Vascular Flora of Three Ridges Mountain

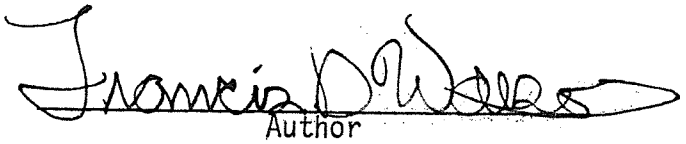
Nelson County, Virginia

APPROVAL SHEET

This thesis is submitted in partial fulfillment

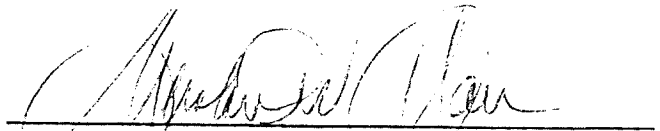
of the requirements for the degree of

Master of Arts

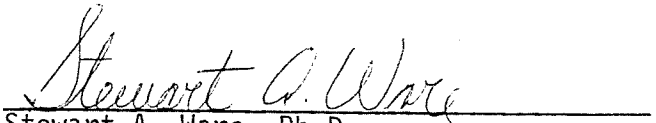


Author

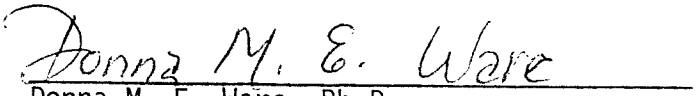
Approved, December 1981



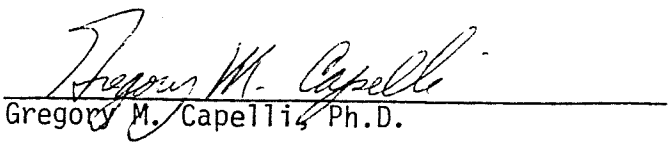
Gustav W. Hall, Ph.D.



Stewart A. Ware, Ph.D.



Donna M. E. Ware, Ph.D.



Gregory M. Capelli, Ph.D.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS

I would like to express thanks to Dr. G. W. Hall, committee chairman, for advice and assistance in all phases of this project. Dr. S. Ware provided valuable field time as well as help with the ecological aspects of this thesis. Dr. D. M. E. Ware receives thanks for her help in the herbarium as well as the field. Dr. G. Capelli, and those mentioned above all contributed their time in reading the manuscript and offering valuable criticisms.

Celeste Corcoran, George Diggs. Jim Greaves, and Gerald Roe receive special thanks for constant assistance and providing the required working environment.

I would also like to extend my appreciation to Dr. Gwynn Ramsey of Lynchburg College for his help in selecting a site suitable for this project.

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

Three Ridges Mountain is located in the southwest portion of Nelson County, Virginia, on the eastern escarpment of the Blue Ridge Mountains. The mountain as a natural unit encompasses approximately twenty square miles of land ranging from 850 to 3970 feet in elevation. Collecting trips were made at approximately weekly intervals from March through mid October 1976. Less extensive collecting was done in late October 1976 and the early spring of 1977. A total of 571 species representing 342 genera of 97 families of vascular plants was collected, dried and identified. Two hundred seventy three species constitute new county records, and one species has not previously been reported as occurring in the state of Virginia. A complete set of voucher specimens has been deposited in the Herbarium of the College of William and Mary.

Background information is provided on the area's location, geology, climate, soils and vegetation. A brief quantitative survey (using the Bitterlich Method) was made in seven stands representing seven different community types present (northern red oak, white oak, northern hardwoods, chestnut oak, moist cove, dry cove and successional forests). Brief qualitative descriptions are included for the more restricted and/or unusual habitats.

VASCULAR FLORA OF THREE RIDGES MOUNTAIN

INTRODUCTION

This project was undertaken to produce an annotated catalogue of the vascular flora of Three Ridges Mountain, Nelson County, Virginia. The distributional records established are intended as contributions toward the proposed manual of the vascular flora of Virginia, to be published by the Flora Committee of the Virginia Academy of Science.

Nelson County was chosen as a study site on the basis of meager published collection records for the flora of the counties along the Blue Ridge. A number of taxa have been reported from Nelson County in Freer's (1950, 1960, 1968) earlier studies of the Central Virginia Blue Ridge. Three Ridges Mountain was chosen as a relatively undisturbed area within Nelson County, and one which offered a potentially wide range of physiographic and ecological diversity and reasonable access. The mountain has not been mentioned in the botanical literature, although some collecting has been carried out there by some Virginia botanists, primarily Charles E. Stevens and Thomas F. Wieboldt.

As an interesting ornithological note and of possible significance in the past ecology of the area, the slopes of Three Ridges and the neighboring mountain to the south, the Priest, are apparently the only well-documented breeding areas of the now extinct Passenger Pigeon (Ectopistes migratorius) in the state of Virginia (Simpson 1976).

DESCRIPTION OF THE STUDY AREA

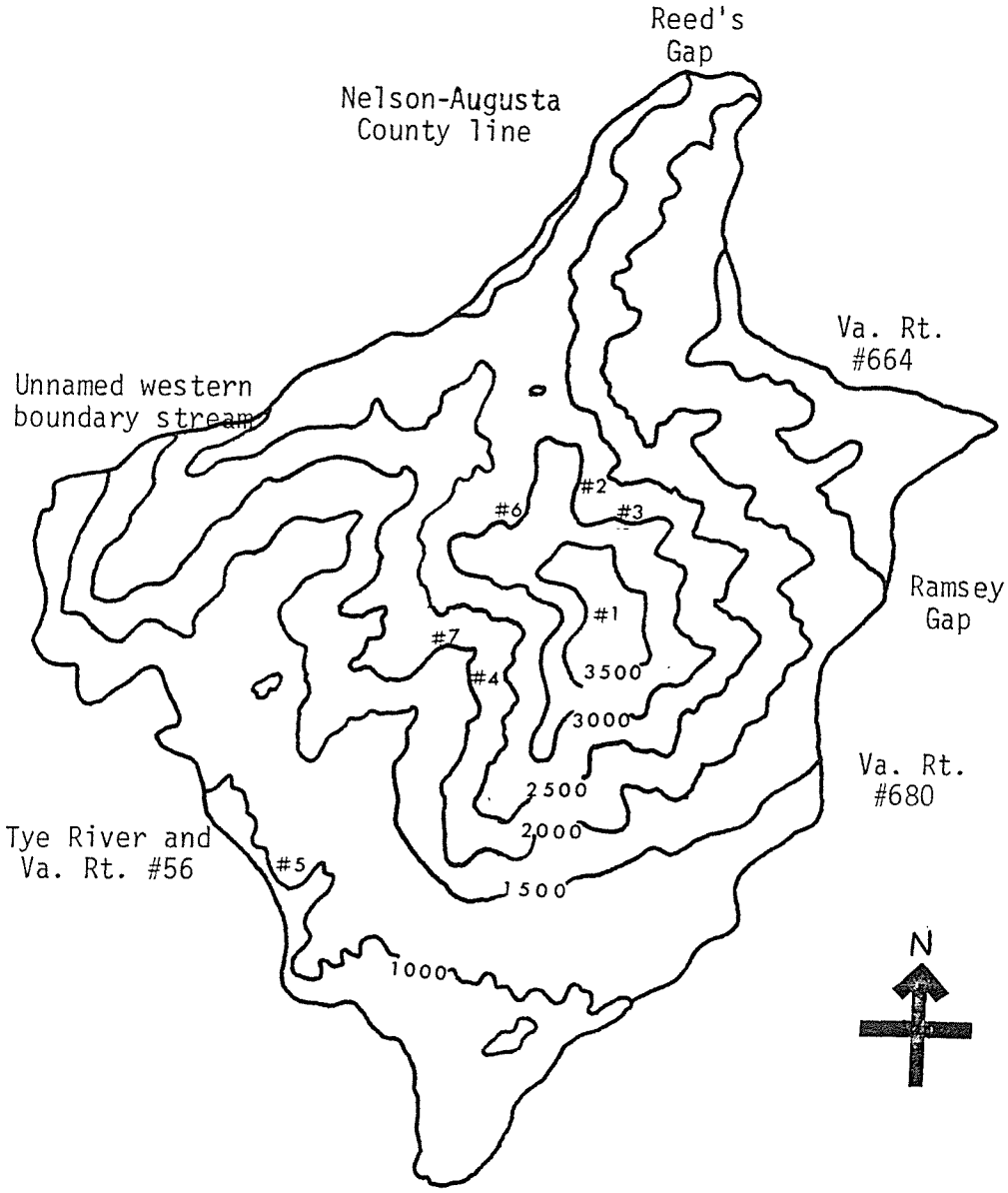
Nelson County is located in central Virginia with the crest of the Blue Ridge Mountains forming its western border. It contains a land area of 468 square miles which lies primarily in the Piedmont Physiographic Province (U.S.D.A.-S.C.S. 1970). The study area is not in the Piedmont, however, but comprises approximately 20 square miles of land located on the Eastern escarpment of the Central Blue Ridge Mountains of Virginia. Three Ridges Mountain as a unit of study was delineated by Virginia Routes 664 and 680 on the north and east respectively, with the Tye River and the North Fork of the Tye forming the southern border. An unnamed tributary, which enters the North Fork of the Tye at approximately 1250 feet, the Blue Ridge Parkway, and the Nelson-Augusta county line border the area on the west and northwest. So delineated, the area is a fairly natural geographical and physiographic unit.

The area has the steep and rocky aspect associated with much of the Blue Ridge. The altitudinal gradient ranges from approximately 850 feet along the Tye River at the area's southeastern edge to an elevation of 3970 feet at the summit. A wide range of degrees of slope and exposure are present (Fig. 1).

The bulk of the area lies within the Pedlar Ranger District of the George Washington National Forest, with an additional 640 acres contained within the Lesesne State Forest (bordering on Virginia Route 680), and the remainder in private holdings.

FIGURE 1

Three Ridges Mountain, general contour map, and location of vegetational sampling sites, (#1-7) (elevations are in feet)



GEOLOGY

The Blue Ridge Province is comprised of a belt of mountains lying between the Piedmont Province to the east and the Ridge and Valley Province to the west. The mountains represent the remnants of a former highland, uplifted with an eastern slope, which antedates the peneplains lying on either side. Most of the rocks of the Blue Ridge Province are "old, strong, and of highly complex structure" (Fenneman 1938).

Fenneman (1938) treats the Blue Ridge in two divisions, a northern and a southern section, separated by the Roanoke River. The linear form of the northern section gives it its distinctive character. From the Roanoke River north to the Susquehanna River the width of the range nowhere exceeds 12 to 14 miles, and often decreases to only half that distance. South of the Roanoke much broader expanses and higher peaks are characteristic.

Three Ridges Mountain lies in an area of highly irregular skyline of the central portion of the Blue Ridge in Virginia. This area runs approximately 25 miles north from Elk Pond Mountain (Lexington quadrangle) to Turk Mountain (Harrisonburg quadrangle) (Fenneman 1938).

Three Ridges Mountain is located in a complex area where none of the major geologic formations of the Piedmont, Blue Ridge, or the Ridge and Valley Province are structurally isolated. The Pedlar and Marshall formations, both of Precambrian age, and presumably formed through granitization of metasedimentary rocks, constitute the basement complex in the study area (Bloomer and Werner 1955).

The Pedlar formation, which forms the primary area of the basement complex of the Blue Ridge (north of Roanoke) is composed of an "assemblage of granitic, granodioritic, syenitic, quartz dioritic, anorthositic and unakitic rocks undifferentiable in the field as well as in certain fabric relations" (Bloomer and Werner 1955). These resistant rocks of the Pedlar formation comprise the bulk of the mountain which is surrounded by rocks of the less resistant Marshall formation, a primary constituent of the basement complex in the Piedmont. The rocks of the Marshall formation are a "gray or green, uniformly medium-grained gneiss consisting of quartz, potash feldspar, oligoclaseandesine (An 30), and biotite" (Bloomer and Werner 1955). Many of the mountains and smaller knobs east of the bulk of the Blue Ridge in this area have a similar structure.

Smaller outcroppings of rocks of the Swift Run formation and Catoctin greenstone, both of late Precambrian age, are also present. These are found overlying either formation of the basement complex. Where the Swift Run overlies the Pedlar formation "the lower part of the formation is a conglomeratic graywacke with clasts from about 0.50 inch to 5.0 feet in diameter composed of quartz, potash feldspar, lithic fragments, and a pastelike aggregate of chlorite and sericite" (Bloomer and Werner 1955). Catoctin greenstone (metavolcanic rocks of basaltic or andesitic composition) forms two belts south of a split in Maryland with one belt running along the mountains to the Tye River Gap, and the other in the Piedmont, separated by about 20 miles (Bloomer and Werner 1955). Three Ridges is located primarily between these belts. The Catoctin consists of "an undeterminable thickness of greenstone with several mappable members composed of graywackes, arkoses, and tuffs" (Bloomer and Werner 1955).

Within the study area outcrops consisting of Catoctin greenstone comformably overlie the Swift Run formation separated from it by an alternating succession of greenstone and metasedimentary or sedimentary beds (Bloomer and Werner 1955). Although not common in the area, these outcrops occur on both the Pedlar and Marshall formations of the basement complex. A prominent example of greenstone outcrops occurs at the Greenstone Overlook on the Blue Ridge Parkway just northeast of the study area proper.

SOILS

The soils of Nelson County belong to the Red-Yellow and Gray-Brown podzolic zonal soil groups, with some shallow azonal soils of the lithosols type also present (Braun 1950). These soils are distinctly acidic due to rainwater, acidified by the forest's litter, percolating through the soil and dissolving out free and adsorbed basic ions which are then lost through stream drainage (Daubenmire 1974). The county's soils as a whole have not been extensively described, excepting limited surveys on agricultural land in the Piedmont portion. A published map of the county's major soil associations was presented as tentative and subject to change pending more detailed surveys (U.S.D.A.-S.C.S. 1971).

The soils of the study area are mapped as members of two soil associations. The majority of the area's soils are members of the Porters-Tusquitee-Stony Land Association. Soils of this association dominate areas having "stony soils with brown to dark brown loam to silt loam surface soils and brown to reddish brown friable clay loam subsoils" (U.S.D.A.-S.C.S. 1970). A small portion of the study area contains soils of the Hayesville-Porters-Duke-Tusquitee Association which dominates areas of soil with "brown or dark reddish brown loam surface soils and brown to dark red clay to clay loam subsoils" (U.S.D.A.-S.C.S. 1970).

Considering the lack of a detailed soil map of Nelson County utilizing the current nomenclature (7th Approximation 1960 and 1967 Supplement), this summary is badly outdated. As there are no simple

rules for conversion between the older and newer systems of nomenclature this will not be attempted. However, based on the newer system of classification, the soils of the study area most likely represent three of the six soil orders occurring in the Southeast: Entisols, Inceptisols and Ultisols (U.S.D.A.-S.C.S. 1975).

CLIMATE

The climate of Nelson County is warm temperate, mesothermal with mountain influences in the western portion. Temperatures are relatively moderate and rainfall is distributed relatively uniformly throughout the year. Considering the county as a whole, the temperature averages 35°F in January and 76°F in July with precipitation totaling about 41 inches annually (Chamber of Commerce, Nelson County). Locally, the mountain topography would be expected to modify these climatic values. No climatic or microclimatic measurements were taken during this study.

The closest recording station to the area was Tye River 1 S.E., located approximately 10 miles southwest of Three Ridges Mountain in the Piedmont at an elevation of 710 feet (U.S.D.C. Weather Bureau 1961-1975). The data from this station, while probably quite similar to the lower elevations of the study area, presumably show higher average temperatures, a longer frost-free season and lower average precipitation than the study area as a whole. Big Meadows, approximately 60 miles north of the study area along the Blue Ridge Mountains at an elevation of 3535 feet is the closest station having an altitude similar to that reached in the study area (U.S.D.C. Weather Bureau 1961-1975). Data from this station should more closely approximate the general climatic conditions existing at the higher elevations, showing lower average temperatures, a smaller number of frost-free days per year, as well as higher and more erratic precipitation than Tye River 1 S.E.

Climatic data are given in Tables 1 and 2. Average monthly temperatures are given for the average of the five warmest years at Tye River 1 S.E. and the five coolest at Big Meadows between 1961 and 1975. Average monthly precipitation data are from the average of the five lowest years of rainfall at Tye River 1 S.E. and the five years of highest rainfall at Big Meadows between 1961 and 1975. Temperature extremes and freeze data are given in Table 2. Climatic data from Three Ridges Mountain would be expected to fall somewhere in the range of values between the two sets of data presented, depending on the elevation, exposure and microclimatic variables. The data are in good agreement with Hunt (1967) for the 10 wettest years (average = 59.10 inches/year), and the 10 driest years (average = 32.00 inches/year) over a 40 year period in the Appalachian Mountains.

Departures from the general data occur within the area in response to the area's physiography, creating both more moderate and more extreme microclimatic regimes. The location of several abandoned apple orchards above 2500 feet in the study area attests to microclimatic differences being likely correlated with the phenomenon of cold air drainage patterns in the area (Oosting 1948).

TABLE 1

Temperature data by months for the 5 highest years at Tye River 1 S.E., and the 5 lowest years at Big Meadows. Precipitation data is for the 5 highest years at Big Meadows, and the 5 lowest at Tye River 1 S.E.[a]

TEMPERATURE (° F)	Jan.	Feb.	Mar.	April	May.	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average
TYE RIVER 1 S.E.	37.3	37.6	44.6	55.1	66.7	71.3	75.3	74.6	68.8	57.1	49.2	39.4	56.4
BIG MEADOWS	25.8	25.3	37.4	37.4	52.5	63.4	65.5	64.5	57.5	50.5	38.4	28.7	46.4
PRECIPITATION (inches)													
TYE RIVER 1 S.E.	2.5	3.0	3.8	2.6	2.8	1.6	4.4	2.3	1.2	3.2	3.5	1.8	33.2
BIG MEADOWS	3.5	3.8	5.3	3.1	7.1	3.7	4.9	5.8	7.2	7.5	2.3	3.7	55.3

[a]Adapted from U.S. Dept. of Commerce, Weather Bureau. Climatological Data (Annual Summaries 1961-1975 for Virginia). Vol. 62-81.

TABLE 2

Temperature extremes and freeze data from Tye River 1 S.E. and Big Meadows[a]

TEMPERATURE EXTREMES (^{o}F)	VALUES
TYE RIVER 1 S.E.	
Extreme High (1970)	102.0
Average Annual High (1961-1975)	97.4
Average Annual Low (1961-1975)	5.9
Extreme Low (1963)	-1.0
BIG MEADOWS	
Extreme High (1974)	90.0
Average Annual High (1961-1975)	85.0
Average Annual Low (1961-1975)	-5.0
Extreme Low (1963 & 1970)	-11.0
FREEZE DATA	
TYE RIVER 1 S.E.	
Maximum Number of Frost Free Days (1973)	204
Average Number of Frost Free Days (1961-1975)	178
Minimum Number of Frost Free Days (1968)	151
BIG MEADOWS	
Maximum Number of Frost Free Days (1964)	161
Average Number of Frost Free Days (1961-1975)	143
Minimum Number of Frost Free Days (1963)	123

[a]Adapted from U.S. Dept. of Commerce, Weather Bureau. Climatological Data (Annual Summaries 1961-1975 for Virginia). Vol. 62-81.

DESCRIPTION OF THE VEGETATION

The forests of the study area are located in the Oak-Chestnut Forest Region of the Deciduous Forest Formation as described by Braun (1950). The wide ranging genera Quercus, Acer, Fagus, and Tilia, and the somewhat more restricted Carya, Fraxinus, Ulmus, Betula, Liriodendron and Castanea characterize this formation in a broad sense (Braun 1950). The Oak-Chestnut forest, recognized by Braun (1950) as a climax association derived from the mixed Tertiary forest, contains Castanea dentata, Quercus prinus, Q. rubra, and Liriodendron tulipifera as common dominants. This forest region is diversified by inclusions of oak-hickory, oak-pine, and mixed oak forests, as well as the more mesophytic cove communities (Braun 1950).

Chestnut blight (Endothia parasitica), which was well established in the central Blue Ridge by 1920 (Keever 1953), has slowly eliminated the American Chestnut (Castanea dentata) as a major community dominant. The forests of this region have not yet stabilized following the loss of this species. Keever (1953, 1973) reported a possible oak-hickory climax in the southern Blue Ridge, and a chestnut oak (Quercus prinus) forest in southeastern Pennsylvania as results of chestnut replacement. Nelson (1955) noted an increase in the basal area of Liriodendron tulipifera in a western North Carolina watershed, while Woods and Shanks (1959) as well as Stevenson (1974) reported the development of an "oak association-complex" with chestnut replacement in the Great Smokey Mountains and in western Virginia respectively. Glenn Johnson and

S. Ware (personal communication) believe that in the central Virginia Blue Ridge Carya ovalis is increasing in importance in chestnut oak forests as well as in those of northern red oak. The oak-hickory forests of the Piedmont lie fairly close to the mountains at this point, whereas the old oak-chestnut forests occupy wider areas of the Piedmont further north, and this could relate to the importance of Carya ovalis in the Peaks of Otter area of the Virginia Blue Ridge. Many more vegetational studies are needed to clarify the distribution of various forest types following chestnut replacement throughout its former range.

The Lesesne State Forest, located within the study area,is dedicated to the restoration of the American Chestnut to the forests of the Blue Ridge where it was once so important. Large populations of saplings from gamma-irradiated seeds as well as various American X Asiatic Chestnut species hybrids are maintained and studied in the area.

VEGETATIONAL METHODS

Brief qualitative and quantitative surveys were made of seven stands occupying various elevations and exposures within the study area: two occupying ridges, three on slopes and two in coves or draws. Quantitative data were obtained using a Spiegel Relaskop (angle gauge). Dominance was measured (square meters per hectare, cross sectional area breast height) by the Bitterlich method (Beers and Miller 1964). The relative dominance for each species in a stand was computed by division of each species' measured dominance by the total dominance of the stand. The density of each species (trees per hectare) was based on a stem count including all individuals in a circular plot (10 meter radius) having a four inch or greater diameter at breast height. Relative density values were computed from measured values as was done for relative dominance. Importance values (I.V.) were obtained by averaging relative dominance and relative density values. These methods were chosen because they obtain valuable plant ecological information in a rapid survey (Levy and Walker 1971). Qualitative descriptions of some of the more characteristic local community types follow the stand descriptions.

All taxonomic nomenclature in the following account follows Radford, Ahles, and Bell (1968).

VEGETATIONAL PATTERNS

The forests of the area are primarily second or third growth deciduous wooded uplands. Quantitative data were obtained for seven stands.

Stand 1 (Table 3), located on the mountain's crest along the Appalachian Trail at approximately 3950 feet (Fig. 1) was dominated by Quercus rubra (I.V. = 99.5). The general appearance was mesophytic; and stunted trees, many with double boles probably indicate ice damage from severe winter storms. Small numbers of Prunus serotina and Q. prinus were also present. A few individuals of Cornus alternifolia and Sorbus americana comprised the understory. Ribes rotundifolia and Dennstaedtia punctilobula were common throughout, with lesser numbers of Aster acuminatus and Solidago roanensis. Amianthium muscaetoxicum and Lilium superbum were locally abundant.

Stand 2 (Table 4) located on a wide ridge top at an elevation of 3000 feet (Fig. 1) was noticeably more rocky and xeric than Stand 1. This stand was dominated by Quercus alba (I.V. = 48.6) and Q. rubra (I.V. = 45.4) with some individuals of Q. prinus and Q. velutina also present. Small numbers of Acer saccharum occurred on the east slope. The shrub and herbaceous strata of this stand were noticeably depauperate in terms of both coverage and species diversity. A large number of chestnut (Castanea dentata) sprouts, an indication of that species' former importance in this stand were also noted. Aureolaria laevigata was fairly abundant; individuals of Solidago bicolor, S. roanensis,

TABLE 3

VEGETATIONAL DATA - STAND 1

Mesic Ridgetop at 3950 feet

Tree Species	Relative Dominance	Relative Density	Relative Importance Value
Quercus rubra	100.0%	99.0%	99.5%
Prunus serotina	0.0	1.0	0.5

Total Dominance = 27.33 meters square/hectare (cross-sectional area breast height)

Total Density = 1050.39 trees/hectare

TABLE 4

VEGETATIONAL DATA - STAND 2

Xeric Ridgetop at 3000 feet

Tree Species	Relative Dominance	Relative Density	Relative Importance Value
Quercus alba	47.8%	49.3%	48.6%
Quercus rubra	45.7	45.2	45.4
Quercus prinus	6.5	5.5	6.0

Total Dominance = 23.00 meters square/hectare (cross-sectional area breast height)

Total Density = 580.90 trees/hectare

Aster acuminatus, and A. undulatus were also present, as well as scattered plants of Carex spp.

Stand 3 (table 5) on a steep rocky, north to northeast facing slope at an altitude of 3000 feet (Fig. 1) was dominated by Betula lutea (I.V. = 38.31) and Quercus rubra (I.V. = 28.25). Tilia heterophylla (I.V. = 13.82) and Acer pensylvanicum (I.V. = 10.38) were the most common associate species, with smaller numbers of Carya cordiformis, Robinia psuedo-acacia, and A. saccharum present. Acer pensylvanicum, A. spicatum, Hamamelis virginiana, Viburnum acerifolium, Ilex montana, and scattered individuals of Kalmia latifolia formed the understory-shrub layer. The herbaceous layer was lacking excepting extensive moss colonization of loose boulders, and occasional colonies of Polypodium virginianum.

Stand 4 (Table 6) on a dry, rocky, west-facing slope, located above Harper's Creek at an elevation of 2000 feet (Fig. 1), was dominated by Quercus prinus (I.V. = 80.24). Q. rubra (I.V. = 9.12), anc Carya glabra (I.V. = 6.8), were the most common associate species in this stand. Of lesser importance were Acer rubrum, Hamamelis virginiana, Liriodendron tulipifera and Cornus florida. Scattered colonies of Kalmia latifolia and Vaccinium vacillans dominated the limited shrub stratum, and individuals of Aureolaria laevigata, Geranium maculatum, Aster spp. , and Solidago spp. were noted in the herbaceous stratum.

Stand 5 (Table 7) was located on a mesic slope above the Tye River at an elevation of 1000 feet (Fig. 1). Liriodendron tulipifera (I.V. = 58.8) was the dominant species. Nyssa sylvatica, Carya glabra, Quercus rubra, Juglans nigra, Fraxinus americana, Acer rubrum, and Cercis canadensis were also present. Other species present, including

TABLE 5

VEGETATIONAL DATA - STAND 3

North-Northeast Slope at 3000 feet

Tree Species	Relative Dominance	Relative Density	Relative Importance Value
Betula lutea	36.0%	40.6%	38.3%
Quercus rubra	44.0	12.5	28.3
Tilia heterophylla	12.0	15.6	13.8
Acer pensylvanicum	2.0	18.8	10.4
Carya cordiformis	4.0	6.3	5.1
Robinia pseudo-acacia	2.0	3.1	2.6
Acer saccharum	0.0	3.1	1.6

Total Dominance = 25.00 meters square/hectare (cross-sectional area breast height)

Total Density = 254.65 trees/hectare

TABLE 6

VEGETATIONAL DATA - STAND 4

West Slope at 2000 feet

Tree Species	Relative Dominance	Relative Density	Relative Importance Value
Quercus prinus	80.8%	79.7%	80.2%
Quercus rubra	6.4	11.9	9.1
Carya glabra	8.5	5.1	6.8
Acer rubrum	2.1	0.0	1.1
Hamamelis virginiana	2.1	0.0	1.1
Cornus florida	0.0	1.7	0.9
Liriodendron tulipifera	0.0	1.7	0.9

Total Dominance = 31.34 meters square/hectare (cross-sectional area breast height)

Total Density = 625.99 trees/hectare

TABLE 7

VEGETATIONAL DATA - STAND 5

South to West Slope at 1000 feet

Tree Species	Relative Dominance	Relative Density	Relative Importance Value
Liriodendron tulipifera	64.8%	52.9%	58.8%
Robinia pseudo-acacia	8.5	8.7	8.6
Nyssa sylvatica	4.2	8.7	6.4
Carya glabra	5.6	6.7	6.2
Sassafras albidum	1.4	6.7	4.1
Quercus rubra	4.2	2.9	3.6
Pinus virginiana	4.2	2.9	3.6
Juglans nigra	0.0	4.8	2.4
Fraxinus americana	2.8	1.9	2.4
Juniperus virginiana	2.8	1.9	2.4
Acer rubrum	1.4	0.0	0.7
Pinus strobus	0.0	1.0	0.5
Cercis canadensis	0.0	1.0	0.5

Total Dominance = 28.40 meters square/hectare (cross-sectional area breast height)

Total Density = 662.06 trees/hectare

Robinia pseudo-acacia, Sassafras albidum, Pinus virginiana, P. strobus, and Juniperus virginiana serve to illustrate the successional nature of this second or third growth stand. Species of Carya and Quercus were commonly observed in the seedling and sapling stages. Polystichum acrostichoides was the most characteristic herbaceous species present.

Stand 6 (Table 8) located in a north-northwest facing mesophytic cove at 3000 feet contains a seasonal stream (Fig. 1), and is apparently an old rockslide area dominated by large, scattered, hollow sugar maples. Acer saccharum (I.V. = 57.0) is the dominant species and Carya cordiformis (I.V. = 11.4), Betula lenta (I.V. = 9.8), and Quercus rubra (I.V. = 8.9) were common associates. Lesser numbers of Tilia heterophylla, Robinia pseudo-acacia, and Juglans nigra were also present. The shrub layer was essentially lacking, but a diverse and extensive herbaceous layer was present. Characteristic herbaceous species including Dennstaedtia punctilobula, Adiantum pedatum, Asplenium platyneuron, Arisaema triphyllum, Laportea canadensis, Anemone lancifolia, A. virginiana, Impatiens capensis, Lilium canadense, Trillium grandiflorum, Dicentra cucullaria, Cardamine concatenata, and Asarum canadense, along with trailing and reclining vines of Aristolochia macrophylla, were noted.

Stand 7 (Table 9) was located at 2000 feet in a south facing cove (Fig. 1) through which an occasionally summer-dry stream flows. Quercus prinus (I.V. = 43.3) was dominant. Fifteen other tree species were found in this community, including Q. rubra, Acer rubrum, Carya glabra, Liriodendron tulipifera, Robinia pseudo-acacia, Tilia heterophylla, and Ulmus rubra. The shrub layer was poorly developed excepting some individuals of Lindera benzoin, while a diverse herbaceous layer was present. Typical herbaceous species included Asarum canadense, Viola canadensis,

TABLE 8

VEGETATIONAL DATA - STAND 6

North-Northwest Cove at 3000 feet

Tree Species	Relative Dominance	Relative Density	Relative Importance Value
Acer saccharum	60.0%	54.0%	57.0%
Carya cordiformis	9.2	13.5	11.4
Betula lenta	6.1	13.5	9.8
Quercus rubra	12.3	5.4	8.9
Tilia heterophylla	6.2	5.4	5.8
Robinia pseudo-acacia	3.0	8.2	5.6
Juglans nigra	3.0	0.0	1.5

Total Dominance = 21.64 meters square/hectare (cross-sectional area breast height)

Total Density = 196.37 trees/hectare

TABLE 9

VEGETATIONAL DATA - STAND 7

South Cove at 2000 feet

Tree Species	Relative Dominance	Relative Density	Relative Importance Value
Quercus prinus	43.9%	42.6%	43.3%
Quercus rubra	12.3	5.6	9.0
Acer rubrum	7.0	9.3	8.2
Carya glabra	7.0	7.4	7.2
Liriodendron tulipifera	5.3	5.6	5.5
Robinia pseudo-acacia	3.5	5.6	4.6
Tilia heterophylla	1.8	5.6	3.7
Ulmus rubra	3.5	3.7	3.6
Nyssa sylvatica	5.3	0.0	2.7
Ostrya virginiana	0.0	3.7	1.9
Cornus florida	0.0	3.7	1.9
Betula lenta	1.8	1.6	1.7
Carya tomentosa	1.8	1.6	1.7
Quercus alba	1.8	1.6	1.7
Platanus occidentalis	1.8	1.6	1.7
Quercus velutina	1.8	0.0	0.9

Total Dominance = 28.50 meters square/hectare (cross-sectional area breast height)

Total Density = 429.68 trees/hectare

V. eriocarpa, V. papilionacea, V. palmata, Dicentra cucullaria and D. eximia.

Although insufficient data were taken to state specific vegetational patterns and their controlling factors within the area, some broad comparisons can be drawn to other more detailed studies concerning the vegetation of this general area. Oaks, whether or not they are a primary species in chestnut replacement, were present in every stand sampled. The consistent importance of Quercus spp. in communities of both slopes and ridges (with the exception of Stand 5) was also found by Johnson and Ware (personal communication) in the Peaks of Otter area. The change from high importance of northern red oak in more mesic habitats and higher elevations, to increased importance of chestnut oak on lower and more xeric sites as described by Braun (1950) and Whittaker (1956) is a general trend in this region. Stand 2 correlates well with Whittaker's (1956) findings of the importance of white oak in the Great Smokies at elevations above 4500 feet if the altitude and latitude relationships are considered.

Betula lutea (Stand 3) and B. lenta (Stands 6 & 7) are reported as important species in the Blue Ridge by Braun (1950) and by Johnson and Ware (personal communication). Stand 5, although not yet stabilized, indicates some of the importance of tuliptree in successional stands in the Blue Ridge as noted by Braun (1950) and Johnson and Ware (personal communication).

Stands 6 and 7 show two expected patterns for coves from the more mesophytic type characterized by sugar maple, basswood and red oak (Stand 6), as discussed by Braun (1950), to the more xeric red and

chestnut oak-containing coves (Stand 7), some of which occur in the Peaks of Otter area (Johnson and Ware, personal communication).

In addition to the seven general community types quantitatively sampled (northern red oak, white oak, northern hardwoods, chestnut oak, moist cove, dry cove, and successional), many other local and more restricted communities are found within the area.

The ericaceous shrub community is widely distributed throughout the area, occurring primarily on thin soils overlying or surrounding bedrock outcroppings and along ridges in either mixed deciduous and/or pine woodlands. This community is characterized by Kalmia latifolia, Rhododendron catawbiense, R. nudiflorum, Vaccinium vacillans, V. stamineum, Gaylussacia baccata and Menziesia pilosa. Herbaceous species including Polypodium virginianum, Cypripedium acaule and Carex spp. were occasionally found in these communities, which typically support little herbaceous growth.

Exposed rock cliffs and ledges were found in many locations within the study area. These habitats included species of the ericaceous shrub community mentioned above and often a few individuals of Pinus pungens or Crategus spp. also surround these areas. Calamagrostis porteri, Asplenium montanum, A. pinnatifidum, Polypodium virginianum, Sedum telephioides, Selaginella rupestris, Dicentra eximia and Corydalis sempervirens were some of the herbaceous species collected in this type of habitat.

Two small granitic rock outcrops were noted within the area; these support a characteristic herbaceous vegetation including Talinum teretifolium, Portulaca oleracea and Carex muhlenbergii. These species were found growing directly on the outcrops. Both outcrops were also

noted to have individuals of Pinus virginiana, Chionanthus virginicus, Smilax spp. and Rubus spp. bordering them.

Two small areas with a high importance of Tsuga canadensis were noted, both on slopes above streams. In addition, two other small areas were found, located on alluvial flats or benches along streams where Fagus grandifolia was a primary component of the overstory. The occurrence of these areas may be related to the presence of unique microclimatic determinants, as expressed by Nemeth (1973).

Disturbed areas excepting the usual weedy roadsides, old homesites, and old-field communities were not commonly encountered. At least three abandoned apple orchards in various stages of succession were noted on the mountain, and were mentioned earlier. Two other communities reflecting past severe disturbance were found, one consisting of an almost pure stand of Robinia pseudo-acacia with a dense shrub layer of Symphoricarpus orbiculatus, and a stand of Pinus virginiana with a few individuals of P. pungens and P. rigida. Both of these areas may owe their present composition to severe burns in the past as discussed by Allard (1943) for Bull Run Mountain, and Zobel (1969) for the Appalachian region in general.

FLORISTIC METHODS AND DISTRIBUTION RECORDS

Collection of specimens from Three Ridges Mountain began in March 1976 and continued until mid-October 1976. Other trips were taken in late October 1976 and during the early spring 1977. Collecting trips were made at weekly intervals. Location, abundance and habitat were noted for each number. Species abundance was noted as abundant, common, occasional, uncommon or rare. A complete set of voucher specimens has been deposited in the Herbarium of the College of William and Mary. Duplicate specimens will be exchanged with other herbaria, primarily in the Southeast.

Radford, Ahles, and Bell (1968) was the primary manual used for identification of specimens. Fernald (1950), Gleason and Cronquist (1963), Gould (1975), Hitchcock (1950), Strausbaugh and Core (1964-1971), Bailey (1949), and Gleason (1952) were the other manuals used for identifications. Nomenclature and common names follow Radford, Ahles, and Bell (1968) except for plants not occurring within the range of that manual, in which case Fernald (1950) was followed. Nomenclature for the genus Dichanthelium follows Gould (1975).

Determination of distributional records follows three sources. For the Pteridophyta, Coniferophyta, and Monocotyledoneae the records follow the newly published Atlas of the Virginia Flora, part I, Pteridophytes through Monocotyledons (Harvill, Stevens, and Ware 1977). The data for the Dicotyledons follows two sources: Massey's Virginia

Flora (1961), and the three papers by Freer (1950, 1958, 1968) on the vascular plants of the central Blue Ridge Mountains of Virginia.

A total of 571 species representing 342 genera of 97 families of vascular plants has been recorded for Three Ridges Mountain. Two hundred seventy three of these species have not been mentioned in the earlier botanical literature dealing with Nelson County. In the annotated checklist these species are preceded by an asterisk (*) denoting them as county records.

Calystegia sericata (House) Bell, is preceded by a double asterisk (**) denoting a species not previously reported as occurring in the state of Virginia. A single collection of this species was made in an old field at the north end of the Lesesne State Forest. This species was previously known only from limited collections along the western North Carolina-South Carolina border and from a few locations in Georgia.

Spiranthes ovalis Lindley was collected from a small colony growing above the Tye River along the Appalachian Trail (A.T.). This colony was located on a successionally wooded slope and may possibly be the northernmost record of this species.

Other species of uncommon occurrence, although not comprising physiographic records, included Parietaria pensylvanicum Muhl. ex Willd., Solidago uliginosa Nuttall, Agastache nepetoides (L.) Kuntze, and Chenopodium standleyanum Aellen.

A collection of Habenaria viridis var. bracteata (Muhl. ex Willd.) Gray, was also made in Nelson County (Watson, 1173); however, the collection was not made within the study area proper.

TABLE 10

SUMMARY OF THE TAXA

	FAMILIES	GENERA	SPECIES
PTERIDOPHYTA	9	15	28
CONIFEROPHYTA	2	3	7
ANTHOPHYTA			
MONOCOTYLEDONEAE	12	69	123
DICOTYLEDONEAE	74	255	413
TOTALS	97	342	571

ANNOTATED CHECKLIST

PTERIDOPHYTA

ASPIDIACEAE

Athyrium asplenioides (Michaux) A. A. Eaton, Southern Lady Fern. Common; streambanks and mesic wooded slopes; (446, 919).

A. thelypterioides (Michaux) Desvaux, Silvery Spleenwort. Locally common; mesic slopes and coves; (834).

Cystopteris protrusa (Weatherby) Blasdell, Spreading Bladder Fern. Occasional; mesic slopes and coves; (334).

Dryopteris intermedia (Willd.) Gray, Fancy Fern. Common; rocky slopes, generally in shaded areas; (240, 920).

D. marginalis (L.) Gray, Marginal Shield Fern. Abundant; wooded slopes throughout; (2).

D. spinulosa (Mueller) Watt, Spinulose Woodfern. Uncommon; wet, wooded areas; (900).

Polystichum acrostichoides (Michaux) Schott, Christmas Fern. Abundant; wooded areas throughout; (1082).

Thelypteris hexagonoptera (Michaux) Weatherby, Broad Beech-Fern. Occasional; mesic, wooded slopes; (1034).

T. noveboracensis (L.) Nieuwland, New York Fern. Common in mesic deciduous woods; (828).

Woodsia obtusa (Sprengel) Torrey, Blunt-lobed Woodsia. Occasional; wet woodland margins and seepage areas; (880).

ASPLENIACEAE

Asplenium montanum Willd., Mountain Spleenwort. Uncommon; shaded cracks among rocks of steep cliffs; (903a).

A. pinnatifidum Nuttall, Lobed Spleenwort. Rare; growing in cracks among exposed granitic rocks; (903b).

A. platyneuron (L.) Oakes, Ebony Spleenwort. Common; wooded areas throughout; (360).

A. trichomanes L., Maidenhair Spleenwort. Occasional; cracks in shaded rocks; (68a).

BLECHNACEAE

Woodwardia areolata (L.) Moore, Netted Chain-Fern. Uncommon; wet wooded areas and thickets; (447).

LYCOPODIACEAE

Lycopodium flabelliforme (Fernald) Blanchard, Running Pine. Common; pine woods and successional woodlands; (1009).

L. lucidulum Michaux, Shining Clubmoss. Uncommon; streambanks and wet, wooded areas; (692).

L. obscurum L., Ground Pine. Occasional; successional woods; (24).

OPHIOGLOSSACEAE

Botrychium dissectum Sprengel, Common Grapefern. Occasional; dry thickets and successional woods; (821).

*B. oneidense (Gilbert) House, Blunt-lobed Grapefern. Rare; dry, wooded thickets; (1049).

B. virginianum (L.) Schwartz, Rattlesnake Fern. Common; successional woods and woodland margins throughout; (203, 1048).

OSMUNDACEAE

Osmunda cinnamomea L., Cinnamon Fern. Occasional; low woods and streambanks; (193).

O. claytoniana L., Interrupted Fern. Uncommon; low woods and streambanks; (289).

O. regalis var. spectabilis (Willd.) Gray, Royal Fern. Uncommon; wet, wooded thickets; (577).

POLYPODIACEAE

Polypodium virginianum L., Rock Cap Fern. Locally abundant; colonizing open rocks throughout; (1).

PTERIDACEAE

Adiantum pedatum L., Maidenhair Fern. Common; mesic slopes and coves; (423).

Dennstaedtia punctilobula (Michaux) Moore, Hay-Scented Fern. Locally abundant; rocky, deciduous wooded slopes and ridges; (679).

SELAGINELLACEAE

Selaginella rupestris (L.) Spring, Rock Spikemoss. Uncommon; rock ledges and cliffs in exposed locations; (394).

CONIFEROPHYTA

CUPRESSACEAE

Juniperus virginiana L., Red Cedar. Locally abundant; old fields, woodland margins and roadsides throughout; (46).

PINACEAE

*Pinus echinata Miller, Short-Leaf Pine. Uncommon; mixed pine woods; (924).

P. pungens Lambert, Table Mountain Pine. Occasional; rock cliffs as well as dry, open woods; (30).

P. rigida Miller, Pitch Pine. Rare; scattered individuals in successional woods; (1013, 1032).

P. strobus L., White Pine. Common; scattered individuals throughout; (697).

P. virginiana Miller, Scrub Pine. Abundant; successional woods, woodland margins and old fields; (470).

Tsuga canadensis (L.) Carr., Canada Hemlock. Occasional; wooded slopes above streams; (951).

ANTHOPHYTA

MONOCOTYLEDONEAE

ALISMATACEAE

Sagittaria latifolia Willd. var. pubescens (Muhl.) J.G. Smith, Wapato, Duck-Potato. One small colony in a seepage area at the head of the unnamed boundary stream, ca. 2500 ft.; (886).

AMARYLLIDACEAE

*Narcissus pseudo-narcissus L., Daffodil. Occasional; escaped or persisting from cultivation, old homesites and streambanks; (23).

ARACEAE

Arisaema triphyllum (L.) Schott, Jack in the Pulpit. Common; mesic coves and streambanks throughout; (101, 378).

Symplocarpus foetidus (L.) Nuttall, Skunk Cabbage. One colony in an extensive seepage area along the unnamed western boundary stream, ca. 2500 ft.; (12).

COMMELINACEAE

Commelina communis L. Common; old homesites and waste places; (480, 505).

*Tradescantia subaspera Ker. Uncommon; disturbed areas in the Lesesne State Forest; (263).

T. virginiana L. Uncommon; deciduous woods along the A.T. near Chimney Rock; (154).

CYPERACEAE

Bulbostylis capillaris (L.) Clarke. Uncommon; growing in the area surrounding an outcrop adjacent to the A.T., above the Tye River; (909).

Carex aestivalis M.A. Curtis. Common; mesic, wooded slopes at higher elevations; (816).

*Carex blanda Dewey. Occasional; thinly wooded slopes in rocky woods; (931).

C. cephalophora Muhl. ex Schkuhr. Rare; growing on a rock outcrop above the Tye River, adjacent to the A.T.; (908b).

C. crinita Lam. var. gynandra (Schweinitz) Schweinitz and Torrey. Common; disturbed areas, usually around water; (440).

C. laxiflora Lam. Occasional; mesic deciduous woods; (547).

C. lurida Wahlenberg. Locally common; wet woodland margins in the Lesesne State Forest; (585).

C. muhlenbergii Schkuhr. Rare; rock outcrop adjacent to the A.T. above the Tye River; (908a).

C. normalis Mackenzie. Common; wooded areas throughout; (565).

C. pensylvanica Lam. Occasional; rocky woods, primarily at higher elevations; (342).

C. platyphylla Carey. Rare; dry, rocky area adjacent to intermittent stream at the south boundary of the Lesesne State Forest; (43).

C. prasina Wahlenberg. Occasional; streambanks in mesic woods; (512).

C. rosea Schkuhr. Abundant; throughout rocky, deciduous wooded areas; (338, 930).

C. scabrata Schweinitz. Occasional; open, wet areas along streams; (586).

*C. stipata Muhl. ex Schkuhr. Occasional; open, wet areas along streams; (247).

C. swanii (Fernald) Mackenzie. Occasional; old homesites and fields; (506).

C. virescens Muhl. ex Schkuhr. Common; throughout rocky woods; (313).

C. vulpinoidea Michaux. Common; old fields, orchards and roadsides; (398).

*Cyperus retrofractus (L.) Torrey. Occasional; old fields and orchards; (397).

*C. strigosus L. Locally common; wet fields and open seepage areas; (843).

Eleocharis obtusa (Willd.) Schultes, Spike-rush. Common; wet fields and roadsides; (753, 953).

*Scirpus polyphyllus Vahl., Bullrush. Locally common; wet areas in open fields; (368).

DIOSCOREACEAE

*Dioscorea batatas Dcne., Cinnamon Vine. Rare; one colony at an old homesite along Harper's Creek, ca. 1600 ft.; (776).

D. villosa L., Wild Yam. Common; wooded areas throughout; (129, 302).

IRIDACEAE

Belamcanda chinensis (L.) DC., Blackberry Lily. Locally abundant along Rt. 680 by an old homesite south of the Lesesne State Forest; (356, 479, 724).

Iris germanica L., Garden Iris. Common; persisting at old homesites throughout; (254).

Sisyrinchium angustifolium Miller, Blue-eyed Grass. Occasional; roadsides, orchards and old homesites; (171, 241).

JUNCACEAE

*Juncus dudleyi Wiegand. Occasional; open streambanks; (268).

*J. effusus L. Common; wet, open areas throughout; (267, 233).

*J. platyphyllus (Wiegand) Fernald. Uncommon; streambanks; (991).

*J. subcaudatus (Engelm) Colville & Blake. Occasional; wet woodland margins; (844).

J. tenuis Willd., Path Rush. Common; woodland margins; (376, 427).

Luzula echinata (Small) Hermann, Woodrush. Common; mesic woodlands throughout; (1064).

LILIACEAE

*Allium canadense L., Wild Onion. Common; old fields and roadsides; (520).

*A. vineale L., Field Garlic. Abundant; roadsides, fields and waste areas throughout; (195, 372).

Amianthium muscaetoxicum (Walter) Gray, Fly Poison. Occasional; mesic woods at higher elevations; (327).

Clintonia umbellulata (Michaux) Morong, Speckled Wood-Lily. Occasional; wooded streambanks; (191, 291).