1	0	
Poaceae	N	*Muhlenbergia*	*mexicana*	1	0	0	0	
Poaceae	N	*Muhlenbergia*	*schreberi*	1	0	1	0	
Poaceae	N	*Muhlenbergia*	*tenuiflora*	1	1	1	1	
Poaceae	N	*Panicum*	*anceps*	0	0	0	0	
Poaceae	N	*Panicum*	*capillare*	1	0	1	0	
Poaceae	N	*Panicum*	*dichotomiflorum*	1	0	1	0	
Poaceae	N	*Panicum*	*gattingeri*	0	0	1	0	
Poaceae	N	*Panicum*	*lithophilum*	0	0	1	0	
Poaceae	N	*Panicum*	*philadelphicum*	0	0	1	0	
Poaceae	E	*Paspalum*	*dilatatum*	1	0	0	0	
Poaceae	N	*Paspalum*	*laeve*	1	0	0	0	
Poaceae	N	*Paspalum*	*setaceum*	1	0	0	1	
Poaceae	N	*Phalaris*	*arundinacea*	1	0	0	0	
Poaceae	E	*Phleum*	*pratense*	1	1	1	1	ssp. pratense
Poaceae	E	*Phragmites*	*australis*	0	0	1	0	
Poaceae	N	*Poa*	*alsodes*	0	0	1	0	
Poaceae	E	*Poa*	*annua*	1	0	0	0	
Poaceae	N	*Poa*	*autumnalis*	0	0	1	0	
Poaceae	E	*Poa*	*compressa*	1	1	1	0	
Poaceae	N	*Poa*	*cuspidata*	1	1	1	0	
Poaceae	E	*Poa*	*pratensis*	1	1	1	0	
Poaceae	N	*Poa*	*palustris*	0	0	0	1	
Poaceae	N	*Poa*	*sylvestris*	0	0	1	0	
Poaceae	E	*Poa*	*trivialis*	1	0	0	0	
Poaceae	N	*Saccharum*	*alopecuroides*	0	0	0	0	
Poaceae	E	*Schedonorus*	*arundinaceus*	1	1	0	1	(Festuca elatior)
Poaceae	N	*Schizachyrium*	*scoparium*	1	1	1	1	var. scoparium

Poaceae	E	*Secale*	*cereale*	1	0	1	0	
Poaceae	E	*Setaria*	*faberi*	1	0	0	0	
Poaceae	N	*Setaria*	*parviflora*	1	0	1	1	(=S. geniculata)
Poaceae	E	*Setaria*	*pumila*	1	0	0	1	(=S. glauca)
Poaceae	E	*Setaria*	*viridis*	1	0	1	0	
Poaceae	N	*Sorghastrum*	*nutans*	1	0	0	0	
Poaceae	E	*Sorghum*	*halepense*	1	0	0	0	
Poaceae	N	*Sphenopholis*	*nitida*	1	0	1	0	
Poaceae	N	*Sporobolus*	*vaginiflorus*	1	0	1	0	
Poaceae	N	*Tridens*	*flavus*	1	0	0	0	
Poaceae	E	*Triticum*	*aestivum*	1	0	0	0	
Poaceae	N	*Vulpia*	*octoflora*	0	0	0	0	
Poaceae	E	*Vulpia*	*myuros*	0	0	0	1	
Ruscaceae	N	*Convallaria*	*majuscula*	1	1	1	1	(=C. majalis var. montana)
Ruscaceae	N	*Maianthemum*	*canadense*	1	1	1	1	
Ruscaceae	N	*Maianthemum*	*racemosum*	1	1	1	1	(=Smilacina)
Ruscaceae	N	*Polygonatum*	*biflorum*	1	1	1	1	
Ruscaceae	N	*Polygonatum*	*pubescens*	1	0	1	1	
Smilaceae	N	*Smilax*	*glauca*	1	0	1	0	
Smilaceae	N	*Smilax*	*herbacea*	1	0	1	1	
Smilaceae	N	*Smilax*	*hispida*	1	0	1	0	
Smilaceae	N	*Smilax*	*pulverulenta*	1	0	0	0	
Smilaceae	N	*Smilax*	*rotundifolia*	1	1	1	0	
Tofieldiaceae	N	*Triantha*	*glutinosa*	0	0	1	0	
Trilliaceae	N	*Trillium*	*catesbaei*	0	0	0	0	
Trilliaceae	N	*Trillium*	*erectum*	0	1	1	1	
Trilliaceae	N	*Trillium*	*grandiflorum*	1	1	1	1	
Trilliaceae	N	*Trillium*	*sulcatum*	1	0	0	0	
Trilliaceae	N	*Trillium*	*undulatum*	1	0	1	1	
Trilliaceae	N	*Trillium*	*vaseyi*	0	0	0	0	
Typhaceae	N	*Typha*	*latifolia*	0	1	1	0	
Xyridaceae	N	*Xyris*	*torta*	0	0	1	0	
Acanthaceae	N	*Ruellia*	*caroliniensis*	0	0	0	0	
Adoxaceae	N	*Sambucus*	*canadensis*	1	1	1	1	
Adoxaceae	N	*Sambucus*	*racemosa*	1	1	1	1	(incl. var. pubens)
Adoxaceae	N	*Viburnum*	*acerifolium*	1	1	1	1	
Adoxaceae	N	*Viburnum*	*cassinoides*	0	1	0	1	
Adoxaceae	N	*Viburnum*	*lantanoides*	1	1	1	1	(=V. alnifolium)
Adoxaceae	N	*Viburnum*	*nudum*	0	0	0	0	
Amaranthaceae	E	*Amaranthus*	*hybridus*	0	0	0	0	
Amaranthaceae	E	*Amaranthus*	*retroflexus*	1	0	0	0	
Anacardiaceae	N	*Rhus*	*copallina*	0	0	0	0	
Anacardiaceae	N	*Rhus*	*glabra*	1	0	1	1	
Anacardiaceae	N	*Rhus*	*typhina*	0	1	1	1	
Anacardiaceae	N	*Toxicodendron*	*radicans*	1	0	1	1	
Anacardiaceae	N	*Toxicodendron*	*vernix*	0	0	0	0	
Apiaceae	N	*Angelica*	*triquinata*	1	1	1	0	
Apiaceae	N	*Angelica*	*venenosa*	1	0	1	1	
Apiaceae	N	*Cryptotaenia*	*canadensis*	1	1	1	1	

Apiaceae	E	*Daucus*	*carota*	1	0	1	1	
Apiaceae	N	*Ligusticum*	*canadense*	1	0	1	1	
Apiaceae	N	*Osmorhiza*	*claytonii*	1	1	1	1	
Apiaceae	N	*Osmorhiza*	*longistylis*	1	1	1	1	
Apiaceae	N	*Oxypolis*	*rigidior*	1	0	1	1	
Apiaceae	E	*Pastinaca*	*sativa*	1	0	0	0	
Apiaceae	N	*Sanicula*	*canadensis*	1	1	1	1	
Apiaceae	N	*Sanicula*	*gregaria*	0	0	1	0	
Apiaceae	N	*Sanicula*	*marilandica*	0	0	1	0	
Apiaceae	N	*Taenidia*	*integerrima*	0	0	0	1	
Apiaceae	N	*Thaspium*	*barbinode*	0	1	1	1	
Apiaceae	N	*Thaspium*	*trifoliatum*	0	1	1	1	(incl. var. flavum)
Apiaceae	N	*Zizia*	*aptera*	1	0	0	0	
Apiaceae	N	*Zizia*	*trifoliata*	1	1	1	1	
Apocynaceae	N	*Apocynum*	*androsaemifolium*	1	0	1	1	
Apocynaceae	N	*Apocynum*	*cannabinum*	1	0	1	0	
Apocynaceae	N	*Asclepias*	*exaltata*	1	0	1	1	
Apocynaceae	N	*Asclepias*	*incarnata*	1	0	1	0	
Apocynaceae	N	*Asclepias*	*quadrifolia*	1	1	1	1	
Apocynaceae	N	*Asclepias*	*syriaca*	1	0	1	1	
Apocynaceae	N	*Asclepias*	*tuberosa*	1	0	1	0	
Apocynaceae	E	*Vinca*	*minor*	1	0	1	0	
Aquifoliaceae	N	*Ilex*	*montana*	1	1	1	0	(=I. ambiqua var. montana)
Aquifoliaceae	N	*Ilex*	*opaca*	0	0	0	0	
Araliaceae	N	*Aralia*	*nudicaulis*	1	1	1	1	
Araliaceae	N	*Aralia*	*racemosa*	1	0	0	0	
Araliaceae	N	*Aralia*	*spinosa*	0	0	0	0	
Araliaceae	N	*Panax*	*quinquefolius*	1	1	1	1	
Araliaceae	N	*Panax*	*trifolium*	0	0	0	1	
Aristolochiaceae	N	*Isotrema*	*macrophyllum*	1	1	1	1	=Aristolochia
Aristolochiaceae	N	*Asarum*	*canadense*	1	1	1	1	
Aristolochiaceae	N	*Hexastylis*	*shuttleworthii*	0	0	0	0	
Aristolochiaceae	N	*Hexastylis*	*virginica*	0	0	0	0	
Asteraceae	N	*Achillea*	*millefolium*	1	1	1	1	
Asteraceae	N	*Ageratina*	*altissima*	1	1	1	1	(=E. rugosum); incl. var. altissima & var. roanensis
Asteraceae	N	*Ageratina*	*aromaticum*	0	0	0	0	
Asteraceae	N	*Ambrosia*	*artemisiifolia*	1	0	1	1	
Asteraceae	N	*Ambrosia*	*trifida*	1	0	1	1	
Asteraceae	N	*Antennaria*	*plantaginifolia*	1	0	1	1	
Asteraceae	N	*Antennaria*	*solitaria*	0	0	0	0	
Asteraceae	E	*Anthemis*	*arvensis*	1	0	1	0	
Asteraceae	E	*Anthemis*	*cotula*	0	0	1	0	
Asteraceae	E	*Arctium*	*minus*	1	1	1	1	
Asteraceae	N	*Arnoglossum*	*atriplicifolium*	1	1	1	1	(=Cacalia); A. reniforme
Asteraceae	N	*Arnoglossum*	*muehlenbergii*	1	0	1	0	
Asteraceae	E	*Artemisia*	*ludoviciana*	0	0	1	0	
Asteraceae	E	*Artemisia*	*vulgaris*	1	0	0	0	
Asteraceae	N	*Bidens*	*bipinnata*	1	0	1	1	

Asteraceae	N	*Bidens*	*frondosa*	1	0	1	0	
Asteraceae	E	*Bidens*	*tripartita*	0	0	1	0	
Asteraceae	N	*Bidens*	*vulgata*	0	0	1	0	
Asteraceae	E	*Carduus*	*acanthoides*	1	0	0	1	
Asteraceae	E	*Cichorium*	*intybus*	1	0	1	1	
Asteraceae	E	*Cirsium*	*arvense*	1	0	0	0	
Asteraceae	N	*Cirsium*	*discolor*	1	0	1	0	
Asteraceae	N	*Cirsium*	*muticum*	0	0	1	0	
Asteraceae	E	*Cirsium*	*vulgare*	1	0	1	1	(=Carduus lanceolatus)
Asteraceae	N	*Chysopsis*	*mariana*	0	0	0	1	(=Heterotheca mariana)
Asteraceae	N	*Conoclinum*	*coelestinum*	0	0	0	0	
Asteraceae	N	*Conyza*	*canadensis*	1	0	1	0	
Asteraceae	N	*Coreopsis*	*major*	1	1	1	1	(var. stellata see also C. delphifolia);C. m var. rigida
Asteraceae	N	*Coreopsis*	*pubescens*	1	0	0	0	
Asteraceae	E	*Crepis*	*capillaris*	1	0	1	1	
Asteraceae	N	*Doellingeria*	*infirma*	0	0	1	0	
Asteraceae	N	*Doellingeria*	*umbellata*	1	1	1	0	
Asteraceae	N	*Elephantopus*	*carolinianus*	0	0	0	0	
Asteraceae	N	*Erechtites*	*hieraciifolius*	1	0	0	0	
Asteraceae	N	*Erigeron*	*annuus*	1	1	1	1	
Asteraceae	N	*Erigeron*	*philadelphicus*	1	0	1	1	
Asteraceae	N	*Erigeron*	*pulchellus*	1	0	1	1	
Asteraceae	N	*Erigeron*	*strigosus*	1	1	1	1	(var. strigosus) (Three Top) Montane Sexual Diploid material
Asteraceae	N	*Eupatorium*	*album*	0	0	0	0	
Asteraceae	N	*Eupatorium*	*cordigerum*	0	0	0	0	(=E. rotundifolium var. ovatum) see also E. pubescens
Asteraceae	N	*Eupatorium*	*perfoliatum*	1	0	1	1	
Asteraceae	N	*Eupatorium*	*serotinum*	0	0	1	0	
Asteraceae	N	*Eupatorium*	*sessilifolium*	1	0	0	0	
Asteraceae	N	*Eurybia*	*chlorolepis*	1	1	0	0	
Asteraceae	N	*Eurybia*	*divaricata*	1	1	1	1	(=Aster divaricatus)
Asteraceae	N	*Eurybia*	*macrophylla*	1	1	1	1	
Asteraceae	N	*Eutrochium*	*fistulosum*	1	1	0	1	(=Eupatorium fistulosum RAB)
Asteraceae	N	*Eutrochium*	*maculatum*	0	0	0	1	(=Eupatorium maculatum RAB))
Asteraceae	N	*Eutrochium*	*purpureum*	1	0	1	1	(=Eupatorium)
Asteraceae	N	*Eutrochium*	*steelei*	1	0	0	0	
Asteraceae	E	*Galinsoga*	*quadriradiata*	1	1	1	1	(=G. ciliata)
Asteraceae	N	*Gamochaeta*	*pupurea*	0	0	0	0	(Gnaphalium p., syn. problematic)
Asteraceae	N	*Helenium*	*autumnale*	1	0	1	1	
Asteraceae	N	*Helianthus*	*atrorubens*	0	0	0	0	
Asteraceae	N	*Helianthus*	*decapetalus*	0	0	1	0	
Asteraceae	N	*Helianthus*	*divaricatus*	1	0	1	0	
Asteraceae	N	*Helianthus*	*×glaucus*	1	0	0	0	
Asteraceae	N	*Helianthus*	*glaucophyllus*	0	0	0	0	

Asteraceae	N	*Helianthus*	*microcephalus*	1	0	1	1	(=Phoenix=Heliopsis microcephalus); no specimen found
Asteraceae	N	*Helianthus*	*strumosus*	0	0	1	0	
Asteraceae	E	*Helianthus*	*tuberosus*	0	0	1	0	
Asteraceae	N	*Heliopsis*	*helianthoides*	1	1	1	1	(=var. helianthoides)
Asteraceae	E	*Hieracium*	*caespitosum*	1	0	1	1	(=H. pratense)
Asteraceae	N	*Hieracium*	*gronovii*	0	0	1	1	
Asteraceae	N	*Hieracium*	*marianum*	1	0	0	0	
Asteraceae	N	*Hieracium*	*paniculatum*	1	1	1	1	
Asteraceae	E	*Hieracium*	*pilosella*	1	1	1	1	
Asteraceae	N	*Hieracium*	*scabrum*	0	0	1	0	
Asteraceae	N	*Hieracium*	*venosum*	1	0	1	1	
Asteraceae	E	*Hypochaeris*	*radicata*	1	0	0	0	
Asteraceae	N	*Ionactis*	*linariifolia*	1	0	1	0	
Asteraceae	N	*Krigia*	*biflora*	0	0	1	0	
Asteraceae	N	*Krigia*	*montana*	0	1	1	0	
Asteraceae	N	*Krigia*	*virginica*	1	0	0	0	
Asteraceae	N	*Lactuca*	*biennis*	1	0	1	0	
Asteraceae	N	*Lactuca*	*canadensis*	1	0	1	1	
Asteraceae	E	*Lactuca*	*floriana*	0	1	0	0	(Three Top, Keys to L. florida; I.D suspect)
Asteraceae	E	*Lactuca*	*serriola*	1	0	1	0	
Asteraceae	E	*Lapsana*	*communis*	1	0	0	0	
Asteraceae	E	*Leucanthemum*	*vulgare*	1	1	1	1	(=Chrysanthemum leucanthemum)
Asteraceae	N	*Liatris*	*aspera*	0	0	1	0	
Asteraceae	N	*Liatris*	*helleri*	0	1	1	0	
Asteraceae	N	*Liatris*	*spicata*	0	0	1	1	
Asteraceae	N	*Liatris*	*squarrosa*	0	0	0	0	
Asteraceae	N	*Liatris*	*virgata*	1	0	1	0	ISSUE (L. graminifolia in part, problematic)
Asteraceae	N	*Lonactis*	*linariifolius*	0	0	0	1	
Asteraceae	E	*Matricaria*	*discoidea*	1	0	0	0	(=M. matricarioides)
Asteraceae	N	*Oclemena*	*acuminata*	1	1	1	1	(=Aster acum.)
Asteraceae	N	*Packera*	*anonyma*	1	0	1	1	(=S. smallii)
Asteraceae	N	*Packera*	*aurea*	1	1	1	1	(=S. aureus)
Asteraceae	N	*Packera*	*plattensis*	0	0	1	0	
Asteraceae	N	*Packera*	*tomentosa*	0	0	0	0	
Asteraceae	N	*Prenanthes*	*altissima*	1	0	1	0	
Asteraceae	N	*Prenanthes*	*roanensis*	1	0	1	0	
Asteraceae	N	*Prenanthes*	*serpentaria*	0	0	1	0	
Asteraceae	N	*Prenanthes*	*trifoliolata*	1	0	1	1	
Asteraceae	N	*Pseudognaphalium*	*obtusifolium*	1	0	1	0	
Asteraceae	N	*Pyrrhopappus*	*carolinianus*	0	0	0	0	
Asteraceae	N	*Rudbeckia*	*hirta*	1	1	1	1	(=var. pulcherrima)
Asteraceae	N	*Rudbeckia*	*laciniata*	0	1	1	1	(=var. humilis, Three Top)
Asteraceae	N	*Sericocarpus*	*asteroides*	1	0	1	1	(=A. paternus)
Asteraceae	N	*Smallanthus*	*uvedalia*	1	0	1	0	
Asteraceae	N	*Siliphium*	*compositum*	0	0	0	0	

Asteraceae	N	*Solidago*	*altissima*	0	1	1	0	(=var. altissima)
Asteraceae	N	*Solidago*	*arguta*	1	1	1	0	
Asteraceae	N	*Solidago*	*bicolor*	1	1	1	1	
Asteraceae	N	*Solidago*	*caesia*	0	0	0	0	
Asteraceae	N	*Solidago*	*canadensis*	1	0	0	0	
Asteraceae	N	*Solidago*	*curtisii*	1	1	1	1	(> var. pubens)
Asteraceae	N	*Solidago*	*erecta*	1	0	0	1	
Asteraceae	N	*Solidago*	*flexicaulis*	1	0	0	0	
Asteraceae	N	*Solidago*	*gigantea*	1	0	1	0	
Asteraceae	N	*Solidago*	*juncea*	1	0	1	0	
Asteraceae	N	*Solidago*	*latissimifolia*	0	0	0	0	
Asteraceae	N	*Solidago*	*nemoralis*	1	0	1	1	
Asteraceae	N	*Solidago*	*odora*	0	0	0	0	
Asteraceae	N	*Solidago*	*patula*	0	0	1	0	
Asteraceae	N	*Solidago*	*petiolaris*	0	0	0	0	
Asteraceae	N	*Solidago*	*puberla*	0	0	0	1	
Asteraceae	N	*Solidago*	*roanensis*	1	1	1	1	
Asteraceae	N	*Solidago*	*rugosa*	1	1	1	0	(=var. aspera)
Asteraceae	N	*Solidago*	*speciosa*	0	0	0	0	
Asteraceae	N	*Solidago*	*uliginosa*	1	0	1	0	
Asteraceae	E	*Sonchus*	*asper*	1	0	1	0	
Asteraceae	E	*Sonchus*	*oleraceus*	1	0	0	1	
Asteraceae	N	*Symphyotrichum*	*cordifolium*	1	1	1	1	(=A. cordifolius)
Asteraceae	N	*Symphyotrichum*	*dumosum*	0	0	0	0	
Asteraceae	N	*Symphyotrichum*	*lanceolatum*	1	0	0	0	
Asteraceae	N	*Symphyotrichum*	*lateriflorum*	1	0	1	0	
Asteraceae	N	*Symphyotrichum*	*×sp.*	1	0	0	0	(S. lateriflorum ×S. prenanthoides fide Semple)
Asteraceae	N	*Symphyotrichum*	*novae-angliae*	0	0	0	1	
Asteraceae	N	*Symphyotrichum*	*patens*	0	0	0	1	
Asteraceae	N	*Symphyotrichum*	*pilosum*	1	1	1	0	
Asteraceae	N	*Symphyotrichum*	*prenanthoides*	1	1	1	1	
Asteraceae	N	*Symphyotrichum*	*puniceum*	1	0	0	0	
Asteraceae	N	*Symphyotrichum*	*retroflexum*	0	0	0	0	(=A. curtisii)
Asteraceae	N	*Symphyotrichum*	*undulatum*	1	1	1	1	
Asteraceae	E	*Taraxacum*	*laevigatum*	1	0	0	0	
Asteraceae	E	*Taraxacum*	*officinale*	1	0	1	1	
Asteraceae	E	*Tussilago*	*farfara*	1	0	0	0	
Asteraceae	N	*Verbesina*	*alternifolia*	1	1	1	1	
Asteraceae	N	*Verbesina*	*occidentalis*	0	0	0	0	
Asteraceae	N	*Vernonia*	*gigantea*	1	0	0	0	(=V. altissima)
Asteraceae	N	*Vernonia*	*glauca*	0	0	0	0	
Asteraceae	N	*Vernonia*	*noveboracensis*	1	0	1	1	
Balsaminaceae	N	*Impatiens*	*capensis*	1	1	1	1	
Balsaminaceae	N	*Impatiens*	*pallida*	1	1	1	1	
Balsaminaceae	E	*Impatiens*	*walleriana*	1	0	0	0	
Berberidaceae	E	*Berberis*	*thunbergii*	1	0	0	0	
Berberidaceae	N	*Caulophyllum*	*giganteum*	1	1	0	0	
Berberidaceae	N	*Caulophyllum*	*thalictroides*	1	1	1	1	
Berberidaceae	N	*Diphylleia*	*cymosa*	1	1	1	1	

Berberidaceae	E	*Mahonia*	*bealei*	0	0	0	0	
Berberidaceae	N	*Podophyllum*	*peltatum*	1	1	1	1	
Betulaceae	N	*Alnus*	*serrulata*	0	1	1	0	
Betulaceae	N	*Betula*	*alleghaniensis*	1	1	1	1	(=B. lutea)
Betulaceae	N	*Betula*	*lenta*	1	1	1	1	
Betulaceae	N	*Carpinus*	*caroliniana*	1	1	1	1	
Betulaceae	N	*Corylus*	*americana*	1	0	1	0	
Betulaceae	N	*Corylus*	*cornuta*	1	0	1	1	
Betulaceae	N	*Ostrya*	*virginiana*	1	1	1	1	
Boraginaceae	N	*Cynoglossum*	*virginianum*	1	0	1	1	
Boraginaceae	E	*Echium*	*vulgare*	1	0	1	1	
Boraginaceae	E	*Myosotis*	*scorpioides*	0	0	1	0	
Brassicaceae	E	*Alliaria*	*petiolata*	1	0	0	1	
Brassicaceae	N	*Arabis*	*canadensis*	0	0	0	1	
Brassicaceae	N	*Arabidopsis*	*lyrata*	1	0	1	0	
Brassicaceae	E	*Arabidopsis*	*thaliana*	0	0	0	0	
Brassicaceae	E	*Barbarea*	*verna*	1	0	1	0	
Brassicaceae	E	*Barbarea*	*vulgaris*	1	0	1	1	(>B. v. var. arcuata)
Brassicaceae	N	*Boechera*	*canadensis*	1	0	1	0	
Brassicaceae	N	*Boechera*	*laevigata*	1	0	1	0	
Brassicaceae	N	*Brassica*	*juncea*	0	0	0	1	
Brassicaceae	E	*Brassica*	*rapa*	1	1	1	0	(see also B. napus)
Brassicaceae	E	*Capsella*	*bursa-pastoris*	1	0	1	1	
Brassicaceae	N	*Cardamine*	*angustata*	0	0	0	0	
Brassicaceae	N	*Cardamine*	*clematitis*	0	0	0	0	
Brassicaceae	N	*Cardamine*	*concatenata*	1	1	1	1	
Brassicaceae	N	*Cardamine*	*diphylla*	0	0	0	0	
Brassicaceae	E	*Cardamine*	*hirsuta*	1	0	0	0	
Brassicaceae	N	*Cardamine*	*pensylvanica*	1	0	1	1	
Brassicaceae	E	*Draba*	*verna*	1	0	0	0	
Brassicaceae	E	*Erysimum*	*cheiranthoides*	0	0	0	1	
Brassicaceae	E	*Lepidium*	*campestre*	0	0	1	0	
Brassicaceae	N	*Lepidium*	*virginicum*	1	0	1	1	
Brassicaceae	E	*Lunaria*	*annua*	1	0	0	0	
Brassicaceae	E	*Raphanus*	*raphanistrum*	0	0	1	0	
Brassicaceae	E	*Sisymbrium*	*officinale*	1	0	1	0	
Brassicaceae	E	*Thlaspi*	*arvense*	0	0	1	0	
Calycanthaceae	N	*Calycanthus*	*floridus*	0	0	0	1	(=var. laevigatus)
Campanulaceae	N	*Campanula*	*divaricata*	1	1	1	1	
Campanulaceae	N	*Campanula*	*rotundifolia*	0	1	0	0	
Campanulaceae	N	*Campanulastrum*	*americanum*	1	1	1	0	(=Campanula americanum)
Campanulaceae	N	*Lobelia*	*amoena*	0	0	0	0	
Campanulaceae	N	*Lobelia*	*cardinalis*	0	0	0	0	
Campanulaceae	N	*Lobelia*	*glandulosa*	0	0	0	0	
Campanulaceae	N	*Lobelia*	*inflata*	1	1	1	1	
Campanulaceae	N	*Lobelia*	*puberula*	0	0	0	0	
Campanulaceae	N	*Lobelia*	*siphilitica*	1	1	1	1	(=var. silphitica)
Campanulaceae	N	*Lobelia*	*spicata*	0	0	0	0	
Campanulaceae	N	*Triodanis*	*perfoliata*	1	0	1	0	(=Specularia)

Cannabaceae	N	*Celtis*	*occidentalis*	0	0	0	0	
Caprifoliaceae	N	*Lonicera*	*dioica*	1	0	1	0	
Caprifoliaceae	E	*Lonicera*	*japonica*	1	0	1	0	
Caprifoliaceae	N	*Symphoricarpos*	*orbiculatus*	0	0	1	0	
Caprifoliaceae	N	*Triosteum*	*aurantiacum*	1	0	1	0	
Caryophyllaceae	E	*Arenaria*	*serpyllifolia*	1	0	1	0	
Caryophyllaceae	E	*Cerastium*	*fontanum*	1	0	1	0	(=C. holosteoides var. vulgare)
Caryophyllaceae	E	*Cerastium*	*glomeratum*	1	0	0	0	
Caryophyllaceae	E	*Cerastium*	*semidecandrum*	1	0	0	1	
Caryophyllaceae	E	*Dianthus*	*armeria*	1	1	1	1	
Caryophyllaceae	E	*Dianthus*	*barbatus*	1	0	0	0	
Caryophyllaceae	N	*Minuartia*	*glabra*	0	1	0	0	
Caryophyllaceae	N	*Minuartia*	*groenlandica*	0	0	0	1	
Caryophyllaceae	E	*Myosoton*	*aquaticum*	1	0	0	0	
Caryophyllaceae	N	*Paronychia*	*argyrocoma*	1	1	1	1	
Caryophyllaceae	N	*Paronychia*	*canadensis*	1	0	0	1	
Caryophyllaceae	N	*Paronychia*	*fastigiata*	0	0	1	0	
Caryophyllaceae	E	*Saponaria*	*officinalis*	1	0	1	0	
Caryophyllaceae	N	*Silene*	*antirrhina*	1	0	1	0	
Caryophyllaceae	E	*Silene*	*dichotoma*	0	0	1	0	
Caryophyllaceae	E	*Silene*	*latifolia*	0	0	0	0	(<Lychnis alba)
Caryophyllaceae	N	*Silene*	*ovata*	0	0	0	0	
Caryophyllaceae	N	*Silene*	*stellata*	1	1	1	1	
Caryophyllaceae	N	*Silene*	*virginica*	1	1	1	1	
Caryophyllaceae	E	*Silene*	*vulgaris*	1	0	1	0	
Caryophyllaceae	N	*Stellaria*	*corei*	0	1	0	0	
Caryophyllaceae	E	*Stellaria*	*graminea*	1	0	0	1	
Caryophyllaceae	E	*Stellaria*	*media*	1	0	1	1	
Caryophyllaceae	E	*Stellaria*	*neglecta*	0	1	0	0	
Caryophyllaceae	N	*Stellaria*	*pubera*	1	0	1	1	
Celastraceae	E	*Celastrus*	*orbiculatus*	1	0	0	0	
Celastraceae	N	*Euonymus*	*americanus*	0	0	0	0	
Celastraceae	E	*Euonymus*	*fortunei*	0	0	0	0	
Chenopodiaceae	E	*Chenopodium*	*album*	1	0	1	0	
Chenopodiaceae	N	*Dysphania*	*anthelmintica*	0	0	0	0	(C. ambrosioides)
Cistaceae	N	*Lechea*	*minor*	0	0	0	0	
Cistaceae	N	*Lechea*	*racemulosa*	1	0	0	1	
Cistaceae	N	*Crocanthemum*	*bicknellii*	1	0	1	0	
Cistaceae	N	*Crocanthemum*	*propinquum*	1	0	1	0	
Clethraceae	N	*Clethra*	*acuminata*	1	1	1	1	
Convolvulaceae	N	*Calystegia*	*catesbeiana*	0	0	0	0	
Convolvulaceae	N	*Calystegia*	*sepium*	1	0	1	1	
Convolvulaceae	E	*Convolvulus*	*arvensis*	0	0	0	0	
Convolvulaceae	N	*Cuscuta*	*compacta*	0	0	0	0	
Convolvulaceae	N	*Cuscuta*	*gronovii*	1	1	0	0	
Convolvulaceae	N	*Cuscuta*	*rostrata*	0	0	1	1	
Convolvulaceae	N	*Ipomoea*	*pandurata*	0	0	0	0	
Cornaceae	N	*Cornus*	*alternifolia*	1	1	1	1	
Cornaceae	N	*Cornus*	*amomum*	1	0	1	0	

Cornaceae	N	*Cornus*	*florida*	1	1	1	1	
Crassulaceae	N	*Hylotelephium*	*telephioides*	1	1	1	1	
Crassulaceae	E	*Sedum*	*sarmentosum*	0	0	0	0	
Crassulaceae	N	*Sedum*	*ternatum*	1	1	1	1	
Crassulaceae	E	*Sempervivum*	*tectorum*	1	0	0	0	
Cucurbitaceae	E	*Cucurbita*	*pepo*	1	0	0	0	
Cucurbitaceae	N	*Sicyos*	*angulatus*	1	0	0	0	
Diapensiaceae	N	*Galax*	*urceolata*	1	1	1	1	
Diervillaceae	N	*Diervilla*	*lonicera*	1	1	1	0	
Diervillaceae	N	*Diervilla*	*sessilifolia*	0	0	0	0	
Droseraceae	N	*Drosera*	*rotundifolia*	0	0	1	0	
Ebenaceae	N	*Diospyros*	*virginiana*	0	0	0	0	
Ericaceae	N	*Chimaphila*	*maculata*	1	0	1	1	
Ericaceae	N	*Epigaea*	*repens*	1	1	1	0	
Ericaceae	N	*Eubotrys*	*recurva*	1	1	1	0	(=Leucothoe rec.)
Ericaceae	N	*Gaultheria*	*procumbens*	1	0	1	0	
Ericaceae	N	*Gaylussacia*	*baccata*	1	0	1	1	
Ericaceae	N	*Gaylussacia*	*ursina*	0	0	0	0	
Ericaceae	N	*Hypopitys*	*monotropa*	1	0	1	0	
Ericaceae	N	*Kalmia*	*latifolia*	1	1	1	1	
Ericaceae	N	*Leucothoe*	*fontanesiana*	1	0	0	1	(=L. axillaris var. editorum)
Ericaceae	N	*Lyonia*	*ligustrina*	1	0	1	0	
Ericaceae	N	*Menziesia*	*pilosa*	1	1	1	1	
Ericaceae	N	*Monotropa*	*uniflora*	1	1	1	1	
Ericaceae	N	*Oxydendrum*	*arboreum*	1	0	0	1	
Ericaceae	N	*Pyrola*	*americana*	0	0	1	1	(=P. rotundifolia var. americana)
Ericaceae	N	*Rhododendron*	*calendulaceum*	1	1	1	1	
Ericaceae	N	*Rhododendron*	*catawbiense*	1	1	1	1	
Ericaceae	N	*Rhododendron*	*maximum*	1	1	1	1	
Ericaceae	N	*Rhododendron*	*minus*	0	0	0	0	
Ericaceae	N	*Rhododendron*	*periclymenoides*	0	0	0	0	(=R. nudiflorum)
Ericaceae	N	*Rhododendron*	*prinophyllum*	0	0	1	0	
Ericaceae	N	*Vaccinium*	*corymbosum*	1	1	1	0	
Ericaceae	N	*Vaccinium*	*erythrocarpum*	1	1	1	1	
Ericaceae	N	*Vaccinium*	*pallidum*	1	1	1	1	(=V. vaccillans)
Ericaceae	N	*Vaccinium*	*simulatum*	1	0	1	1	(=V. constablaei RAB see also cormybosum
Ericaceae	N	*Vaccinium*	*stamineum*	1	0	1	1	(+Phoenix); No specimen
Euphorbiaceae	N	*Acalypha*	*rhomboidea*	1	0	1	0	
Euphorbiaceae	N	*Acalypha*	*virginica*	0	0	0	0	
Euphorbiaceae	N	*Chamaesyce*	*maculata*	1	0	1	1	(=E. supina; E. maculata)
Euphorbiaceae	N	*Chamaesyce*	*nutans*	1	0	1	0	
Euphorbiaceae	N	*Euphorbia*	*corollata*	1	0	1	1	Also (=var. ziniifolia)
Euphorbiaceae	N	*Euphorbia*	*pubentissima*	0	0	0	0	
Fabaceae	N	*Amphicarpaea*	*bracteata*	1	0	1	0	
Fabaceae	N	*Apios*	*americana*	1	0	0	0	
Fabaceae	N	*Baptisia*	*tinctoria*	0	0	0	0	
Fabaceae	N	*Chamaecrista*	*fasciculata*	0	0	0	0	

Fabaceae	N	*Chamaecrista*	*nictitans*	0	0	1	0	
Fabaceae	N	*Desmodium*	*marilandicum*	1	0	0	0	
Fabaceae	N	*Desmodium*	*nudiflorum*	1	0	1	0	
Fabaceae	N	*Desmodium*	*paniculatum*	1	0	1	0	
Fabaceae	N	*Desmodium*	*rotundifolium*	1	0	0	0	
Fabaceae	E	*Kummerowia*	*stipulacea*	1	0	1	0	(=Lespedeza)
Fabaceae	E	*Kummerowia*	*striata*	1	0	1	0	
Fabaceae	E	*Lathyrus*	*hirsutus*	1	0	0	0	
Fabaceae	E	*Lathyrus*	*latifolius*	1	0	0	0	
Fabaceae	N	*Lathyrus*	*venosus*	1	0	0	0	
Fabaceae	E	*Lespedeza*	*cuneata*	1	0	0	0	
Fabaceae	N	*Lespedeza*	*frutescens*	0	0	0	0	
Fabaceae	N	*Lespedeza*	*hirta*	1	0	0	0	
Fabaceae	N	*Lespedeza*	*repens*	1	0	0	0	
Fabaceae	N	*Lespedeza*	*stuevei*	1	0	0	0	
Fabaceae	N	*Lespedeza*	*violacea*	1	0	0	0	(=L. intermedia)
Fabaceae	E	*Medicago*	*lupulina*	1	1	0	1	
Fabaceae	E	*Melilotus*	*albus*	1	0	1	0	
Fabaceae	E	*Melilotus*	*officinalis*	1	0	1	0	
Fabaceae	N	*Mimosa*	*microphylla*	0	0	0	0	
Fabaceae	N	*Robinia*	*hispida*	0	0	0	0	
Fabaceae	N	*Robinia*	*pseudoacacia*	1	1	1	1	
Fabaceae	E	*Securigera*	*varia*	1	1	0	0	
Fabaceae	N	*Senna*	*hebecarpa*	0	0	0	0	
Fabaceae	N	*Stylosanthes*	*biflora*	0	0	0	0	
Fabaceae	N	*Tephrosia*	*virginiana*	1	0	0	0	
Fabaceae	N	*Thermopsis*	*villosa*	0	0	0	0	
Fabaceae	E	*Trifolium*	*aureum*	0	0	1	1	(=T. agrarium)
Fabaceae	E	*Trifolium*	*campestre*	1	0	1	0	
Fabaceae	E	*Trifolium*	*dubium*	1	0	0	0	
Fabaceae	E	*Trifolium*	*hybridum*	1	0	1	0	
Fabaceae	E	*Trifolium*	*pratense*	1	1	1	1	
Fabaceae	E	*Trifolium*	*repens*	1	0	1	1	
Fabaceae	N	*Vicia*	*caroliniana*	1	1	0	1	
Fabaceae	E	*Vicia*	*sativa*	1	0	0	0	(=V. angustifolia)
Fabaceae	E	*Vicia*	*villosa*	1	0	0	0	
Fagaceae	N	*Castanea*	*dentata*	1	1	1	1	
Fagaceae	E	*Castanea*	*mollissima*	0	0	0	0	
Fagaceae	N	*Castanea*	*pumila*	0	0	0	0	
Fagaceae	N	*Fagus*	*grandifolia*	1	1	1	1	
Fagaceae	N	*Quercus*	*alba*	1	1	1	1	
Fagaceae	N	*Quercus*	*coccinea*	1	0	0	1	
Fagaceae	N	*Quercus*	*falcata*	0	0	0	0	
Fagaceae	N	*Quercus*	*imbricaria*	0	0	0	0	
Fagaceae	N	*Quercus*	*marilandica*	0	0	0	0	
Fagaceae	N	*Quercus*	*montana*	1	1	1	1	(=Q. prinus)
Fagaceae	N	*Quercus*	*rubra*	1	1	1	1	(incl. var. borealis)
Fagaceae	N	*Quercus*	*stellata*	0	0	0	0	
Fagaceae	N	*Quercus*	*velutina*	1	0	0	0	
Fumariaceae	N	*Capnoides*	*sempervirens*	0	0	0	0	(=Corydalis)

Fumariaceae	N	*Dicentra*	*canadensis*	1	1	1	1	
Fumariaceae	N	*Dicentra*	*cucullaria*	1	1	1	0	
Gentianaceae	N	*Bartonia*	*virginica*	0	0	1	0	
Gentianaceae	N	*Gentiana*	*austromontana*	0	1	1	0	
Gentianaceae	N	*Gentiana*	*clausa*	1	0	0	1	
Gentianaceae	N	*Gentiana*	*decora*	0	0	0	1	
Gentianaceae	N	*Gentianopsis*	*crinata*	0	0	1	0	
Gentianaceae	N	*Gentiana*	*saponaria*	0	0	1	0	
Gentianaceae	N	*Gentianella*	*quinquefolia*	1	1	1	1	
Gentianaceae	N	*Obolaria*	*virginiana*	0	0	0	1	
Gentianaceae	N	*Sabatia*	*angularis*	0	0	0	0	
Gentianaceae	N	*Geranium*	*carolinianum*	1	0	1	0	
Gentianaceae	E	*Geranium*	*columbinum*	0	0	0	0	
Gentianaceae	E	*Geranium*	*dissectum*	1	0	1	0	
Gentianaceae	N	*Geranium*	*maculatum*	1	1	1	1	
Gentianaceae	E	*Geranium*	*molle*	0	0	0	0	
Grossulariaceae	N	*Ribes*	*cynosbati*	1	1	1	0	
Grossulariaceae	N	*Ribes*	*glandulosum*	0	0	0	1	
Grossulariaceae	N	*Ribes*	*rotundifolium*	0	0	1	1	
Hamamelidaceae	N	*Hamamelis*	*virginiana*	1	1	1	1	
Hydrangeaceae	N	*Hydrangea*	*arborescens*	1	1	1	1	
Hydrophyllaceae	N	*Hydrophyllum*	*canadense*	1	1	1	1	
Hydrophyllaceae	N	*Hydrophyllum*	*virginianum*	1	0	1	1	
Hydrophyllaceae	N	*Phacelia*	*bipinnatifida*	0	0	0	0	
Hydrophyllaceae	N	*Phacelia*	*purshii*	0	0	0	0	
Hydrophyllaceae	N	*Phacelia*	*fimbriata*	0	0	0	1	
Hypericaceae	N	*Hypericum*	*buckleyi*	0	0	0	0	
Hypericaceae	N	*Hypericum*	*canadense*	0	0	1	0	
Hypericaceae	N	*Hypericum*	*densiflorum*	0	0	1	0	
Hypericaceae	N	*Hypericum*	*gentianoides*	1	0	1	0	
Hypericaceae	N	*Hypericum*	*mitchellianum*	1	1	1	1	
Hypericaceae	N	*Hypericum*	*mutilum*	1	0	1	1	
Hypericaceae	E	*Hypericum*	*perforatum*	1	0	1	1	
Hypericaceae	N	*Hypericum*	*prolificum*	0	0	0	0	
Hypericaceae	N	*Hypericum*	*punctatum*	1	0	1	0	
Hypericaceae	N	*Hypericum*	*stragalum*	0	0	0	0	
Juglandaceae	N	*Carya*	*alba*	0	0	1	1	(=C. tomentosa)
Juglandaceae	N	*Carya*	*cordiformis*	1	1	1	0	
Juglandaceae	N	*Carya*	*glabra*	1	1	0	1	
Juglandaceae	N	*Carya*	*ovalis*	1	0	1	0	
Juglandaceae	N	*Carya*	*ovata*	1	0	1	0	
Juglandaceae	N	*Carya*	*pallida*	0	0	0	0	
Juglandaceae	N	*Juglans*	*cinerea*	1	0	1	0	
Juglandaceae	N	*Juglans*	*nigra*	1	0	1	1	
Lamiaceae	N	*Agastache*	*scrophulariifolia*	1	0	1	0	
Lamiaceae	E	*Ajuga*	*reptans*	1	0	0	0	
Lamiaceae	N	*Blephilia*	*hirsuta*	1	0	0	0	
Lamiaceae	N	*Clinopodium*	*vulgare*	1	0	1	1	(=Satureja vulgaris)
Lamiaceae	N	*Collinsonia*	*canadensis*	1	1	1	1	
Lamiaceae	E	*Galeopsis*	*bifida*	1	0	0	0	(<G. tetrahit)

Lamiaceae	E	*Glechoma*	*hederacea*	1	0	1	1	
Lamiaceae	N	*Hedeoma*	*pulegioides*	1	0	1	0	
Lamiaceae	E	*Lamium*	*amplexicaule*	1	0	0	0	
Lamiaceae	E	*Lamium*	*maculatum*	1	0	0	0	
Lamiaceae	E	*Lamium*	*purpureum*	1	0	0	0	
Lamiaceae	N	*Lycopus*	*americanus*	1	0	0	0	
Lamiaceae	N	*Lycopus*	*uniflorus*	1	0	1	0	
Lamiaceae	N	*Lycopus*	*virginicus*	0	0	1	1	
Lamiaceae	N	*Meehania*	*cordata*	0	1	0	0	
Lamiaceae	E	*Mentha*	*xpiperita*	0	0	1	1	
Lamiaceae	E	*Mentha*	*×rotundifolia*	1	0	0	0	
Lamiaceae	E	*Mentha*	*spicata*	0	0	0	1	
Lamiaceae	N	*Monarda*	*clinopodia*	1	1	1	1	
Lamiaceae	N	*Monarda*	*didyma*	1	1	1	1	
Lamiaceae	N	*Monarda*	*fistulosa*	0	0	1	0	
Lamiaceae	E	*Nepeta*	*cataria*	1	0	1	1	
Lamiaceae	N	*Physostegia*	*virginiana*	0	0	1	0	
Lamiaceae	N	*Prunella*	*vulgaris*	1	1	1	1	
Lamiaceae	N	*Pycnanthemum*	*incanum*	0	0	0	1	
Lamiaceae	N	*Pycnanthemum*	*montanum*	0	0	0	0	
Lamiaceae	N	*Pycnanthemum*	*muticum*	1	0	1	0	
Lamiaceae	N	*Pycnanthemum*	*tenuifolium*	1	0	1	0	
Lamiaceae	N	*Pycnanthemum*	*virginianum*	0	0	1	0	
Lamiaceae	N	*Salvia*	*lyrata*	1	0	1	0	
Lamiaceae	N	*Scutellaria*	*elliptica*	0	0	0	0	
Lamiaceae	N	*Scutellaria*	*incana*	0	0	0	0	
Lamiaceae	N	*Scutellaria*	*lateriflora*	1	0	0	0	
Lamiaceae	N	*Scutellaria*	*ovata*	1	0	0	0	
Lamiaceae	E	*Stachys*	*byzantina*	1	0	0	0	
Lamiaceae	N	*Stachys*	*latidens*	1	1	1	1	
Lamiaceae	N	*Stachys*	*tenuifolia*	0	0	0	0	
Lamiaceae	N	*Trichostema*	*dichotomum*	0	0	0	0	
Lauraceae	N	*Lindera*	*benzoin*	1	0	1	1	
Lauraceae	N	*Sassafras*	*albidum*	1	1	1	1	
Lentibulariaceae	N	*Utricularia*	*cornuta*	0	0	1	0	
Linaceae	N	*Linum*	*striatum*	0	0	1	0	
Linaceae	N	*Linum*	*virginianum*	1	0	1	0	
Magnoliaceae	N	*Liriodendron*	*tulipifera*	1	1	1	1	
Magnoliaceae	N	*Magnolia*	*acuminata*	1	1	1	1	
Magnoliaceae	N	*Magnolia*	*fraseri*	1	1	1	1	
Magnoliaceae	N	*Magnolia*	*tripetala*	0	0	0	0	
Malvaceae	E	*Hibiscus*	*syriacus*	1	0	0	0	
Malvaceae	N	*Malva*	*moschata*	0	0	1	0	
Malvaceae	N	*Malva*	*neglecta*	0	0	1	0	
Malvaceae	N	*Tilia*	*americana*	1	1	1	1	(incl. T. heterophylla)
Melastomataceae	N	*Rhexia*	*virginica*	0	0	0	0	
Menispermaceae	N	*Menispermum*	*canadense*	1	0	0	0	
Moraceae	N	*Morus*	*rubra*	0	0	0	1	
Mollunginaceae	E	*Mollugo*	*verticillata*	0	0	0	0	
Myrsinaceae	N	*Lysimachia*	*ciliata*	1	0	1	0	

Myrsinaceae	N	*Lysimachia*	*lanceolata*	0	0	0	0	
Myrsinaceae	E	*Lysimachia*	*nummularia*	0	0	0	0	
Myrsinaceae	N	*Lysimachia*	*quadrifolia*	1	1	1	1	
Nyssaceae	N	*Nyssa*	*sylvatica*	1	1	1	1	
Oleaceae	N	*Chionanthus*	*virginicus*	0	0	0	0	
Oleaceae	E	*Forsythia*	*viridissima*	1	0	0	0	
Oleaceae	N	*Fraxinus*	*americana*	1	1	1	1	
Oleaceae	N	*Fraxinus*	*pennsylvanica*	1	0	0	0	
Oleaceae	E	*Ligustrum*	*sinense*	0	0	0	0	
Oleaceae	E	*Ligustrum*	*vulgare*	1	0	0	0	
Oleaceae	E	*Syringa*	*vulgaris*	1	0	0	1	
Onagraceae	N	*Circaea*	*alpina*	1	0	1	0	
Onagraceae	N	*Circaea*	*canadensis*	1	0	1	1	(=C. lutetiana ssp. canadensis)
Onagraceae	N	*Epilobium*	*coloratum*	1	0	1	0	
Onagraceae	N	*Gaura*	*biennis*	1	0	0	0	
Onagraceae	N	*Ludwigia*	*alternifolia*	0	0	1	0	
Onagraceae	N	*Ludwigia*	*palustris*	0	0	0	0	
Onagraceae	N	*Oenothera*	*biennis*	1	0	1	1	
Onagraceae	N	*Oenothera*	*fruticosa*	0	1	0	1	
Onagraceae	N	*Oenothera*	*tetragona*	1	1	1	0	
Orobanchaceae	N	*Agalinis*	*purpurea*	1	0	1	0	
Orobanchaceae	N	*Agalinis*	*tenuifolia*	0	0	0	0	
Orobanchaceae	N	*Aureolaria*	*flava*	0	0	1	1	
Orobanchaceae	N	*Aureolaria*	*laevigata*	1	1	1	1	
Orobanchaceae	N	*Castilleja*	*coccinea*	0	0	1	0	
Orobanchaceae	N	*Conopholis*	*americana*	1	1	1	1	
Orobanchaceae	N	*Epifagus*	*virginiana*	1	1	1	0	
Orobanchaceae	N	*Melampyrum*	*lineare*	1	0	1	0	
Orobanchaceae	N	*Orobanche*	*uniflora*	1	0	1	0	
Orobanchaceae	N	*Pedicularis*	*canadensis*	0	0	1	1	
Oxalidaceae	E	*Oxalis*	*corniculata*	1	0	0	0	
Oxalidaceae	N	*Oxalis*	*dillenii*	1	0	0	0	
Oxalidaceae	N	*Oxalis*	*grandis*	0	0	0	0	
Oxalidaceae	N	*Oxalis*	*montana*	0	0	0	0	(<O. acetosella)
Oxalidaceae	N	*Oxalis*	*stricta*	1	0	1	1	
Oxalidaceae	N	*Oxalis*	*violacea*	0	0	0	0	
Papaveraceae	N	*Sanguinaria*	*canadensis*	1	1	1	1	
Parnassiaceae	N	*Parnassia*	*asarifolia*	0	0	0	0	
Parnassiaceae	N	*Parnassia*	*grandifolia*	0	0	1	0	
Paulowniaceae	E	*Paulownia*	*tomentosa*	0	0	0	0	
Phrymaceae	N	*Mimulus*	*ringens*	1	0	1	0	
Phrymaceae	N	*Phryma*	*leptostachya*	1	0	1	0	
Phytolaccaceae	N	*Phytolacca*	*americana*	1	0	1	1	
Plantaginaceae	N	*Chelone*	*glabra*	0	0	1	1	
Plantaginaceae	N	*Chelone*	*lyonii*	0	1	0	0	
Plantaginaceae	N	*Chelone*	*obliqua*	0	0	1	0	
Plantaginaceae	N	*Gratiola*	*neglecta*	0	0	1	0	
Plantaginaceae	E	*Linaria*	*vulgaris*	0	0	1	0	
Plantaginaceae	N	*Penstemon*	*digitalis*	0	0	1	0	

Plantaginaceae	N	*Penstemon*	*smallii*	1	0	0	0	
Plantaginaceae	E	*Plantago*	*aristata*	0	0	1	0	
Plantaginaceae	E	*Plantago*	*lanceolata*	1	1	1	1	
Plantaginaceae	N	*Plantago*	*major*	1	1	0	0	
Plantaginaceae	N	*Plantago*	*rugelii*	1	0	1	1	
Plantaginaceae	N	*Plantago*	*virginica*	1	0	1	0	
Plantaginaceae	E	*Veronica*	*arvensis*	1	0	1	0	
Plantaginaceae	E	*Veronica*	*officinalis*	1	0	1	0	
Plantaginaceae	N	*Veronica*	*peregrina*	1	0	0	0	
Plantaginaceae	E	*Veronica*	*persica*	0	0	0	1	
Plantaginaceae	E	*Veronica*	*serpyllifolia*	1	1	1	0	
Platanaceae	N	*Platanus*	*occidentalis*	0	0	1	1	
Polemoniaceae	N	*Phlox*	*carolina*	0	0	1	0	
Polemoniaceae	N	*Phlox*	*latifolia*	0	0	0	1	(=P. ovata)
Polemoniaceae	N	*Phlox*	*maculata*	0	0	1	0	
Polemoniaceae	N	*Phlox*	*paniculata*	1	0	0	0	
Polemoniaceae	N	*Phlox*	*stolonifera*	0	1	1	0	
Polemoniaceae	N	*Phlox*	*subulata*	0	0	1	0	
Polemoniaceae	N	*Polemonium*	*reptans*	1	0	0	0	
Polygalaceae	N	*Polygala*	*ambigua*	0	0	1	0	
Polygalaceae	N	*Polygala*	*cruciata*	0	0	1	0	
Polygalaceae	N	*Polygala*	*curtissii*	1	0	1	0	
Polygalaceae	N	*Polygala*	*sanguinea*	0	0	1	0	
Polygalaceae	N	*Polygala*	*senega*	0	0	1	0	
Polygalaceae	N	*Polygala*	*verticillata*	1	0	1	0	
Polygonaceae	E	*Fallopia*	*convolvulus*	1	1	1	0	
Polygonaceae	N	*Fallopia*	*scandens*	1	0	1	0	
Polygonaceae	N	*Persicaria*	*hydropiper*	1	0	1	0	
Polygonaceae	E	*Persicaria*	*longiseta*	1	0	0	0	(=P. cespitosum var. longisetum)
Polygonaceae	E	*Persicaria*	*maculosa*	1	0	1	1	(=P. persicaria)
Polygonaceae	N	*Persicaria*	*pensylvanica*	1	0	1	0	
Polygonaceae	N	*Persicaria*	*punctata*	1	1	0	0	
Polygonaceae	N	*Persicaria*	*sagittata*	1	0	1	0	
Polygonaceae	N	*Persicaria*	*virginiana*	1	0	1	0	(=Tovara)
Polygonaceae	E	*Polygonum*	*aviculare*	1	0	1	0	
Polygonaceae	N	*Polygonum*	*cilinode*	0	0	0	1	
Polygonaceae	E	*Polygonum*	*cuspidatum*	0	0	0	1	
Polygonaceae	N	*Polygonum*	*erectum*	1	0	0	0	
Polygonaceae	N	*Polygonum*	*tenue*	0	0	1	0	
Polygonaceae	E	*Reynoutria*	*japonica*	0	0	0	0	
Polygonaceae	E	*Rumex*	*acetosella*	1	1	1	1	
Polygonaceae	E	*Rumex*	*crispus*	1	0	1	0	
Polygonaceae	E	*Rumex*	*obtusifolius*	1	1	1	1	
Polygonaceae	E	*Rumex*	*pulcher*	0	0	0	0	
Polygonaceae	N	*Tovara*	*virginiana*	0	0	0	1	
Portulacaceae	N	*Claytonia*	*caroliniana*	1	1	1	1	
Portulacaceae	N	*Claytonia*	*virginica*	0	0	0	1	
Portulacaceae	E	*Portulaca*	*oleracea*	0	0	1	0	
Ranunculaceae	N	*Aconitum*	*reclinatum*	1	1	1	0	

Ranunculaceae	N	*Aconitum*	*uncinatum*	1	0	1	1	
Ranunculaceae	N	*Actaea*	*pachypoda*	1	1	1	0	
Ranunculaceae	N	*Actaea*	*podocarpa*	1	0	1	0	(=Cimicifuga americana)
Ranunculaceae	N	*Actaea*	*racemosa*	1	1	1	1	(=Cimicifuga)
Ranunculaceae	N	*Anemone*	*acutiloba*	0	1	1	1	(=Hepatica)
Ranunculaceae	N	*Anemone*	*canadensis*	0	1	0	0	
Ranunculaceae	N	*Anemone*	*lancifolia*	0	0	0	0	
Ranunculaceae	N	*Anemone*	*quinquefolia*	1	1	1	1	
Ranunculaceae	N	*Anemone*	*virginiana*	1	1	1	1	
Ranunculaceae	N	*Anemonella*	*thalictroides*	0	0	0	0	
Ranunculaceae	N	*Aquilegia*	*canadensis*	1	1	1	1	
Ranunculaceae	E	*Aquilegia*	*caerulea*	1	0	0	0	
Ranunculaceae	E	*Aquilegia*	*vulgaris*	1	0	0	0	
Ranunculaceae	N	*Clematis*	*occidentalis*	1	0	1	0	
Ranunculaceae	N	*Clematis*	*viorna*	1	1	1	1	
Ranunculaceae	N	*Clematis*	*virginiana*	1	1	1	1	
Ranunculaceae	N	*Delphinium*	*exaltatum*	0	0	1	0	
Ranunculaceae	N	*Delphinium*	*tricorne*	0	1	1	1	
Ranunculaceae	N	*Ranunculus*	*abortivus*	0	0	0	1	
Ranunculaceae	E	*Ranunculus*	*acris*	0	0	0	1	
Ranunculaceae	N	*Ranunculus*	*allegheniensis*	1	0	1	0	
Ranunculaceae	E	*Ranunculus*	*bulbosus*	1	0	0	0	
Ranunculaceae	N	*Ranunculus*	*hispidus*	1	1	1	1	
Ranunculaceae	N	*Ranunculus*	*recurvatus*	1	1	1	1	
Ranunculaceae	E	*Ranunculus*	*repens*	1	0	0	0	
Ranunculaceae	E	*Ranunculus*	*sardous*	1	0	0	0	
Ranunculaceae	N	*Thalictrum*	*clavatum*	1	1	1	1	
Ranunculaceae	N	*Thalictrum*	*coriaceum*	1	0	1	0	
Ranunculaceae	N	*Thalictrum*	*dioicum*	1	1	1	1	
Ranunculaceae	N	*Thalictrum*	*pubescens*	0	0	1	0	(=T. polygamum)
Ranunculaceae	N	*Thalictrum*	*revolutum*	1	0	1	0	
Ranunculaceae	N	*Trautvetteria*	*caroliniensis*	1	0	1	1	
Ranunculaceae	N	*Xanthorhiza*	*simplicissima*	0	0	0	0	
Rhamnaceae	N	*Ceanothus*	*americanus*	0	0	1	0	
Rosaceae	N	*Agrimonia*	*gryposepala*	1	0	1	1	
Rosaceae	N	*Adrimonia*	*microcarpa*	0	0	0	0	
Rosaceae	N	*Agrimonia*	*parviflora*	0	0	1	0	
Rosaceae	N	*Agrimonia*	*pubescens*	0	0	1	0	
Rosaceae	N	*Agrimonia*	*rostellata*	1	1	0	0	
Rosaceae	N	*Amelanchier*	*arborea*	1	1	1	1	
Rosaceae	N	*Amelanchier*	*canadensis*	0	1	0	0	
Rosaceae	N	*Amelanchier*	*laevis*	1	0	1	1	
Rosaceae	N	*Aronia*	*arbutifolia*	0	0	0	1	(=S. arbutifolia var. arbutifolia)
Rosaceae	N	*Aronia*	*prunifolia*	0	1	1	0	(=S. arbutifolia var. atropurpurea)
Rosaceae	N	*Aronia*	*melanocarpa*	1	0	1	0	
Rosaceae	N	*Aruncus*	*dioicus*	1	0	1	1	
Rosaceae	N	*Crataegus*	*coccinea*	0	0	0	1	
Rosaceae	N	*Crataegus*	*iracunda*	1	0	0	0	

Rosaceae	N	*Crataegus*	*flabellata*	0	0	1	1	
Rosaceae	N	*Crataegus*	*macrosperma*	1	1	0	0	
Rosaceae	N	*Crataegus*	*pruinosa*	1	1	0	0	
Rosaceae	N	*Crataegus*	*punctata*	1	1	1	1	
Rosaceae	N	*Fragaria*	*virginiana*	1	0	1	1	
Rosaceae	N	*Geum*	*canadense*	1	1	1	0	
Rosaceae	N	*Geum*	*radiatum*	0	1	1	1	
Rosaceae	N	*Geum*	*virginianum*	1	0	1	0	
Rosaceae	N	*Gillenia*	*trifoliata*	1	1	1	1	
Rosaceae	E	*Kerria*	*japonica*	0	0	0	0	
Rosaceae	N	*Malus*	*angustifolia*	0	0	0	0	
Rosaceae	N	*Malus*	*coronaria*	1	0	1	1	
Rosaceae	E	*Malus*	*prunifolia*	0	0	0	1	
Rosaceae	E	*Malus*	*pumila*	1	0	1	1	
Rosaceae	N	*Physocarpus*	*opulifolius*	1	1	1	1	
Rosaceae	N	*Potentilla*	*canadensis*	1	1	1	1	(=var. villosissima)
Rosaceae	E	*Potentilla*	*indica*	1	0	0	0	
Rosaceae	N	*Potentilla*	*norvegica*	1	0	1	1	
Rosaceae	E	*Potentilla*	*recta*	1	0	1	1	
Rosaceae	N	*Potentilla*	*simplex*	1	0	1	0	
Rosaceae	N	*Prunus*	*angustifolia*	0	0	0	0	
Rosaceae	E	*Prunus*	*avium*	0	0	1	1	
Rosaceae	E	*Prunus*	*cerasus*	0	0	0	0	
Rosaceae	N	*Prunus*	*pensylvanica*	1	1	1	1	
Rosaceae	E	*Prunus*	*persica*	0	0	1	0	
Rosaceae	N	*Prunus*	*serotina*	1	0	1	1	
Rosaceae	N	*Prunus*	*virginiana*	1	0	1	0	
Rosaceae	E	*Rosa*	*alba*	0	0	1	0	
Rosaceae	N	*Rosa*	*carolina*	1	1	1	1	
Rosaceae	E	*Rosa*	*hybrid*	0	0	0	1	(=Phoenix) (R. cathayensis c R. Borboniana)
Rosaceae	E	*Rosa*	*damascena*	0	0	1	0	
Rosaceae	E	*Rosa*	*eganteria*	0	0	1	0	
Rosaceae	E	*Rosa*	*gallica*	0	0	1	1	
Rosaceae	E	*Rosa*	*micrantha*	0	0	1	0	
Rosaceae	E	*Rosa*	*multiflora*	1	1	0	0	
Rosaceae	N	*Rosa*	*palustris*	0	0	1	1	
Rosaceae	N	*Rubus*	*allegheniensis*	1	0	1	1	
Rosaceae	N	*Rubus*	*argutus*	1	1	1	0	
Rosaceae	N	*Rubus*	*canadensis*	1	1	1	1	
Rosaceae	N	*Rubus*	*flagellaris*	1	0	1	1	
Rosaceae	N	*Rubus*	*hispidus*	0	0	0	0	
Rosaceae	N	*Rubus*	*occidentalis*	1	0	1	1	
Rosaceae	N	*Rubus*	*odoratus*	1	1	1	1	
Rosaceae	N	*Rubus*	*trivalis*	0	1	0	0	
Rosaceae	N	*Sanguisorba*	*canadensis*	1	0	1	0	
Rosaceae	N	*Sibbaldiopsis*	*tridentata*	1	1	1	0	
Rosaceae	N	*Sorbus*	*americana*	1	1	1	1	
Rosaceae	N	*Spiraea*	*alba*	0	0	1	0	
Rosaceae	E	*Spiraea*	*xbilliardii*	0	0	1	0	

Rosaceae	E	*Spiraea*	*henryi*	0	0	0	0	
Rosaceae	E	*Spiraea*	*japonica*	1	0	1	0	
Rosaceae	N	*Spiraea*	*latifolia*	0	0	1	0	(=S. alba var. lat.)
Rosaceae	N	*Spiraea*	*tomentosa*	0	0	0	0	
Rosaceae	N	*Spiraea*	*virginiana*	0	0	0	1	(=Phoenix) No Specimen in BOON
Rosaceae	E	*Spiraea*	*xvanhouttei*	0	0	1	0	
Rubiaceae	E	*Cruciata*	*pedemontana*	1	0	0	0	
Rubiaceae	N	*Diodia*	*teres*	1	0	1	1	
Rubiaceae	N	*Galium*	*aparine*	1	0	1	1	
Rubiaceae	N	*Galium*	*circaezans*	1	0	0	1	
Rubiaceae	N	*Galium*	*latifolium*	1	1	1	1	
Rubiaceae	E	*Galium*	*mollugo*	0	0	1	0	
Rubiaceae	N	*Galium*	*pilosum*	0	0	1	1	
Rubiaceae	N	*Galium*	*tinctorium*	0	0	0	0	
Rubiaceae	N	*Galium*	*triflorum*	1	1	1	1	
Rubiaceae	N	*Houstonia*	*caerulea*	0	1	1	1	
Rubiaceae	N	*Houstonia*	*montana*	0	1	1	0	
Rubiaceae	N	*Houstonia*	*purpurea*	1	1	1	1	
Rubiaceae	N	*Houstonia*	*pusilla*	0	1	0	0	
Rubiaceae	N	*Houstonia*	*serpyllifolia*	0	0	0	0	
Rubiaceae	N	*Houstonia*	*tenuifolia*	0	0	0	0	
Rubiaceae	N	*Mitchella*	*repens*	1	1	1	1	
Rutaceae	N	*Ptelea*	*trifoliata*	1	0	0	0	
Salicaceae	N	*Populus*	*balsamifera*	0	0	0	1	(=Phoenix) I.D. Suspect; no specimen in BOON
Salicaceae	E	*Populus*	*xjackii*	0	0	1	0	
Salicaceae	N	*Populus*	*grandidentata*	1	0	0	0	
Salicaceae	N	*Populus*	*nigra*	0	0	0	0	
Salicaceae	N	*Salix*	*humilis*	0	1	0	1	
Salicaceae	N	*Salix*	*nigra*	0	0	0	0	
Salicaceae	N	*Salix*	*occidentalis*	1	0	1	0	
Salicaceae	N	*Salix*	*sericea*	1	0	1	1	
Santalaceae	N	*Pyrularia*	*pubera*	0	0	1	1	
Sapindaceae	N	*Acer*	*negundo*	1	0	0	0	
Sapindaceae	N	*Acer*	*pensylvanicum*	1	1	1	1	
Sapindaceae	N	*Acer*	*rubrum*	1	1	1	1	
Sapindaceae	N	*Acer*	*saccharum*	1	1	1	1	
Sapindaceae	N	*Acer*	*spicatum*	1	1	1	0	
Sapindaceae	N	*Aesculus*	*flava*	1	1	1	1	(=A. octandra)
Saxifragaceae	N	*Astilbe*	*biternata*	0	0	0	0	
Saxifragaceae	N	*Boykinia*	*aconitifolia*	0	0	0	0	
Saxifragaceae	N	*Chrysosplenium*	*americanum*	0	0	1	0	
Saxifragaceae	N	*Heuchera*	*americana*	0	0	0	0	
Saxifragaceae	N	*Heuchera*	*villosa*	1	1	1	1	
Saxifragaceae	N	*Mitella*	*diphylla*	0	1	1	1	
Saxifragaceae	N	*Parnassia*	*grandifolia*	0	0	0	1	
Saxifragaceae	N	*Saxifraga*	*caroliniana*	1	1	1	0	(=Micranthes)
Saxifragaceae	N	*Saxifraga*	*michauxii*	1	1	1	1	(=Micranthes petiolaris)
Saxifragaceae	N	*Saxifraga*	*micranthidifolia*	1	1	1	0	(=Micranthes)

Saxifragaceae	N	*Tiarella*	*cordifolia*	0	1	1	1	
Scrophulariaceae	N	*Scrophularia*	*marilandica*	1	1	1	0	
Scrophulariaceae	E	*Verbascum*	*blattaria*	0	0	1	0	
Scrophulariaceae	E	*Verbascum*	*thapsus*	1	0	1	1	
Simaroubaceae	E	*Ailanthus*	*altissima*	0	0	0	0	
Solonaceae	E	*Datura*	*stramonium*	1	0	0	0	
Solonaceae	N	*Physalis*	*heterophylla*	1	0	0	0	
Solonaceae	N	*Physalis*	*longifolia*	1	0	0	0	
Solonaceae	N	*Physalis*	*virginiana*	1	0	0	0	
Solonaceae	N	*Solanum*	*carolinense*	1	0	1	1	
Solonaceae	N	*Solanum*	*ptychanthum*	1	0	0	0	(<S. americanum)
Styraceae	N	*Halesia*	*tetraptera*	0	0	0	1	(=H. carolina)
Symploaceae	N	*Symplocos*	*tinctoria*	0	0	0	0	
Ulmaceae	N	*Ulmus*	*rubra*	0	0	0	0	
Urticaceae	N	*Boehmeria*	*cylindrica*	0	0	0	0	
Urticaceae	N	*Laportea*	*canadensis*	1	1	1	1	
Urticaceae	N	*Pilea*	*pumila*	1	0	1	1	
Verbenaceae	N	*Verbena*	*hastata*	0	0	1	0	
Verbenaceae	N	*Verbena*	*urticifolia*	1	0	1	1	
Violaceae	N	*Hybanthus*	*concolor*	1	0	0	0	
Violaceae	N	*Viola*	*bicolor*	0	0	0	0	
Violaceae	N	*Viola*	*blanda*	1	1	1	1	
Violaceae	N	*Viola*	*canadensis*	1	1	1	1	(var. canadensis), (=Phoenix var. rugulosa)
Violaceae	N	*Viola*	*cucullata*	0	1	0	0	
Violaceae	N	*Viola*	*fimbriatula*	1	0	1	0	
Violaceae	N	*Viola*	*hastata*	0	0	1	0	
Violaceae	N	*Viola*	*hirsutula*	1	0	1	0	
Violaceae	N	*Viola*	*macloskeyi*	1	0	0	0	(incl. var pallens)
Violaceae	N	*Viola*	*palmata*	1	0	0	1	(=var. sororia)
Violaceae	N	*Viola*	*pedata*	1	0	1	1	
Violaceae	N	*Viola*	*primulifolia*	0	0	0	0	
Violaceae	N	*Viola*	*pubescens*	1	1	1	1	(=V. eriocarpa var. leiocarpa)
Violaceae	N	*Viola*	*rotundifolia*	1	0	1	1	
Violaceae	N	*Viola*	*sagittata*	1	0	1	1	(>=V. emarginata)
Violaceae	N	*Viola*	*sororia*	1	0	1	1	(>V. papilionacea)
Violaceae	E	*Viola*	*tricolor*	1	0	0	0	
Viscaceae	N	*Phoradendron*	*serotinum*	0	0	0	0	
Vitaceae	N	*Parthenocissus*	*quinquefolia*	1	0	1	0	
Vitaceae	N	*Vitis*	*aestivalis*	1	1	1	0	
Vitaceae	N	*Vitis*	*cinerea*	0	0	0	0	(<V. baileyana)
Vitaceae	N	*Vitis*	*labrusca*	0	0	1	1	
Vitaceae	N	*Vitis*	*vulpina*	0	0	1	0	

VITA

Andrew P. Jenkins was born in Fairfax, Virginia on December 8th, 1982 to Douglas S. and Anita P. Jenkins. He graduated from Herndon High School in June 2001 and enrolled in Northern Virginia Community College August 2001, where he received an A.S. in Science in 2006. In August 2006 he transferred to George Mason University in Farifax, Virginia, where he received his B.S. in Biology May 2008. He then began his graduate education at Appalachian State University August 2008. He completed his Master's thesis in December 2011. Andrew currently resides in Boone, NC where he is employed as a lecturer in the department of Biology at Appalachian State University.