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To the Graduate Council:

I am submitting herewith a thesis written by Homero Cabrera entitled "Patterns of Species Segregation as Related to Topographic Form and Aspect." I recommend that it be accepted for eighteen quarter hours of credit in partial fulfillment of the requirements for the degree of Master of Science, with a major in Botany.

H. R. De Selva
Major Professor

We have read this thesis
and recommend its acceptance:

Accepted for the Council:

Stetson P. Smith
Vice Chancellor for
Graduate Studies and Research

PATTERNS OF SPECIES SEGREGATION AS RELATED TO TOPOGRAPHIC FORM AND ASPECT

A Thesis

Presented to

the Graduate Council of

The University of Tennessee

In Partial Fulfillment

of the Requirements for the Degree

Master of Science

---

by

Homero Cabrera

August 1969

A mis padres,

Sr. y Sra. Bautista Cabrera

865409

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I. INTRODUCTION

The purpose of this study is twofold. The first aim is to provide a quantitative description of the natural vegetation of a portion of Ash Log Mountain, Campbell County, Tennessee. The second aim is to test the hypothesis of homogeneity of the Mixed Mesophytic forest community, as proposed by Braun, with respect to minor topographic and aspectual variation of the landscape. The study area lies in Campbell County, Tennessee, in the Cumberland Mountains.

As a whole, the Southern Appalachian Region contains greater than twice the proportion of commercial forest lands than does the remainder of the nation. These forest lands are even more important in the rugged areas of the region, wherein agriculture is impractical (Ford, 1962). It is hoped that this study has made a contribution to the understanding of the patterns of organization of forest communities and of the definition of site requirements and intraspecific tolerances of the taxa of concern, such as to permit fuller use and management of this important resource.

This study is a terminal one. Logging of the research area began in August, 1968, and the area has been buried by strip-mining which began in the spring of 1969.

II. REVIEW OF THE LITERATURE

Concept of the Mixed Mesophytic Forest Association

The Mixed Mesophytic Forest Region of the Deciduous Forest Formation, as it is defined by Braun (1942, 1950), is approximately co-extensive with the major portion of the unglaciated Appalachian Plateaus province. The Mixed Mesophytic association is considered to be best developed in the Cumberland Mountains section of eastern Kentucky, southwestern Virginia, and northeastern Tennessee. Furthermore, this association is regarded as the oldest and most complex unit of the Deciduous Forest Formation of eastern North America and is the central climax to which many of the other deciduous forest climaxes of eastern North America are related; they having been all derived from the Mixed Tertiary forests (Braun, 1935).

The term "mixed mesophytic" is used in a broad sense to designate mesophytic forest types wherein dominance, by whatever standard it is determined, cannot be assigned to a few canopy species. In the strict sense, the term refers to the forest climax wherein dominance is shared among: *Liriodendron tulipifera*, *Fagus grandifolia*, *Tilia heterophylla*, *T. floridana*, *T. neglecta* (not *T. americana*), *Acer saccharum*, *Castanea dentata* (before its virtual elimination by the chestnut blight), *Aesculus octandra*, *Quercus borealis* var. *maxima*, *Q. alba*, *Tsuga canadensis*, and *Halesia carolina*. Associates include: *Betula lutea*, *B. lenta*, *Prunus serotina*, *Magnolia acuminata*, *Fraxinus americana*, and *Acer rubrum*. *Nyssa sylvatica*, *Juglans nigra*, *Carya*

ovata, and C. cordiformis constitute widespread albeit minor elements (Braun, 1950).

Of the above species, Aesculus octandra and the several species of Tilia, especially Tilia heterophylla, are held to be the most characteristic species of the Mixed Mesophytic forest association. Tilia americana is considered more typical of the more northerly forests and is believed to occur only in the northern portion of the Mixed Mesophytic forest region and in the Western Mesophytic Forest region (Braun, 1950).

The Association-Segregate

A concept critical to the understanding of the nature of the communities which constitute the Mixed Mesophytic forest association is that of the "association-segregate" (Braun, 1935). Association-segregates result from the segregation and regrouping or recombination of the dominants of the Mixed Mesophytic forest association. This results in communities which may appear superficially very dissimilar but "which are actually a part of one great climax unit" (Braun, 1950). Association-segregates develop in response to local microclimatic and edaphic conditions.

While the association-segregate contains fewer dominants than the undifferentiated Mixed Mesophytic forest community, the exact number of dominants is not fixed, nor are the precise limits of the size of the area occupied by an association-segregate.

The formation of association-segregates is a characteristic of the forests of the central Cumberland Mountains. The forests of the

outlying regions--those areas of mountainous topography adjacent to the Pine Mountain overthrust block (Wilson and Stearns, 1958) are more homogeneous; that is, there is less regrouping of dominants, and association-segregates are less well developed. Individual stands more closely resemble the conceptual Mixed Mesophytic forest community (Braun, 1942).

It should be noted that the formation of association-segregates is not a characteristic restricted to the Mixed Mesophytic forest association. The Piedmont is considered part of the Oak-Pine Forest Region, yet, within the upland oak-hickory, Oosting (1942) recognized three upland segregates; a white oak-black oak-red oak type, a white oak-post oak type, and a white oak type. The segregation of these and other taxa is affected through differential seedling survival and later growth in response to light intensity, temperature, and soil moisture, as modified by interspecific competition (Bourdeau, 1954).

Location of the Mixed Mesophytic Forest Region

Braun (1950) recognizes three major divisions in the Mixed Mesophytic Forest Region. These are: the Cumberland Mountains area, the Allegheny Mountains area, and the Cumberland and Allegheny Plateaus area. These correspond closely to the physiographic sections of the same name described by Fenneman (1938). There exists some question regarding the exact location of the boundaries between these areas. According to Fenneman, the Cumberland Mountains include the Pine Mountain overthrust block (named by Wilson and Stearns, 1958), a region of maturely dissected highland north of Pine Mountain in Kentucky, and

the Wartburg Basin (the last named by Wilson, Jewell, and Luther, 1956)--which are highland areas south, north, and west of the overthrust block in Tennessee (see Figure 1). It was in this last region that the field work for this study was carried out. The exact status of this area as viewed by Braun is uncertain. In 1942, Braun granted this area the status of outlier of the Cumberland Mountains. However, in 1950, Braun makes no specific reference to this area, and the maps given in Deciduous Forests of Eastern North America indicate that it is not considered part of the Cumberland Mountains section of the Mixed Mesophytic Forest Region. This distinction is of some consequence because of the degree of development which Braun believes is attained by the association-segregates within and without the Cumberland Mountains.

The Concept of the Association and the Concept of the Continuum

The concept of the plant association as the basic unit of vegetation does not stand unchallenged. At least two opposing views exist. The first, expounded by Gleason (1926) is the "individualistic" view. In this view, vegetation is regarded as the result of the interaction with the environment, of immigrating plant species, each with different tolerances. Each segment of a general vegetation type is considered a variant which is fluctuating with geographic relation to adjacent flora, history, and local environment.

A second view is that of the "vegetational continuum" or "vegetational gradient" (Curtis and McIntosh, 1951; Whitford and Salamun, 1954; Whittaker, 1951; Buell, et al., 1966; Mowbray and Oosting, 1968; Goff and Zedler, 1968). The essence of this view is that

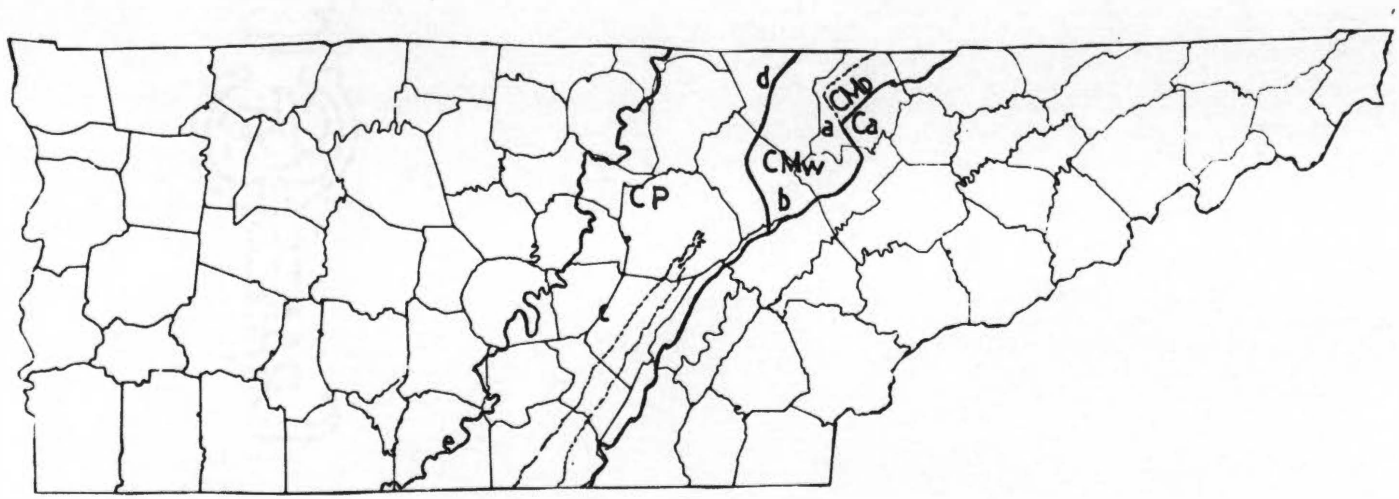


Figure 1. Middle and East Tennessee showing the location of Campbell County (Ca), Ash Log Mountain (a), Wilson Mountain (b), Fall Creek Falls State Park (c), Oneida (d), Cowan (e), the Cumberland Mountains (CM), the Pine Mountain Overthrust Block (CMp), the Wartburg Basin (CMw), and the Cumberland Plateau (CP).

vegetation forms a continuum across environmental gradients through which the importance of each species increases, reaches a maximum value, and declines. The population curves of the several species show various degrees of overlap, and usually no two species reach their maximum value at the same position on the continuum. Whittaker (1951) and Curtis and McIntosh (1951) attack the concept of the plant association on the same grounds used by Gleason; that is, vegetation varies perceptably and continuously from place to place. However, rather than viewing vegetation as a chance-controlled aggregation of species, they recognize in the variations extant in vegetation, certain definable and predictable patterns. Thus, while vegetation is not fixed, neither are all combinations of species possible. Species of similar physiological tolerances tend to occur together more often than species of dissimilar tolerances.

The concept of the vegetational continuum and that of the plant association need not be viewed as irreconcilable, since strict adherence to either results, in the case of the association, in difficulty in explanation of naturally occurring variation, and in the case of the continuum, in difficulty in the formulation of a functional definition of communities. It is through the concept of the association-segregate that the continuum and the association can be linked. Mowbray and Oosting (1968) effectively combine these two concepts. After examination of the vegetational gradients extant in a gorge in the southern Blue Ridge province, they divide the vegetation into five types, each type comparable to an association-segregate. Even though the bounds between the several types are indistinct, there exist

striking differences between vegetation types in different parts of the study area.

The continuum concept has been successfully applied to the forest vegetation of Wisconsin (Curtis and McIntosh, 1951, 1959; Whitford and Salamun, 1954; Goff and Zedler, 1968), New Jersey (Buell, et al., 1966) and parts of the southern Blue Ridge province (Whittaker, 1951; Morbray and Oosting, 1968). In this study, an attempt has been made to supply some elements of the continuum concept to a Mixed Mesophytic forest community in the Cumberland Mountains.

Effects of Site Factors on the Local Distribution of Species

A number of studies has been directed at the discovery of the effects of variation of certain physical characteristics of sites upon the survival, growth, and spatial distribution of the plants upon those sites. Among the characteristics considered are topographic form, aspect, slope angle, and elevation. Geartner (1964) maintains that the single most important factor relating to the survival and growth of plants on a given site is the availability of moisture, which factor is dependent upon the interaction of several controlling agents, including those enumerated above. Usually, however, there exists a complex interaction which confounds the effects of moisture, fertility, and vegetation itself (Oosting, 1956).

Fraser (1954) examined the effects of minor topographic variation, as expressed through a moisture gradient, upon the distribution of tree species in Ontario, Canada. The maximum range in elevation in the study area was 62 feet. A scale of one to six to represent

conditions of dry to moist sites, respectively, was used. The results appear in Table I. That species segregation occurred was obvious. The positions of the species along similar moisture gradients are considered below.

The effect of slope orientation (aspect) upon vegetation has received much attention, although most efforts seem to have been directed at comparisons of northerly and southerly aspects, between which differences are generally greatest. Shreve (1924) holds that differences are greatest in regions of intermediate moisture conditions and/or wide seasonal fluctuations. Although a variety of immediate causes exist, other things being equal (which they rarely are), the interaspectual differences are the result, ultimately of differences in insolation. Shreve also found that soil moisture and evaporation rates were more critical to interaspectual differences than was soil temperature.

In a forest stand in central Iowa, Kucera (1952) found Quercus borealis var. maxima the dominant on the south-facing slope of a valley (61.6 ft.^{2} of basal arm of total 76.8 ft.^{2}). On the opposing slope, Q. borealis var. maxima and Tilia americana were codominants (35.5 ft.^{2} and 35.7 ft.^{2} of basal area, respectively, of 85.3 ft.^{2} total basal area).

Potzger (1950) observed certain relative densities with respect to aspect (Table II).

In a study in central Iowa, Aikman and Smelser (1938) found communities on north-facing slopes dominated by Acer saccharum var.

TABLE I

DISTRIBUTION OF TAXA ALONG MOISTURE GRADIENT IN ONTARIO, CANADA

Taxa	Moisture Regime Number for Maximum Basal Area
Acer rubrum	5-6
A. saccharum	1-2
Fagus grandifolia	1-2
Ostrya virginiana	4-5
Quercus borealis var. *maxima*	3
Tilia americana	3
Prunus serotina	1 (values uncertain)
Fraxinus americana	4 (values uncertain)

Source: D. A. Fraser. 1954. Ecological studies of forest trees at Chalk River, Ontario, Canada. I. Tree species in relation to soil moisture. Ecology 35:406-414.

TABLE II

EFFECT OF ASPECT UPON RELATIVE DENSITIES OF TREE TAXA

Taxa	Relative Density (%) By Aspect N	W	SW	S
Acer saccharum	25	12	10	4
Fagus grandifolia	50	--	--	--
Fraxinus americana	5	12	--	5
Tilia americana	15	--	2	--
Prunus serotina	--	--	2	2
Carya glabra	5	25	35	10
C. ovata	15	3	5	5
Quercus alba	10	25	30	8
Q. velutina	--	--	--	3
Q. borealis var. maxima	--	25	25	20

Source: J. E. Potzger. 1950. Forest types in the Versailles State Park area, Indiana. Amer. Midland Natur. 43:729-741.

nigrum and Tilia americana. West-facing slopes supported communities dominated by assorted Quercus and Carya taxa. The southeast-facing slopes were dominated by A. saccharum var. nigrum at the base, and various species of Quercus and Carya upward: Q. borealis var. maxima dominating the lower mid-slopes, and Q. alba and C. ovata the upper slopes. Q. velutina and C. cordiformis were restricted to the upper slopes and summits. The elevational range of the study area was only 60 feet.

Comparing north-facing and south-facing slopes in New Jersey, Cantlon (1953) observed greater microclimatic variation on the south-facing slopes, greater total basal area on north-facing slopes and higher forest tree densities in all size classes on north-facing slopes. Air temperature, soil temperature, and vapor pressure deficit were greater on the south-facing slope than on the north-facing slope. The relative basal areas of the more prominant species, by slope, appear in Table III.

Doolittle (1957) observed striking interaspectual differences in the site indices of Quercus coccinea and Q. velutina. However, when tested statistically, these differences proved non-significant because of confounding with other factors.

Mowbray and Oosting (1968) found evidence for species segregation along gradients controlled by both aspect and slope position as related to topographic form. With respect to the communities found in the study area, the following sites were dominated by the taxa to the right:

TABLE III

RELATIVE BASAL AREAS OF TREE TAXA ON NORTH-FACING SLOPE AND SOUTH-FACING SLOPE, CUSHETUNK MOUNTAIN, NEW JERSEY

Taxa	North-Facing Slope	South-Facing Slope
Quercus borealis var. *maxima*	34	26
Q. alba	—	2.7
Q. Prinus	30	26
Q. velutina	—	23
Betula lenta	17	—
Liriodendron tulipifera	7	—
Fraxinus americana	2.5	1.4
Cornus florida	2	11
Tilia americana	1.9	—
Acer saccharum	1.4	0.7
A. rubrum	1.4	—
Fagus grandifolia	1.3	—
Carya tomentosa	—	5.6
C. glabra	—	1.2
C. ovata	—	0.8

Source: J. E. Cantlon. 1953. Vegetation and microclimate on north and south slopes of Cushetunk Mountain, New Jersey. Ecol. Monog. 23:241-270.

Upper north-facing slope	Quercus coccinea, Q. Prinus
Middle north-facing slope	Quercus Prinus, Q. borealis var. maxima
Lower north-facing slope and bottom	Liriodendron tulipifera, Betula lenta, Magnolia fraseri
Lower south-facing slope	Quercus coccinea, Prinus rigida
Middle and upper south-facing slope.	Pinus rigida, Quercus coccinea

Mowbray and Oosting made certain comments concerning patterns of distribution of individual species: Quercus Prinus reaches its greatest importance on the middle north-facing slope with Q. borealis var. maxima. Its importance decreases down-slope but is maintained up-slope by increased density which compensates for decreased size. While it does occur on the south-facing slope, it does not attain prominance there. Q. borealis var. maxima is restricted to the north-facing slope. It is most prominant on the lower middle slope, but its importance decreases both upward and downward. Q. coccinea, occurring on both slopes, is most prominant on the upper north-facing slope and the lower south-facing slope.

Liriodendron tulipifera and Betula lenta are dominants in the bottom. The former is restricted thereto, and the latter is also an understory species on the lower north-facing slope.

III. DESCRIPTION OF THE STUDY AREA

Physiography

The study area is located in the southernmost portion of the Cumberland Mountains physiographic section of the Appalachian Plateaus province (Fenneman, 1938). The Tennessee portion of the Cumberland Mountains includes parts of five counties: Anderson, Scott, Claiborne, Morgan, and Campbell. The entire area is characterized by high relief. Ridge crest elevations range from 2,000 ft. in the LaFollette area, to 2,600 ft. in the Jellico area, to over 3,600 ft. in the vicinity of Caryville, close to the study area. The terrain is mountainous and, particularly in the Caryville area, ridges are steep-sided and narrow. Drainage patterns are dendritic (Glenn, 1925). Valleys are likewise narrow, sinuous, and lie at 1,400 to 1,800 ft. elevation. The ridges are approximately 1.3 to 2.0 miles apart.

The study area of 125 acres extent lies between 1,860 and 3,240 feet elevation on the upper north-facing slope of Ash Log Mountain, immediately west of Ash Log Gap (36° 16' 30" north latitude, 84° 18' west longitude, Block Quadrangle, Tennessee Valley Authority topographic maps). This slope drains north to tributaries of the east prong of Nicks Creek, a tributary of New River. This joins Clear Fork River forming the South Fork of the Cumberland River. The study slope is protected to the northeast, north, and northwest by ridges with elevations from 2,500-3,200 feet, and to the southwest by a ridge of some 2,700 feet elevation. The valley of Nicks Creek, which lies to

the west of the study area, is at an elevation of only 1,400 feet at the junction of the east and west prongs.

The range of aspects spanned is from east-northeast to south-southwest. However, the extremes are not well sampled because they constitute only a very small portion of the area. Slopes are generally steep, ranging from 10 per cent to 140 per cent, but most falling into the 40 per cent to 60 per cent class. This slope is divided by a complex system of draws and leads. These vary from depressions and rises 2 feet deep or high and 30 feet wide to hollows and leads 25 feet deep or high and 150 feet wide. Most of these, however, are of intermediate size (ca. 10 feet deep or high and 60 feet wide). The draws were dry after mid-July during the summer of 1968.

Geology

Structurally, the Tennessee Cumberlands are maturely dissected plateau and are not mountains in the strict sense (Gilluly, Waters, and Woodford, 1959). The region is underlain by horizontal, interbedded sandstones, shales and coals of Middle Pennsylvanian age (Glenn, 1925). The study area is underlain by rocks of five formations:

Below 1,900 feet: Indian Bluff Formation

1,900-2,160 feet: Graves Gap Formation

2,160-2,520 feet: Redoak Mountain Formation

2,520-2,960 feet: Vowell Mountain Formation

Above 2,960 feet: Cross Mountain Formation

The description of all of these formations is very similar: horizontal, interbedded sandstones, shales, and coals. In all cases, the sandstones

are fine to medium grained and yellowish-gray to yellowish-brown and occupy about 31 per cent of the column. The shales are clayey to sandy, and light brown to dark gray (Luther, 1967).

Soils

No soil survey exists for Campbell County, Tennessee. However, a portion of adjoining Claiborne County lies within the Cumberland Mountains where Lehew, Montevallo, and Muskingum soils are mapped on this type of bedrock and topography.

These soils develop over sandstones and shales on steep slopes and are generally acid (pH 4.0-5.0), stony, shallow, and have poorly developed profiles (Austin, et al., 1948).

Soils of the Lehew series are moderately stony, shallow, sandy soils on sharp, steep ridges with slopes of 30 to 60 per cent. The parent material is weathered from interbedded sandstones and shales. Moisture conditions are poor because runoff and internal drainage are rapid. A distinct profile does not develop. The surface 6 inches to 8 inches is grayish-brown fine sandy loam which contains fragments of shale and sandstone. The subsoil is a mixture of partly weathered fragments of shale and sandstone and brown or purplish brown fine sandy loam. Depth to bedrock is 8 inches to 24 inches (Austin, et al., 1948).

Soils of the Montevallo series occur on steep slopes (30 per cent to 60 per cent) and are developed from weathered, acid, fissile shales. Runoff is rapid, and moisture retaining capacity is low. A distinct profile is not developed. The surface 4 inches to 6 inches is loose, light brownish-gray shaly silt loam, underlain by a mixture of

shale fragments and grayish-brown silty soil material. Depth to bedrock is usually less than 2 feet (Austin, et al., 1948).

The Muskingum soil series is constituted of light colored, shallow, sandy soils occurring on slopes of 30 per cent to 60 per cent, with the 40 per cent to 45 per cent class best represented. Runoff and internal drainage are rapid. The surface soil is grayish-yellow or yellow, stony, fine sandy loam, underlain by brownish-yellow fine sandy clay subsoil. Acid sandstone and conglomerate bedrock is at a depth of less than 3 feet. These soils are porous and the subsoils contain large quantities of sandstone fragments (Austin, et al., 1948).

Flora and Vegetation

The study area lies within the Cumberland Plateau Floristic Region of Shanks (1958) which is characterized by such tree taxa as Magnolia macrophylla (not, however, found in the study area). No definitive floristic studies of the area have been made, but herbarium collections from nearby Morgan County total 382 taxa (Olson, Cristofolini, and Cristofolini, 1966)--surely a very incomplete record.

Vegetationally, the area lies within the Mixed Mesophytic Forest Region. This region is described by Braun (1950) as vegetated by a mosaic of Mixed Mesophytic, Mixed Quercus and Quercus-Pinus communities on upland sites. The Mixed Mesophytic communities may or may not contain Tsuga canadensis and may be differentiated or undifferentiated. The bottomlands are dominated by such taxa as Liquidamber styraciflua, Platanus occidentalis, and Betula nigra.

Climate

The climatological data presented here is for Oneida, Tennessee (1,450 ft. elevation), 20 miles northwest of the study area (U. S. Weather Bureau, 1960-1967). The mean annual temperature is 53.1 F (11.7° C) with a mean maximum of 91.8° F (33.2° C) and a mean minimum of -12.5° F (-24.7° C). The average number of days during which the temperature does not fall below 32° F (0° C) is 163. Total precipitation averages 56.18 inches (142.7 mm) per annum and is well distributed throughout the year (Table IV).

These temperature observations are very similar to those reported by Shanks (1954) for the Sugarlands Park Headquarters (elevation 1,460 ft.) in the Great Smoky Mountains National Park. This site has a mean annual temperature of 56.5° F (13.6° C) and a mean annual precipitation of 57.8 inches (1,468 mm) (Table IV). Recorded absolute maximum and absolute minimum temperatures for Oneida are a 95° F (35.0° C) and -22° F (-30.0° C), respectively. Extremes of precipitation are 65.31 inches (1,659 mm) and 44.42 inches (1,128 mm). The length of the growing season varies from 130 to 183 days.

Under Thornthwaite's (1948) system of climatic classification, the climate of this region is designated as B_3 B'_2 b'_3 r; that is, a humid, mesothermal climate with little or no water deficiency during any season, and a summer thermal efficiency (potential evapotranspiration) of 51.9 to 56.3 per cent.

Human History

The extent of use of the Cumberland Mountains section of Campbell

TABLE IV

MEAN MONTHLY TEMPERATURE AND PRECIPITATION AT ONEIDA, TENNESSEE, AND PARK HEADQUARTERS, GSMNP

	Temperature				Precipitation	
	Oneida[a] 1961-1967		GSMNP[b] 1946-1950		Oneida 1960-1967	
Month	°F	°C	°F	°C	Inches	mm
January	31.3	-0.4	43.3	6.3	4.25	108
February	34.7	1.5	41.7	5.4	5.23	133
March	44.6	7.0	47.2	8.4	6.14	156
April	54.2	12.3	56.8	13.8	4.77	121
May	62.5	16.9	66.0	18.9	4.85	123
June	68.9	20.5	70.7	21.5	5.71	145
July	71.9	22.2	73.6	23.1	6.58	167
August	70.9	21.6	71.6	22.0	5.33	135
September	65.3	18.5	66.3	19.1	3.39	86
October	54.2	12.3	57.7	14.3	3.07	78
November	47.0	8.3	45.4	7.4	3.99	101
December	36.7	2.6	39.4	4.1	4.51	115
Mean	53.1	11.7	56.5	13.6	Total 56.18	1427

[a]Compiled from United States Weather Bureau. 1960-1967. Climatological Data, Annual Summary, State of Tennessee, Vols. 65-72.

[b]R. E. Shanks. 1954. Climates of the Great Smoky Mountains. Ecology 35(3):354-361.

County by the Indians is not known. It is presumed to have been minimal for a number of reasons: (1) There is no record of permanent Indian settlements in the area, (2) The area lies close to a portion of the Cumberland Plateau which, after many years of almost continuous warfare, came to be recognized by the several tribes of the region as a neutral zone, and (3) Most of the Indian tribes of the Tennessee region recognized the claim of the more northerly Iroquois to this territory and hunted but did not settle therein (Goodspeed, 1887).

The land in and around Campbell County came under the control of the white man through the Henderson purchase of 1775. The boundaries of this territory were essentially restated in the Treaty of Hopewell of 1785. This treaty, which defined the boundaries between the Indian territories and the lands occupied by white settlers, was negotiated in hopes of ending conflicts arising from the Indians' (Cherokee) complaints of encroachment by whites upon their lands (Goodspeed, 1887). Thus, settlement of the region by whites antedates the Hopewell Treaty.

Settlement of Campbell County itself, however, did not begin until 1795 at the site of Jacksboro. Campbell County was created in 1806 by an act of the General Assembly, and Jacksboro was designated as the county seat. Settlement was generally restricted to the Powell Valley portion of the county wherein the land was well suited to agriculture (Goodspeed, 1887).

Caryville (formerly Wheeler's Gap) was founded in 1868 and for several years served as a terminus for the Knoxville and Ohio Railroad. Contemporaneously with the founding of Caryville, several coal mines

were opened and remained in operation for a number of years (Goodspeed, 1887). Lumbering and coal mining are still major industries in this area (Ford, 1962).

Population density in this area has always been low. Of the 23 population centers recognized in Campbell County, 22 are rural, with populations below 1,000 (Ford, 1962). According to Ford (1962) the population has shown a steady decline in recent years: between 1940 and 1950 the county suffered a net population loss of at least 10 per cent, and between 1950 and 1960 the net loss was in excess of 30 per cent. This was the result of unfavorable economic conditions. The population continued to decrease from 27,936 in 1960 to 27,600 in 1966.

Land use in and around the study area was, until the spring of 1969, limited to recreation, hunting, logging, and agriculture. The slope immediately north of the study area was logged in 1965 (personal communication, June, 1968, Otis J. Carroll of the Division of Forestry, Tennessee Department of Conservation). The slopes immediately south and west of the study area were dominated by nearly even-aged stands of Liriodendron tulipifera. These areas, according to Otis J. Carroll (personal communication, June, 1968) were cultivated but were abandoned at the turn of the century. In recent years, the use of the study area itself has been limited to recreation and occasional log removal. Stumps have a density of 1.4 per cent (three stems/acre) of the living trees and equal 3.6 per cent (ca. 6.8 ft.^{2}/acre) of the basal area of the living trees. As has been previously stated, logging of the study area began in August, 1968, and continued until January, 1969. Strip-mining began in April, 1969.

IV. METHODOLOGY

Field Methods

Sampling of the arboreal vegetation was accomplished by the quarters method (Phillips, 1959). The area was divided subjectively into flat slopes, divides (ridges), and channels (draws, hollows) for sampling purposes. Sample points, arranged in flagged transects, were located approximately 40 feet apart horizontally. Interpoint distances were paced. One sample tree was flagged at every third point. Each flag bore the appropriate transect, point, and quarter number. Deviations from the standard interpoint distance were noted on the field sheets for later mapping purposes.

At each sample point, the sequence of measurements was clockwise, beginning with the quarter which lay to the right rear of the worker as he faced away from the slope, sighting along the transect. The distance from the sample point to the nearest tree in each quarter, with a minimum dbh of 4 inches, was measured and recorded to the nearest foot, by species, and the dbh was recorded in 2 inch increment classes (the 4 to 6 inch class was designated class "1," et cetera).

Point-to-tree distances were measured with an Edscorp field range finder to a minimum of 7 feet, below which the distances were estimated. Species were determined by use of the Summer Key to the Trees of Tennessee (Shanks and Sharp, 1950). Where necessary, vouchers were compared with specimens in the herbarium of The University of Tennessee. Nomenclature here follows Gleason (1952).

Three methods were used, at different times, to measure dbh. Direct measurement methods using calipers or a scaling stick were abandoned in favor of a series of eight scales, mounted along the edges of the two faces of a 3 x 5 inch card, and used in conjunction with the parallax range finder. Each calibration on the scales of the "optical dendrometer" (which was designed and constructed by the writer) was such as to correspond to a given dbh class at a specified distance (10, 15, 20, 25, 30, 35, 40, and 45 feet) from the sample point.

The procedure for the use of the optical dendrometer was as follows: (1) the distance from the sample point to the tree under consideration was measured with the range finder, (2) the appropriate scale was selected for that distance, (3) the optical dendrometer was held at arm's length, the plane of the dendrometer perpendicular to the line of sight, so that the selected scale was positioned 2 feet from the facial plane of the worker, (4) the "zero" or left edge of the dendrometer was aligned with the left side of the bole at breast height, and (5) the dbh class was read directly from the scale where the edge of the right side of the bole intercepted the scale. The diameters of trees not at 5 foot distance intervals from the sample point were determined by interpolation.

The efficiency of this method, which eliminated the need to move from tree to tree for dbh measurements, increased the speed of data collection by a factor of slightly less than three for a pair of field workers, and by a factor of greater than three for a lone worker. It also greatly reduced the physical effort required to collect data.

Aspect was measured at most points with a Taylor "Leedawl" (#2920) hand held compass. In the case of flat slopes, aspects were determined from the topographic map. All aspects were grouped into classes of 22° 30' and assigned letter designations (N, NNW, NW, et cetera).

A Suunto O/Y clinometer, calibrated in degrees and in per cent slope, was used to determine slope angle at the first point in each transect and at every third point thereafter. Per cent slope of intervening points was determined from the topographic map.

Fire damage was recorded where noted on sample trees. All partially evergrown, basal dead areas were regarded as fire damage. No attempt was made to assess the age or the extent of such damage.

Stumps noted were recorded by appropriate quadrat and dbh class, assuming this latter to be one 2 inch class less than the stump diameter.

Individuals over 4-1/4 feet high but less than 4 inches dbh were placed in the "sapling" class. These were sampled by complete census, by species, in 6 x 70 foot "walking" transects located, except where otherwise noted, between the twelfth and fourteenth sample points in each of the "tree" transects. The procedure followed was to walk between the points, with a 6 foot staff held horizontally to the ground and perpendicular to the line of the transect. Record was made of all members of any arboreal species the main stems of which were touched by the staff. Total area sampled was 0.385 acres, including 838 saplings.

Thirty-eight 6 x 6 foot temporary plots were located at various sample points throughout the study area. These were used to sample herb and shrub cover, seedlings of arboreal species, and soils. In each plot, the number of seedlings was recorded by species, an arboreal seedling here defined as an individual less than 4-1/2 feet high. Herb and shrub cover were recorded as a per cent of total plot area. Total area sampled was 0.031 acres, including 627 seedlings. Initially, an attempt was made to sort the herbs and shrubs into specific categories. However, this was found to be so time consuming and laborious and the identifications based solely upon vegetative parts were often so dubious that the attempt was abandoned. However, specimens of herbs and shrubs were collected and were used as the basis for the floristic list included later. Nomenclature follows Gleason (1952).

Soils samples to a depth of 12 inches were removed from a small pit at the center of each plot. Striking features of the profile were recorded. An estimate was made of the thickness of the litter. A few soils samples were removed from points beyond the limits of vegetation sampling. In the case of autumn collections, new leaf litter was excluded from the thickness estimates.

A total of 63 transects were examined, each consisting of three to 25 sample points. The total number of sample points was 821. Between field excursions, the transects that had been walked were mapped. The completed map was superposed upon an enlarged photograph of the Block Quadrangle Topographic Map. From this composite map, aspect and per cent slope were determined as needed, and elevations were determined for all sample points.

As an aid to planning future studies, an estimate of the time required for the collection of data is here presented. If maximum efficiency is assumed (two 25-point transects per 12 hour work day), sampling of the arboreal vegetation would require 16 days and herb-shrub-soil plots approximately an additional week (7 field days). Total time would be 23 12-hour field days. However, since allowance must be made for difficulties involving plant identification, non-continuity of transects, inclement weather, and physical exhaustion, it is more realistic to double this estimate and allow some 46 field days for a study of this size.

Manipulation of Data

The tree data for each sample point was transcribed onto 3 x 5 inch cards to permit later sorting. Here point-to-tree distances were corrected to zero slope. The purpose behind the sorting was to permit grouping of sample points on the basis of certain physical site characteristics: (1) topographic form, (2) aspect, (3) per cent slope, and (4) elevation. This sorting was necessary since it was found that, within any transect, only slope form was consistent for each sample point included in the transect. The sorting and regrouping followed the sequence of characteristics just noted. Used were three form classes: lead, flat, draw; 11 aspect classes: ENE, NE, NNE, N, NNW, NW, WNW, W, WSW, SW, SSW; six slope per cent classes: 5-12 per cent, 12-20 per cent, 20-30 per cent, 30-45 per cent, 45-60 per cent, and 65 per cent (Martin, 1966) and five elevation zones: 1,800-2,100, 2,100-2,400, 2,400-2,700, 2,700-3,000, and 3,000-3,300 ft. All points

which were similar in all four characteristics were grouped and treated as a sample for that type of site, and the data from these points were pooled. Pooling was extended by omitting one or more characters. Elevation was omitted first, then slope angle, then aspect, and then form was omitted. Finally all points were pooled to give a composite sample of the entire area. Each set of pooled sample points was considered a synthetic "stand" with a high degree of uniformity for the specified site characteristics. This approach is similar to the "composite transect" method used by Whittaker (1956) in the Great Smoky Mountains.

Further manipulation of the data was restricted to the following levels of pooling: total sample, pooled "form" samples, pooled "aspect" samples, and pooled "form-aspect" samples. The following values were computed: relative density and absolute density per acre by species, total density per acre, relative and absolute basal area per acre by species, total basal area per acre, frequency, and relative frequency (Phillips, 1959; Curtis and McIntosh, 1950). Relative density, relative basal area, and relative frequency were summed, after the manner of Curtis and McIntosh (1951) to obtain the importance value of each species. Formulae used for the above computations appear in Appendix A.

The nine species which had the highest importance values for the study area as a whole were selected and used as the basis for several continua, at different levels of sorting. The method for arranging the synthetic stands was that of Curtis and McIntosh (1951): for each synthetic stand, the importance value of each of the selected species was plotted on a strip of paper, using precoded colors for the different

species. The strips were then arranged to give the most satisfactory unimodal population curves for the several species.

V. RESULTS AND DISCUSSION

Introduction

The study area supports a mixed, all-deciduous forest community. Subjective field observations indicate, however, that the vegetation was not uniform. Particularly striking were the differences between the northerly and the westerly and southwesterly aspects, between which, the dominance changes from *Tilia* sp. and *Aesculus octandra* to *Quercus Prinus*. A less striking shift in dominance was noted (subjectively) between leads and draws. *Quercus borealis* var. *maxima* appeared to dominate the former, and *Tilia* sp., *Aesculus octandra*, *Liriodendron tulipifera*, and *Fraxinus americana* seemed to dominate the latter.

Arboreal vegetation was sampled by means of 821 quarter points; the equivalent of 14.1 acres or 11.3 per cent of the study area. The total number of canopy trees in the study area was estimated to be 28,875 (231/acre).

The soils were examined from pits located at 39 sample points throughout the area, or about 4.75 per cent of the total arboreal sample point number. Soils were invariably stony and, on most sites, yellow-brown in color. A distinct color change, from dark yellow-brown to light yellow-brown was observed, on most sites, at *ca.* 9 inches depth. An increase in clay content accompanied the color change. The high clay content of the subsoil, and the yellow-brown color indicate that these soils belonged to the Muskingum series. The mineral soil of the westerly and southwesterly aspects had an ash-gray (presumably

highly leached) surface layer approximately 1/2 inch thick.

Leaf-litter thickness was estimated at the site of each soil pit, and varied from 1/2 inch to 1 inch in thickness. Humus was of the mull type on the northerly aspects, but on the westerly and southwesterly aspects a m o r humus prevailed.

Herb and shrub cover and seedling counts were determined in 38 plots covering 0.031 acres or 0.025 per cent of the study area. A list of herbs and shrubs based upon these plots, appears in Table V. Some 627 seedlings were sampled therein, and the total number of seedlings in the entire study area was estimated at approximately 2,022,000 (approximately 16,000/acre).

Sapling counts made in the 40 6 x 70 ft. "walking" transects represented 0.385 acres, or 0.308 per cent of the entire study area. Some 838 saplings were counted, and the estimated number of saplings, in the study area was approximately 272,000 (approximately 2,000/acre).

The study area was bounded on the southwest and west by formerly cultivated slopes. These slopes, abandoned at the turn of the century (personal communication, Otis J. Carroll, June, 1968) were dominated, at the time of this study, by even-aged stands of Liriodendron tulipifera. It is deemed very likely that these stands constituted a large and important source of seed of Liriodendron tulipifera for the lower slopes, and that this influenced the composition of the vegetation of the study area.

Within and around the study area, Tsuga canadensis and Fagus grandifolia exhibited peculiar, albeit not unexpected distribution patterns. Tsuga canadensis was not found in the study area.

TABLE V

SHRUBS AND HERBS OF THE STUDY AREA

Herbaceous Taxa	Shrub and Woody Liana Taxa
Adiantum pedatum	Kalmia latifolia
Anemonella thalictroides	Parthenocissus quinquifolia
Aralia racemosa	Rubus alleghaniensis
Ariseama triphyllum	Smilax rotundifolia
Asarum canadense	Viburnum acerifolium
Aster sp.	V. dentatum
Athyrium thelypteroides	
Botrychium virginianum	
Cicuta sp.	
Cimicifuga americana	
C. racemosa	
Desmodium glabellum	
Dioscorea quaternata	
Dryopteris marginalis	
Eupatorium rugosum	
Fragaria virginiana	
Galium circaezans	
G. triflorum	
Hydrophyllum appendiculatum	
Impatiens pallida	
Laportia canadensis	
Polygonatum biflorum	
Polystichum acrosticoides	
Pychnanthemum sp.	
Sanguinarea canadensis	
Sanicula trifoliata	
Solidago spp.	
Uvularia perfoliata	

In agreement with Braun (1950) who notes that in the Cumberland Mountains this taxon is restricted to low elevations, the only individual found occurred at the edge of Nicks Creek at 1,720 ft. Braun (1950) notes a discontinuity in the occurrence of Fagus grandifolia from 2,000 ft. to 4,000 ft. In the study area, Fagus occurred only below 2,000 ft. Below the study area, it became much more important. However, the lower elevations in the study area were almost all of westerly to southwesterly aspect so that the effects of aspect and elevation were there confounded.

Vegetation of the Study Area as a Whole

Examination of the Importance Values of tree species over 816 sample points (Table VI) suggested that the vegetation of the study area was a part of the Mixed Mesophytic forest community. (See also Table XXXI, Appendix B). Although it was not closely comparable to any of the examples of Mixed Mesophytic forest communities of Braun (1950), the arboreal vegetation of the study area was comprised of 32 taxa which included nine of the ten dominants (Fagus grandifolia, Liriodendron tulipifera, Tilia sp., Acer saccharum, Castanea dentata-sapling class only, Aesculus octandra, Quercus borealis var. maxima, Q. alba, Halesia carolina) and five of the six associates (Betula lenta, Prunus serotina, Magnolia acuminata, Fraxinus americana, Acer rubrum) designated by Braun (1950) as components of the Mixed Mesophytic forest community and 18 additional tree taxa. Of these 32 taxa, nine had importance values greater than 10, but none were of overwhelming prominance. The importance of Quercus borealis var. maxima and of

TABLE VI

STAND CHARACTERISTICS, WITHOUT SUBDIVISION,
AT ASH LOG MOUNTAIN, TENNESSEE[a]

Taxa	I.V.[b]	R.D.[b] 231[c]	R.D.[d]	R.B.A.[b] 191[e]
Acer saccharum	45.1[f]	14.6	16.5	18.1
Quercus borealis var. maxima	43.5[f]	13.7	16.5	16.7
Liriodendron tulipifera	33.9[f]	12.0	10.4	10.2
Robinia pseudoacacia	21.3[f]	8.2	0.2	4.5
Fraxinus americana	19.7[f]	6.9	9.6	5.9
Quercus Prinus	18.8[f]	6.1	1.1	7.9
Tilia sp.	18.4[f]	6.4	9.3	6.0
Aesculus octandra	13.1[f]	3.7	4.5	5.0
Carya cordiformis	10.2[f]	3.2	---	3.5
Prunus serotina	9.4[f]	2.9	0.4	3.1
Carya ovata	8.8[f]	2.9	0.6	3.0
C. ovalis	7.9[f]	2.7	---	2.3
C. glabra	7.4	2.1	0.2	2.6
Nyssa sylvatica	7.4[f]	2.5	2.1	2.4
Quercus alba	5.3[f]	1.6	4.2	2.2
Magnolia acuminata	4.7[f]	1.6	3.2	1.2
Cornus florida	4.5[f]	1.9	---	0.4
Acer rubrum	4.2[f]	1.3	---	1.1
Quercus velutina	3.5[f]	1.3	---	0.8
Ostrya virginiana	2.7[f]	1.2	---	0.5
Juglans cinerea	2.5	0.7	0.6	0.6
J. nigra	1.6	0.5	2.7	0.6
Sassafras albidum	1.1[f]	0.4	0.6	0.2
Carya sp.	1.0	0.3	0.5	0.4
Cladrastis lutea	0.9[f]	0.3	0.5	0.2
Betula lenta	0.9[f]	0.4	---	0.1
Quercus coccinea	0.6[f]	0.1	---	0.1
Oxydendrum arboreum	0.5[f]	0.2	---	0.1
Fagus grandifolia	0.4	0.1	---	0.1
Quercus Schumardii	0.3[f]	0.1	---	0.1

TABLE VI (continued)

Taxa	I.V.[b]	R.D.[b] 231[c]	R.D.[d]	R.B.A.[b] 191[e]
Betula nigra	0.1	+	---	+
Halesia carolina	0.1	+	---	+
Ulmus americana	---	---	3.7	---
Morus rubra	---	---	0.6	---
Quercus macrocarpa	---	---	2.5	---

[a]Based upon 3,264 trees.

[b]I.V. = Importance Value; R.D. = Relative Density; R.B.A. = Relative Basal Area.

[c]Absolute density (stems/acre).

[d]Average of values from Tables 1-A-3, adjusted to exclude Castanea dentata, and 38, column 3, 359 trees. (E. L. Braun. 1950. Deciduous Forests of Eastern North America. New York: Hafner Publishing Company.)

[e]Absolute basal area (ft.^{2}/acre).

[f]Present in the understory.

+Present, but value less than 0.05.

Robinia pseudoacacia was higher here than in any of the examples of Mixed Mesophytic Forest communities of Braun (1950). This may be interpreted in several ways: (1) This vegetation was a homogeneous dry-mesic phase of the Mixed Mesophytic type, (2) this was an assortment of distinct communities some showing a slight degree of disturbance, (3) this was vegetation whose composition changes continuously along site gradients but without sufficient degree to warrant recognition of community components.

Subjective field observations indicated that this vegetation was not homogeneous. Further evidence against homogeneity was the occurrence, in the undivided sample, of taxa with widely differing tolerances. For example, seven of the nine most prominant taxa in the Ash Log Mountain study area occurred in the gorges of Fall Creek Falls State Park (Caplenor, 1965). Acer saccharum, Tilia heterophylla, Carya cordiformis, and Aesculus octandra reached their highest Importance Values in the Hemlock-Basswood community of Fall Creek Falls State Park. Quercus rubra (Quercus borealis var. maxima) attained its highest Importance Value in the Oak-Hickory community at that park. Quercus Prinus and Liriodendron tulipifera reached their highest importance values in the Chestnut Oak Community in that park. This indicated that, in the undivided sample from Ash Log Mountain, several taxa, which ordinarily attain dominance in different communities had been treated as though they belonged to one community.

Mowbray and Oosting (1968) found segregation related to slope position involving Quercus Prinus, Quercus borealis var. maxima, and

Liriodendron tulipifera. Fraser (1954) likewise observed that Acer saccharum, Quercus borealis var. maxima, and Tilia americana did not have coincident maxima with respect to a topographically controlled moisture gradient.

Martin (1966) observed significant differences in distribution and growth to Carya glabra and other taxa as related to changes in topography and Fraxinus americana, Aesculus octandra, and Tilia heterophylla were found to be largely restricted to north draws.

While, as was stated above, it was not possible to find a Mixed Mesophytic community among those of Braun (1950) that was comparable to the vegetation of the study area, it was possible to create an artificial stand which was very similar to the vegetation of Ash Log Mountain by combining one of Braun's (1950) examples of undifferentiated Mixed Mesophytic with a mesic community in the Oak-Chestnut region (Table VI, page 34).

All of the above indicated that at least a partial sorting, if not a complete segregation, of taxa was to be expected. The synthesis of a stand similar to that on Ash Log Mountain from communities belonging to geographically and ecologically distinct regions was a powerful argument for the existence, in the study area, of at least two recognizable communities which had been combined in the total sample.

Segregation Related to Topographic Form

The wide range of ecological tolerances represented by the taxa grouped in the composite sample, together with subjective field observations and the evidence drawn from the literature suggested that more

than one community was here represented, and that the segregation of the several communities postulated was site related. The first separation attempted was on the basis of slope forms; divides (ridges, leads), channels (draws), and flat slopes (flats). Grouping the sample points according to topographic form revealed incipient segregation of taxa (Tables VII and VIII; see also Table XXXII, Appendix B). All of the more important species occurred on all forms, but their importance changes with form. Liriodendron tulipifera, Fraxinus americana, Tilia sp., and Aesculus octandra, assumed greatest importance in the draws. Quercus borealis var. maxima, Robinia pseudoacacia, Quercus Prinus, and Carya cordiformis were more important on the divides. Acer saccharum reached its highest value on flat slopes.

Assuming that the distribution of these taxa was controlled by moisture availability, and that draws, flats, and ridges supplied moisture each to a lesser degree, this pattern was to be expected, with two exceptions. These were Acer saccharum and Quercus borealis var. maxima. Acer saccharum was considered by some authors to be one of the most mesophytic taxa of those above (Curtis and McIntosh, 1951; Whittaker, 1951; Whitford and Salamun, 1954). However, Fraser (1954) found in Ontario, Canada, that it reached its greatest importance on the drier sites in his study area. Thus, there exists some question regarding the site type whereon A. saccharum should be most prominant. Fraser found that Quercus borealis var. maxima was most prominant on sites that were somewhat mesic than those upon which Acer saccharum was prominant. Again, this was the reverse of what was found by Curtis

TABLE VII

IMPORTANCE VALUES, CHANGE IN IMPORTANCE VALUES, AND RELATIVE DENSITIES OF THE TREE TAXA OF SAMPLE POINTS GROUPED BY FORM

Taxa	Importance Value			% Change	Relative Density		
	Lead[a]	Flat	Draw		Lead[a]	Flat	Draw
	1277[b]	602	1393	I.V.[c]	220[d]	247	231
Acer saccharum	37.6	65.4	43.5	21.3	11.8	21.4	14.1
Quercus borealis var. maxima	54.2	48.9	31.8	13.8	17.8	16.5	8.6
Liriodendron tulipifera	13.1	30.8	52.7	25.0	3.8	11.6	19.6
Robinia pseudoacacia	33.1	12.6	14.1	31.0	13.5	4.5	5.1
Fraxinus americana	8.6	26.0	27.5	22.9	2.9	9.3	9.5
Quercus Prinus	32.6	5.5	11.7	41.6	10.8	2.0	3.6
Tilia sp.	8.4	19.5	27.4	23.1	2.6	5.7	10.1
Aesculus octandra	1.3	14.8	23.8	31.5	0.3	4.2	7.0
Carya cordiformis	14.6	6.0	7.9	29.5	4.9	1.8	2.3
Prinus serotina	12.9	7.1	7.1	50.0	4.0	2.5	2.2
Carya ovata	8.3	11.8	7.5	18.2	2.5	3.5	2.2
C. ovalis	11.2	9.2	4.4	20.2	3.9	2.8	1.5
C. glabra	9.7	2.8	7.4	35.6	2.8	0.7	2.4
Nyssa sylvatica	11.9	4.1	4.4	32.8	3.9	1.8	1.4
Quercus alba	7.7	1.0	4.8	43.5	2.4	0.3	1.4
Magnolia acuminata	4.3	7.5	4.1	22.7	1.3	2.5	1.5
Cornus florida	5.6	4.8	3.4	33.3	2.4	2.0	1.4
Acer rubrum	7.9	1.5	1.8	40.5	2.4	0.5	0.6
Quercus velutina	6.9	0.7	1.3	44.9	2.7	0.2	0.4
Ostrya virginiana	1.4	2.0	4.3	22.5	0.6	1.0	1.8
Juglans cinerea	2.7	6.2	2.1	33.1	0.9	1.8	0.7
J. nigra	0.7	4.7	1.2	42.6	0.2	1.3	0.4
Sassafras albidum	1.8	0.5	0.6	36.1	0.6	0.2	0.3
Carya sp.	0.3	2.2	1.2	43.2	0.1	0.7	0.3
Cladrastis lutea	---	1.4	1.6	6.3	---	0.7	0.5
Betula lenta	---	1.1	1.7	17.6	---	0.3	0.7
Quercus coccinea	1.3	---	0.2	28.2	0.2	---	0.1
Oxydendrum arboreum	0.4	0.5	0.6	11.1	0.2	0.2	0.2
Fagus grandifolia	0.7	---	0.2	23.8	0.2	---	0.1
Quercus Schumardii	0.8	---	---	---	0.3	---	---
Betula nigra	---	---	0.2	---	---	---	0.1
Halesia carolina	---	0.5	---	---	---	0.2	---

[a]Form

[b]Number of Trees

[c]Per cent change in Importance Value per change in form

[d]Absolute Density (stems/acre)

TABLE VIII

RELATIVE BASAL AREAS OF THE TREE TAXA OF SAMPLE POINTS GROUPED BY FORM

Taxa	Lead[a] 1277[b] 181[c]	Flat 602 224	Draw 1393 149
Acer saccharum	15.2	27.8	16.0
Quercus borealis var. maxima	21.1	17.2	12.5
Liriodendron tulipifera	3.1	9.8	17.0
Robinia pseudoacacia	6.7	2.5	3.5
Fraxinus americana	2.5	7.7	8.3
Quercus Prinus	13.8	1.6	5.4
Tilia sp.	2.7	7.0	8.7
Aesculus octandra	0.5	5.4	9.0
Carya cordiformis	4.8	1.7	3.1
Prinus serotina	4.5	2.1	2.3
Carya ovata	2.9	3.9	2.6
C. ovalis	3.0	2.9	1.4
C. glabra	3.4	0.9	2.6
Nyssa sylvatica	4.2	1.7	1.2
Quercus alba	3.5	0.1	2.0
Magnolia acuminata	1.5	1.6	0.8
Cornus florida	0.5	0.4	0.3
Acer rubrum	2.4	0.3	0.4
Quercus velutina	1.9	0.2	0.2
Ostrya virginiana	0.2	0.4	0.8
Juglans cinerea	0.7	1.6	0.5
J. nigra	0.2	1.9	0.3
Sassafras albidum	0.3	+	0.1
Carya sp.	0.1	0.9	0.5
Cladrastis lutea	---	0.2	0.5
Betula lenta	---	0.2	0.2
Quercus coccinea	0.1	---	+
Oxydendrum arboreum	0.1	+	0.1
Fagus grandifolia	0.3	---	+
Quercus Schumardii	0.2	---	---
Betula nigra	---	---	+
Halesia carolina	---	+	---

[a]Form

[b]Number of Trees

[c]Absolute Basal Area ($ft.^2$/acre)

+Present, but value less than 0.05

and McIntosh (1951) and Whittaker (1951). The pattern found here agrees with that found by Whittaker.

In an attempt to assess the relative sensitivities to changes in topographic form of the taxa found in the study area, the following manipulation was carried out. The minimum importance value for each taxon was subtracted from the maximum value for that taxon. The difference was divided by the maximum to obtain the relative amount of variation (expressed as a per cent of the maximum). This latter value was then divided by the number of forms spanned from the minimum to the maximum to obtain the per cent change in importance value per change in topographic form, assuming that the change increment is uniform between changes in topographic form. No attempt was made to test this assumption. The values appear as column "per cent change" in Table VII, page 39). The results showed that certain taxa were site selective with respect to topographic form and that others were more or less site indifferent. It was suggested that such taxa as Quercus Prinus, Aesculus octandra, Carya cordiformis, Liriodendron tulipifera, Prunus serotina, Robinia pseudoacacia, Carya glabra, Quercus alba, Q. velutina, Juglans nigra, and others with high "per cent change" were site selective and that other taxa were less so.

Relative basal area and relative density peaks for selected taxa on Wilson Mountain (Martin, 1966, Tables XXIII and XXII, respectively) showed that some taxa, notably Quercus coccinea and Fraxinus americana peak on ridges and in draws, respectively, regardless of aspect. Others, such as Quercus alba, Q. velutina, Q. Prinus, Nyssa sylvatica, and Carya tomentosa, peaked on southerly aspects, while

Acer rubrum, Liriodendron tulipifera, Carya ovalis, and C. cordiformis peaked on northerly aspects. Here, aspect appeared to override form. A third group of taxa, represented on Wilson Mountain by Quercus borealis var. maxima, Aesculus octandra, and Tilia heterophylla, showed distribution peaks that appeared to be controlled by both form and aspect. This suggested that, in addition to form, aspect was a prominent factor in the control of patterns of species segregation.

Comparisons were made among the synthetic stand resulting from the grouping in the present study with communities described by several other workers (Braun, 1950; Caplenor, 1965; Martin, 1966). The composition of the draws was found to be most similar to one of the mixed mesophytic communities described for the northwest slope of Pine Mountain, in Whitley County, Kentucky (Braun, 1950, Table V, page 53). When the density values in the latter were adjusted by omission of Castanea dentata, the similarity between the two increased. Relative densities for both communities appear in Table IX. The synthetic stand developed for pooled flat slopes was found to be very similar to a chestnut-sugar maple-tulip tree community (adjusted to exclude Castanea dentata) described by Braun (1950) for the upper slopes of Log Mountain, Bell County, Kentucky. Relative densities of taxa in both communities appear in a later table. No description was found of a community that closely resembled the synthetic stand obtained here for pooled leads.

TABLE IX

RELATIVE DENSITIES OF TREE TAXA IN DRAWS AT ASH LOG MOUNTAIN, TENNESSEE, AND AT PINE MOUNTAIN, KENTUCKY

Taxa	Ash Log[a] Mountain 1393[c]	Pine[b] Mountain 283[c]
Acer saccharum	14.1	14.8
Quercus borealis var. maxima	8.6	3.4
Liriodendron tulipifera	19.6	20.8
Robinia pseudoacacia	5.1	0.4
Fraxinus americana	9.5	7.7
Quercus Prinus	3.6	2.1
Tilia sp.	10.1	11.9
Aesculus octandra	7.0	8.9
Carya cordiformis	2.3	---
Prunus serotina	2.2	---
Carya ovata	2.2	1.2
C. ovalis	1.5	---
C. glabra	2.4	0.4
Nyssa sylvatica	1.4	4.1
Quercus alba	1.4	---
Magnolia acuminata	1.5	6.4
Cornus florida	1.4	---
Acer rubrum	0.6	---
Quercus velutina	0.4	---
Ostrya virginiana	1.8	---
Juglans cinerea	0.7	1.2
J. nigra	0.4	0.4
Sassafras albidum	0.3	1.2
Carya sp.	0.3	0.9
Cladrastis lutea	0.5	0.9
Betula lenta	0.7	---
Quercus coccinea	0.1	---
Oxydendrum arboreum	0.2	---
Fagus grandifolia	0.1	11.0
Betula nigra	0.1	---
Morus rubra	---	1.2
Ulmus americana	---	0.4

[a]All draws

[b]Northwest slope of Pine Mountain above Limestone Creek, Whitley County, Kentucky; data adjusted to exclude Castanea dentata. (E. L. Braun, 1950. Deciduous Forests of Eastern North America. New York: Hafner Publishing Company, 596 p.)

[c]Number of trees

Segregation Related to Aspect

The role of aspect in determining patterns of species segregation cannot be ignored. These differences are contingent largely upon differences in insolation (Shreve, 1924) and may be subtle or striking.

Kucera (1952), in central Iowa, observed that on a south-facing slope, Quercus borealis var. maxima accounted for ca. 80 per cent of the basal area. On the opposing slope, it constituted only 41.5 per cent of the basal area and was codominant with Tilia americana which made a nearly equivalent contribution to the basal area.

Potzger (1950), working in Indiana, observed that Acer saccharum, Tilia americana, and Carya ovata reached their highest densities on sites of northerly aspect and that Fagus grandifolia was restricted thereto. Quercus borealis var. maxima, Q. alba, and Carya glabra attained their highest densities on sites of west and southwest aspect.

Cantlon (1953) observed interaspectual differences on Cushetunk Mountain, New Jersey. Tilia americana, Liriodendron tulipifera, Betula lenta, Acer rubrum, and Fagus grandifolia were restricted to the north-facing slope. Quercus alba, Q. velutina, Carya tomentosa, C. glabra, and C. ovata were restricted to the south-facing slope. The relative basal areas of other taxa varied between aspects.

Martin (1966) found significant differences between exposures (north and south) upon density and/or basal area of several taxa, including Quercus borealis var. maxima, Q. velutina, Q. Prinus, Liriodendron tulipifera, and Nyssa sylvatica.

The effect of aspect upon species segregation patterns examined by grouping the samples according to aspect, recomputing Importance

Values of all taxa, and constructing a gradient (Importance Values appear in Table X, Relative Density and Relative Basal Area in Tables XI and XII, respectively. (Relative Frequency appears in Table XXXIII, Appendix B.) The method used to construct the gradient was that of Curtis and McIntosh (1951) in which stands (here aspects) were arrayed according to the rise and fall of the Importance Values of the most important taxa in the study area (first nine taxa of Table V, page 32). The array matched precisely the sequence of compass points from southwest to northeast. There existed a trend within the more mesophytic taxa toward greater Importance Values on the northerly aspects than on westerly aspects. However, wide fluctuations occurred which often obscured these patterns. When aspects were grouped according to the moisture availability ratings given by Nash (1963) the NE, N, and NW were considered nearly identical but W and SW constituted separate classes. From this point of view, the more mesophytic taxa formed a distinct group: Acer saccharum, Quercus borealis var. maxima, Liriodendron tulipifera, Fraxinus americana, Tilia sp., Aesculus octandra, Carya ovata, Ostrya virginiana, Prunus serotina, Magnolia acuminata, Juglans cinerea, J. nigra, Carya sp., Cladastris lutea. On SW and WSW aspects the peak Importance Values of Quercus Prinus, Nyssa sylvatica, Acer rubrum, Cornus florida, Oxydendrum arboreum, Quercus coccinea, and some minor taxa occurred. Robinia pseudoacacia, Carya cordiformis, C. ovalis, C. glabra, Quercus alba, and Q. velutina were among the prominent taxa which peak in an intermediate position.

In this array (Table X) several taxa showed two major Importance Value peaks. Among these were Quercus borealis var. maxima, Aesculus

TABLE X

IMPORTANCE VALUES OF THE TREE TAXA OF THE SAMPLE POINTS GROUPED BY ASPECT

Taxa	SW[a] 63[b] 11[c]	WSW 95 16	W 187 25	WNW 485 56	NW 667 29	NNW 732 25	N 701 23	NNE 291 21	NE 57 20
Acer saccharum	8.7	2.8	27.6	29.7	30.9	48.9	66.5	80.3	39.3
Quercus borealis var. maxima	19.3	18.2	29.4	49.3	51.2	34.3	49.7	42.7	74.0
Liriodendron tulipifera	22.1	16.9	17.2	20.7	35.8	40.6	34.4	32.1	38.8
Robinia pseudoacacia	45.1	26.4	34.4	27.3	25.9	24.1	11.1	5.8	11.7
Fraxinus americana	--	--	1.4	11.5	13.8	25.2	29.2	34.0	9.2
Quercus Prinus	146.9	129.8	68.9	25.8	11.5	10.8	2.6	--	--
Tilia sp.	--	--	4.0	9.0	17.2	27.5	25.3	19.0	10.7
Aesculus octandra	--	--	--	5.5	14.0	21.8	13.8	18.3	24.3
Carya cordiformis	--	4.2	12.1	24.7	11.3	6.6	4.9	5.0	10.9
Prunus serotina	--	--	10.5	10.5	9.4	8.7	12.5	7.2	5.8
Carya ovata	--	--	5.8	6.0	7.8	10.3	8.8	13.4	16.8
C. ovalis	9.4	--	8.7	12.2	11.8	6.2	5.3	6.2	6.3
C. glabra	4.4	5.8	13.4	7.8	9.7	5.3	6.3	3.2	10.1
Nyssa sylvatica	15.6	43.9	9.9	16.3	7.8	2.6	3.5	0.8	--
Quercus alba	--	--	13.6	13.3	8.2	1.7	2.2	--	--
Magnolia acuminata	--	--	2.9	1.3	3.7	6.2	5.6	10.3	4.9
Cornus florida	9.1	2.8	4.0	4.5	4.4	2.8	6.0	6.9	4.4
Acer rubrum	9.4	21.7	7.5	9.6	5.8	1.1	0.9	--	--
Quercus velutina	--	6.5	9.2	5.6	6.1	1.2	--	2.7	4.6
Ostrya virginiana	--	--	1.7	1.0	1.2	4.2	4.5	2.9	4.6
Juglans cinerea	--	--	1.7	1.9	3.9	4.5	2.1	4.5	--
J. nigra	--	--	1.7	1.6	1.7	0.8	3.0	1.3	5.8

TABLE X (continued)

Taxa	SW[a]	WSW	W	WNW	NW	NNW	N	NNE	NE
	63[b]	95	187	485	667	732	701	291	57
	11[c]	16	25	56	29	25	23	21	20
Sassafras albidum	--	--	1.3	2.5	2.9	--	--	--	--
Carya sp.	--	--	--	0.5	--	2.4	0.5	1.5	9.3
Cladrastis lutea	--	--	--	--	0.4	1.8	1.0	2.1	4.4
Betula lenta	--	2.8	--	1.2	1.4	1.5	--	--	--
Quercus coccinea	--	8.3	8.2	--	0.5	--	--	--	--
Oxydendrum arboreum	10.0	2.8	--	--	0.7	--	0.4	--	--
Fagus grandifolia	--	3.5	2.9	--	0.4	--	--	--	--
Quercus Schumardii	--	2.8	2.0	0.8	--	--	--	--	--
Betula nigra	--	--	--	--	0.4	--	--	--	--
Halesia carolina	--	--	--	--	--	--	--	--	4.4

[a]Aspect

[b]Number of trees

[c]Number of taxa

TABLE XI

RELATIVE DENSITIES OF THE TREE TAXA OF THE SAMPLE POINTS GROUPED BY ASPECT

Taxa	SW[a] 63[b] 226[c]	WSW 95 283	W 187 194	WNW 485 244	NW 667 236	NNW 732 229	N 701 246	NNE 291 208	NE 57 215
Acer saccharum	3.2	1.1	8.6	9.7	9.8	14.9	21.7	26.1	14.0
Quercus borealis var. maxima	7.9	6.3	8.6	16.1	12.7	13.0	15.8	12.0	24.6
Liriodendron tulipifera	7.9	5.3	5.9	8.0	13.9	15.7	12.1	11.3	17.5
Robinia pseudoacacia	19.1	10.5	13.9	10.7	10.6	8.7	3.9	2.4	5.3
Fraxinus americana	--	--	0.5	3.9	5.1	8.6	10.3	12.0	1.8
Quercus Prinus	42.9	40.0	23.5	7.8	3.6	3.1	0.9	--	--
Tilia sp.	--	--	1.6	2.7	5.4	8.6	10.3	6.5	3.5
Aesculus octandra	--	--	--	1.2	4.2	6.2	3.8	5.8	5.3
Carya cordiformis	--	--	3.7	8.5	3.6	2.1	1.4	1.4	3.5
Prunus serotina	--	--	3.7	3.1	3.2	2.7	3.7	2.4	1.8
Carya ovata	--	--	2.1	2.1	2.6	2.7	2.3	4.1	5.3
C. ovalis	3.2	--	3.2	3.9	4.4	1.9	1.6	2.1	1.8
C. glabra	1.6	--	4.8	2.1	3.0	1.4	2.0	1.4	1.8
Nyssa sylvatica	4.8	--	2.7	5.2	2.4	0.8	1.3	0.3	--
Quercus alba	--	--	3.2	4.3	2.9	0.4	0.4	--	--
Magnolia acuminata	--	--	1.1	0.4	1.4	2.3	1.6	3.8	1.8
Cornus florida	3.2	--	1.6	1.9	1.8	1.1	2.4	2.8	1.8
Acer rubrum	3.2	7.4	2.7	2.7	2.1	0.3	0.3	--	--
Quercus velutina	--	--	3.7	2.3	2.4	0.4	2.0	1.0	1.8
Ostrya virginiana	--	--	0.5	0.4	0.5	1.6	--	1.7	1.8
Juglans cinerea	--	--	0.5	0.6	1.4	1.5	0.7	1.4	--
J. nigra	--	--	0.5	0.6	0.6	0.3	0.7	0.3	1.8

TABLE XI (continued)

Taxa	SW[a] 63[b] 226[c]	WSW 95 283	W 187 194	WNW 485 244	NW 667 236	NNW 732 229	N 701 246	NNE 291 208	NE 57 215
Sassafras albidum	--	--	0.5	1.0	1.1	--	--	--	--
Carya sp.	--	--	--	0.2	--	0.6	0.3	--	1.8
Cladrastis lutea	--	--	--	--	0.2	0.6	0.4	0.7	1.8
Betula lenta	--	--	--	0.4	0.8	0.6	--	--	--
Quercus coccinea	--	--	1.1	--	0.2	--	--	--	--
Oxydendrum arboreum	3.2	1.1	--	--	0.3	--	0.1	--	--
Fagus grandifolia	--	--	0.5	--	0.2	--	--	--	--
Quercus Schumardii	--	--	1.1	0.2	--	--	--	--	--
Betula nigra	--	--	--	--	0.2	--	--	--	--
Halesia carolina	--	--	--	--	--	--	--	--	1.8

[a]Aspect

[b]Number of trees

[c]Absolute density (stems/acre)

TABLE XII

RELATIVE BASAL AREAS OF THE TREE TAXA OF THE SAMPLE POINTS GROUPED BY ASPECT

Taxa	SW[a] 63[b] 159[c]	WSW 95 161	W 187 152	WNW 485 189	NW 667 188	NNW 732 189	N 701 221	NNE 291 188	NE 57 215
Acer saccharum	3.1	0.3	10.6	10.1	11.2	19.9	25.2	34.0	10.9
Quercus borealis var. maxima	3.9	6.1	10.3	20.2	23.1	9.6	18.4	18.1	32.8
Liriodendron tulipifera	4.2	5.8	4.3	7.0	10.7	13.0	11.7	9.1	9.4
Robinia pseudoacacia	8.6	4.3	7.8	5.4	6.1	5.8	2.0	1.2	1.7
Fraxinus americana	--	--	0.2	3.2	3.3	7.9	8.3	9.8	5.1
Quercus Prinus	71.5	58.0	31.3	11.5	4.8	4.9	1.0	--	--
Tilia sp.	--	--	0.3	2.9	5.3	10.2	7.4	5.3	2.4
Aesculus octandra	--	--	--	1.7	5.1	7.9	5.1	5.7	11.9
Carya cordiformis	--	1.7	3.4	8.2	4.2	2.0	1.8	1.8	2.6
Prunus serotina	--	--	3.3	3.8	3.2	2.7	4.3	1.6	1.6
Carya ovata	--	--	1.5	1.6	2.4	4.2	3.4	4.3	4.4
C. ovalis	1.2	--	1.9	3.9	3.1	2.1	1.6	1.4	2.2
C. glabra	0.3	0.8	3.0	3.4	3.3	1.6	2.6	0.5	6.0
Nyssa sylvatica	3.4	13.3	5.2	5.4	3.2	0.9	1.0	0.1	--
Quercus alba	--	--	6.2	4.8	3.7	1.0	1.1	--	--
Magnolia acuminata	--	--	0.4	0.3	0.9	1.4	1.9	2.5	0.8
Cornus florida	0.9	0.3	0.3	0.3	0.4	0.3	0.4	0.5	0.2
Acer rubrum	1.2	5.7	1.3	3.2	1.6	0.5	0.3	--	--
Quercus velutina	--	1.5	3.4	1.5	1.3	0.3	--	0.4	0.5
Ostrya virginiana	--	--	0.5	0.1	0.3	0.8	0.7	0.7	0.5
Juglans cinerea	--	--	0.5	0.5	1.1	1.1	0.4	1.3	--
J. nigra	--	--	0.5	0.2	0.6	0.2	1.3	0.5	1.6

TABLE XII (continued)

Taxa	SW[a] 63[b] 159[c]	WSW 95 161	W 187 152	WNW 485 189	NW 667 188	NNW 732 189	N 701 221	NNE 291 188	NE 57 215
Sassafras albidum	--	--	0.1	0.2	0.6	--	--	--	--
Carya sp.	--	--	--	0.1	--	1.1	+	0.8	5.2
Cladrastis lutea	--	--	--	--	+	0.6	0.2	0.5	0.2
Betula lenta	--	0.3	--	0.3	0.2	0.2	--	--	--
Quercus coccinea	--	0.8	2.2	--	0.2	--	--	--	--
Oxydendrum arboreum	1.8	0.3	--	--	0.1	--	0.1	--	--
Fagus grandifolia	--	1.0	1.6	--	0.1	--	--	--	--
Quercus Schumardii	--	0.3	0.2	0.3	--	--	--	--	--
Betula nigra	--	--	--	--	+	--	--	--	--
Halesia carolina	--	--	--	--	--	--	--	--	0.2

[a]Aspect

[b]Number of trees

[c]Absolute basal area (ft.^{2}/acre)

+Present, but value less than 0.05.

octandra, Carya glabra, Quercus velutina, and Cornus florida. The Aesculus octandra and Quercus borealis var. maxima peaks fell to either side of the Acer saccharum maximum suggesting its shade-controlled interference with seedling survival of the first two since A. saccharum is more shade tolerant than either (Fowells, 1965). The spread of the modes of Carya glabra and Cornus florida was wider than that of Q. borealis var. maxima, and Aesculus octandra. The explanations of these differences in pattern were not known.

The number of taxa varied from 11 at the SW aspect to 29 at the NW aspect, but dropped to 20 on the NE aspect. The floristic richness of the NW aspect was interpreted as the result of its falling at the boundary between two major aspect classes, one mesic (northerly) and one xeric (westerly). Thus, it contained many elements from both, as well as several indigenous elements, and attained a floristic diversity that was greater than the adjacent aspect classes.

As before, the synthetic stands obtained here were compared with communities described by other workers. The synthetic stand of NNE aspect was found to be very similar, as was the stand for pooled-flat slopes, to the chestnut-sugar maple-tulip tree community described by Braun (1950) which occupied the upper slopes at Log Mountain, Bell County, Kentucky (Table XIII), the values of which were adjusted to exclude Castanea dentata.

Synthetic stands of SW and WSW aspect showed rather close correspondence to a Chestnut Oak subclimax community of Nolan Branch, Clay County, Kentucky (Braun, 1950). Relative densities calculated

TABLE XIII

RELATIVE DENSITIES OF TREE TAXA AT ASH LOG MOUNTAIN, TENNESSEE, AND AT LOG MOUNTAIN, KENTUCKY

Taxa	Ash Log Mountain Flat[a] 602[d]	Ash Log Mountain NNE[b] 291[d]	Log Mountain[c] 83[d]
Acer saccharum	21.4	26.1	26.6
Quercus borealis var. maxima	16.5	12.0	14.4
Liriodendron tulipifera	11.6	11.3	10.9
Robinia pseudoacacia	4.5	2.4	1.2
Fraxinus americana	9.3	12.0	2.4
Quercus Prinus	2.0	--	--
Tilia sp.	5.7	6.5	7.2
Aesculus octandra	4.2	5.8	7.2
Carya cordiformis	1.8	1.4	--
Prunus serotina	2.5	2.4	--
Carya ovata	3.5	4.1	1.2
C. ovalis	2.8	2.1	--
C. glabra	0.7	1.4	--
Nyssa sylvatica	1.8	0.3	7.2
Quercus alba	0.3	--	7.2
Magnolia acuminata	2.5	3.8	2.4
Cornus florida	2.0	2.8	--
Acer rubrum	0.5	--	--
Quercus velutina	0.2	1.0	--
Ostrya virginiana	1.0	1.7	--
Juglans cinerea	1.8	1.4	--
J. nigra	1.3	0.3	--
Sassafras albidum	0.2	--	--
Carya sp.	0.7	--	12.1
Cladrastis lutea	0.7	0.7	--
Betula lenta	0.3	--	--

TABLE XIII (continued)

Taxa	Ash Log Mountain Flat[a] 602[d]	Ash Log Mountain NNE[b] 291[d]	Log Mountain[c] 83[d]
Quercus coccinea	--	--	--
Oxydendrum arboreum	0.2	--	--
Fagus grandifolia	--	--	--
Quercus Schumardii	--	--	--
Betula nigra	--	--	--
Halesia carolina	0.2	--	--

[a]All flat slopes, WNW to NNE aspects

[b]All NNE aspects

[c]Upper slopes of Log Mountain, Bell County, Kentucky; data adjusted to exclude Castanea dentata. (E. L. Braun. 1950. Deciduous Forests of Eastern North America. New York: Hafner Publishing Company, 596 p.)

[d]Number of trees

for these stands appear in Table XIV (Nolan Branch community densities were also adjusted to exclude Castanea dentata).

Segregation Related to Form and Aspect

The above has been an attempt to determine patterns of species segregation as it was related to topographic form and to aspect as independent factors. The effects of these two factors may reinforce or negate each other since they occur together on the landscape.

Aikman and Smelser (1938) observed the interaction of these two factors upon the distribution of taxa in central Iowa. They found north-facing slopes dominated by Acer saccharum var. nigrum and Tilia americana. West-facing slopes were dominated by Quercus and Carya taxa. Southeast-facing slopes supported all the above taxa, but their distribution was dependent on slope position, a manifestation of form. Mowbray and Oosting (1968) observed a similar interaction in the southern Blue Ridge. Although the taxa were not all the same in both studies, similar patterns occurred.

Martin (1966) observed significant effects of both aspect and form upon distribution and size of Quercus Prinus, Q. velutina, Carya tomentosa, and C. glabra.

The grouping of sample points by form and aspect revealed distinct Importance Value trends in all of the major taxa. As before, Importance Values were recomputed and the synthetic stands arrayed by comparison of trends of Importance Values of the nine most prominent tree taxa (Tables XV to XXVI and Appendix B, Tables XXXIV - XXXVII). No regard was given to aspect or form until after the

TABLE XIV

RELATIVE DENSITIES OF TREE TAXA AT ASH LOG MOUNTAIN, TENNESSEE, AND AT NOLAN BRANCH, KENTUCKY

Taxa	SW[a] 63[e]	WSW[b] 95[e]	WSW[c] Draws 36[e]	Nolan[d] Branch 85[e]
Acer saccharum	3.2	1.1	—	3.5
Quercus borealis var. maxima	7.9	6.3	11.1	1.2
Liriodendron tulipifera	7.9	5.3	2.8	11.8
Robinia pseudoacacia	19.1	10.5	13.9	1.2
Quercus Prinus	42.9	40.0	44.4	42.3
Carya ovalis	3.2	—	—	—
C. glabra	1.6	—	5.6	—
Nyssa sylvatica	4.8	—	5.6	7.1
Cornus florida	3.2	—	2.8	—
Acer rubrum	3.2	7.4	5.6	4.6
Oxydendrum arboreum	3.2	1.1	—	1.2
Tilia sp.	—	—	—	1.2
Magnolia acuminata	—	—	—	8.2
Betula sp.	—	—	—	10.5
Fagus grandifolia	—	—	—	7.1
Quercus velutina	—	—	5.6	—
Quercus coccinea	—	—	2.8	—

[a]All sample points of southwest aspect

[b]All sample points of west-southwest aspect

[c]All draws of west-southwest aspect

[d]Nolan Branch, Clay County, Kentucky; data adjusted to exclude Castanea dentata. (E. L. Braun. 1950. Deciduous Forests of Eastern North America. New York: Hafner Publishing Company, 596 p.)

[e]Number of trees

TABLE XV

IMPORTANCE VALUES OF TREE TAXA OF THE CHESTNUT OAK-BLACK LOCUST SEGREGATE (I)

Taxa	Draw[a] SW[b] 27[c] 8[d]	Draw WSW 36 10	Lead SW 36 9	Lead WSW 48 11
Acer saccharum	--	--	16.6	5.3
Quercus borealis var. maxima	--	28.8	35.4	9.0
Liriodendron tulipifera	20.3	11.5	24.8	17.9
Robinia pseudoacacia	28.9	33.2	58.4	22.2
Fraxinus americana	--	--	--	--
Quercus Prinus	175.2	142.9	120.0	117.3
Tilia sp.	--	--	--	--
Aesculus octandra	--	--	--	--
Carya cordiformis	--	--	--	8.0
Prunus serotina	--	--	--	--
Carya ovata	--	--	--	--
C. ovalis	10.7	--	8.5	--
C. glabra	10.1	15.9	--	--
Nyssa sylvatica	11.4	17.8	19.5	71.5
Quercus alba	--	--	--	--
Magnolia acuminata	--	--	--	--
Cornus florida	10.1	7.6	8.5	--
Acer rubrum	10.7	16.8	8.5	24.1
Quercus velutina	--	17.8	--	--
Ostrya virginiana	--	--	--	--
Juglans cinerea	--	--	--	--
J. nigra	--	--	--	--
Sassafras albidum	--	--	--	--
Carya sp.	--	--	--	--
Cladrastis lutea	--	--	--	--
Betula lenta	--	--	--	--
Quercus coccinea	--	7.6	--	10.7
Oxydendrum arboreum	22.5	--	--	--
Fagus grandifolia	--	--	--	8.8
Quercus Schumardii	--	--	--	5.3
Betula nigra	--	--	--	--

[a] Form

[b] Aspect

[c] Number of trees

[d] Number of taxa

TABLE XVI

IMPORTANCE VALUES OF THE TREE TAXA OF THE RED OAK-SUGAR MAPLE-BLACK LOCUST SEGREGATE (II)

Taxa	Lead[a] W[b] 118[c] 20[d]	Lead WNW 245 23	Lead NW 333 23	Draw WNW 193 23	Draw W 57 19	Lead NNW 256 22	Flat WNW 48 16	Lead N 158 20
Acer saccharum	20.8	23.7	28.7	39.2	42.9	53.5	22.9	62.3
Quercus borealis var. maxima	29.7	49.3	59.2	39.8	31.2	49.8	85.7	83.7
Liriodendron tulipifera	7.2	3.4	15.0	45.0	44.7	12.3	13.6	6.1
Robinia pseudoacacia	35.6	35.0	35.4	16.2	34.3	39.1	34.2	22.0
Fraxinus americana	--	4.8	2.7	15.8	4.7	18.7	29.4	19.0
Quercus Prinus	83.7	41.1	18.4	9.7	22.1	20.9	10.5	11.3
Tilia sp.	--	5.1	8.0	10.9	13.0	9.6	20.3	16.5
Aesculus octandra	--	1.7	2.1	7.2	--	1.5	12.6	2.8
Carya cordiformis	10.4	25.7	17.6	25.6	19.2	13.1	17.6	3.9
Prunus serotina	10.5	14.7	12.1	6.5	12.1	12.9	5.3	23.6
Carya ovata	2.6	4.9	9.3	7.4	14.5	14.2	6.5	3.8
C. ovalis	13.4	10.2	17.8	15.5	--	11.5	9.5	4.0
C. glabra	13.8	10.7	8.7	6.3	14.6	10.9	--	5.9
Nyssa sylvatica	10.5	18.5	13.0	13.1	--	3.5	--	--
Quercus alba	17.0	11.0	11.0	16.9	8.8	1.6	11.0	6.6
Magnolia acuminata	2.4	1.4	2.8	--	4.1	8.5	5.6	8.9
Cornus florida	2.1	7.1	6.9	2.5	4.3	5.9	--	6.9
Acer rubrum	6.7	14.2	11.2	6.0	5.8	3.4	--	1.9
Quercus velutina	10.8	7.5	10.3	2.5	6.9	2.5	7.8	--
Ostrya virginiana	--	--	--	2.6	6.0	1.0	--	7.0
Juglans cinerea	--	2.4	4.4	1.6	6.0	4.4	--	1.8
J. nigra	2.6	1.0	--	2.7	--	--	--	--
Sassafras albidum	--	5.0	3.4	--	4.3	--	--	--
Carya sp.	--	--	--	1.3	--	1.5	--	--
Cladrastis lutea	--	--	--	--	--	--	--	--

TABLE XVI (continued)

Taxa	Lead[a] W[b] 118[c] 20[d]	Lead WNW 245 23	Lead NW 333 23	Draw WNW 193 23	Draw W 57 19	Lead NNW 256 22	Flat WNW 48 16	Lead N 158 20
Betula lenta	--	--	--	1.3	--	--	7.1	--
Quercus coccinea	12.7	--	1.0	--	--	--	--	--
Oxydendrum arboreum	--	--	.7	--	--	--	--	1.9
Fagus grandifolia	4.3	--	--	--	--	--	--	--
Quercus Schumardii	3.1	1.6	--	--	--	--	--	--
Betula nigra	--	--	--	--	--	--	--	--

[a]Form

[b]Aspect

[c]Number of trees

[d]Number of taxa

TABLE XVII

IMPORTANCE VALUES OF THE TREE TAXA OF THE SUGAR MAPLE-RED OAK-TULIPTREE-BASSWOOD SEGREGATE (III)

Taxa	Lead[a] NNE[b] 63[c] 14[d]	Flat NNE 136 19	Flat N 197 21	Flat NW 91 18	Flat NNW 89 15
Acer saccharum	81.4	87.6	78.8	63.0	55.7
Quercus borealis var. maxima	63.9	42.6	38.8	64.0	45.9
Liriodendron tulipifera	18.3	33.3	30.6	32.3	33.3
Robinia pseudoacacia	15.3	3.4	11.8	16.0	15.6
Fraxinus americana	19.7	21.2	26.5	19.6	42.2
Quercus Prinus	--	--	--	--	--
Tilia sp.	27.7	10.3	23.0	22.2	27.9
Aesculus octandra	--	19.9	11.7	15.0	10.1
Carya cordiformis	4.8	8.1	3.6	2.8	2.7
Prunus serotina	9.4	6.7	7.7	6.4	12.6
Carya ovata	26.5	9.4	10.7	6.8	21.4
C. ovalis	4.2	10.9	10.6	11.5	6.8
C. glabra	--	4.0	4.6	10.2	--
Nyssa sylvatica	--	--	12.4	2.8	--
Quercus alba	--	--	--	--	--
Magnolia acuminata	5.3	14.1	3.8	4.5	5.6
Cornus florida	4.0	7.1	5.3	5.3	2.7
Acer rubrum	--	--	1.7	--	--
Quercus velutina	12.7	--	--	--	--
Ostrya virginiana	6.8	4.9	4.3	--	--
Juglans cinerea	--	9.8	3.2	6.5	10.8
J. nigra	--	2.6	6.5	8.6	6.5
Sassafras albidum	--	--	--	2.6	--
Carya sp.	--	3.1	3.2	--	--
Cladrastis lutea	--	1.8	2.1	--	--
Betula lenta	--	--	--	--	--
Quercus coccinea	--	--	--	--	--
Oxydendrum arboreum	--	--	--	--	--
Fagus grandifolia	--	--	--	--	--
Quercus Schumardii	--	--	--	--	--
Betula nigra	--	--	--	--	--

[a] Form

[b] Aspect

[c] Number of trees

[d] Number of taxa

TABLE XVIII

IMPORTANCE VALUES OF THE TREE TAXA OF THE SUGAR MAPLE-TULIPTREE-BASSWOOD-BUCKEYE SEGREGATE (IV)

Taxa	Draw[a] NNE[b] 92[c] 14[d]	Draw N 346 19	Draw NW 268 28	Draw NNW 67 23
Acer saccharum	64.5	61.6	20.4	44.5
Quercus borealis var. maxima	26.2	38.8	42.1	21.1
Liriodendron tulipifera	40.8	50.1	62.4	60.8
Robinia pseudoacacia	2.9	5.6	16.6	16.3
Fraxinus americana	67.7	35.6	25.5	25.6
Quercus Prinus	--	--	6.4	6.9
Tilia sp.	27.3	30.7	26.6	39.0
Aesculus octandra	28.3	20.3	28.7	35.9
Carya cordiformis	--	6.2	5.8	3.2
Prunus serotina	6.2	10.1	6.5	5.2
Carya ovata	10.1	10.0	6.8	5.2
C. ovalis	--	2.8	3.9	2.1
C. glabra	4.0	7.5	13.5	2.9
Nyssa sylvatica	2.7	--	2.6	2.6
Quercus alba	--	1.3	7.1	2.2
Magnolia acuminata	7.5	5.1	4.3	4.9
Cornus florida	8.3	6.0	0.9	0.7
Acer rubrum	--	--	0.9	--
Quercus velutina	--	--	2.7	0.6
Ostrya virginiana	--	3.4	3.2	7.3
Juglans cinerea	--	1.7	2.3	3.0
J. nigra	--	2.3	1.4	--
Sassafras albidum	--	--	2.2	--
Carya sp.	--	--	--	3.4
Cladrastis lutea	4.2	0.9	0.9	3.5
Betula lenta	--	--	3.7	2.8
Quercus coccinea	--	--	--	--
Oxydendrum arboreum	--	--	0.9	--
Fagus grandifolia	--	--	1.0	--
Quercus Schumardii	--	--	--	--
Betula nigra	--	--	0.9	--

[a]Form

[b]Aspect

[c]Number of trees

[d]Number of taxa

TABLE XIX

RELATIVE DENSITIES OF THE TREE TAXA OF THE CHESTNUT OAK-BLACK LOCUST SEGREGATE (I)

Taxa	Draw[a] SW[b] 27[c] 160[d]	Draw WSW 36 260	Lead SW 36 307	Lead WSW 48 274
Acer saccharum	--	--	5.6	2.1
Quercus borealis var. maxima	--	11.1	13.9	2.1
Liriodendron tulipifera	7.4	2.8	8.3	6.3
Robinia pseudoacacia	11.1	13.9	25.0	8.3
Fraxinus americana	--	--	--	--
Quercus Prinus	55.6	44.4	33.3	35.4
Tilia sp.	--	--	--	--
Aesculus octandra	--	--	--	--
Carya cordiformis	--	--	--	2.1
Prunus serotina	--	--	--	--
Carya ovata	--	--	--	--
C. ovalis	3.7	--	2.8	--
C. glabra	3.7	5.6	--	--
Nyssa sylvatica	3.7	5.6	5.6	25.0
Quercus alba	--	--	--	--
Magnolia acuminata	--	--	--	--
Cornus florida	3.7	2.8	2.8	--
Acer rubrum	3.7	5.6	2.8	8.3
Quercus velutina	--	5.6	--	--
Ostrya virginiana	--	--	--	--
Juglans cinerea	--	--	--	--
J. nigra	--	--	--	--
Sassafras albidum	--	--	--	--
Carya sp.	--	--	--	--
Cladrastis lutea	--	--	--	--
Betula lenta	--	--	--	--
Quercus coccinea	--	2.8	--	4.2
Oxydendrum arboreum	7.4	--	--	--
Fagus grandifolia	--	--	--	4.2
Quercus Schumardii	--	--	--	2.1
Betula nigra	--	--	--	--

[a]Form

[b]Aspect

[c]Number of trees

[d]Absolute density (stems/acre)

TABLE XX

RELATIVE DENSITIES OF THE TREE TAXA OF THE RED OAK-SUGAR MAPLE-BLACK LOCUST SEGREGATE (II)

Taxa	Lead[a] W[b] 118[c] 165[d]	Lead WNW 245 257	Lead NW 333 242	Draw WNW 193 218	Draw W 57 268	Lead NNW 256 233	Flat WNW 48 254	Lead N 158 176
Acer saccharum	5.1	7.4	8.1	13.0	15.8	15.2	8.3	23.4
Quercus borealis var. maxima	8.5	15.9	16.8	11.9	8.8	21.5	33.3	26.6
Liriodendron tulipifera	2.5	1.2	5.1	17.6	14.0	3.9	4.2	1.9
Robinia pseudoacacia	15.3	13.9	15.3	6.2	12.3	14.8	12.5	8.2
Fraxinus americana	--	1.6	0.9	5.2	1.8	5.9	10.4	6.3
Quercus Prinus	29.7	13.1	6.0	2.6	5.3	6.3	2.1	3.8
Tilia sp.	--	1.6	2.4	3.6	5.3	2.7	4.2	5.1
Aesculus octandra	--	0.4	0.6	2.6	--	0.4	2.1	0.6
Carya cordiformis	3.4	9.4	5.7	7.8	5.3	4.3	6.3	1.3
Prunus serotina	3.4	4.1	3.9	2.1	5.3	3.9	2.1	7.6
Carya ovata	0.9	2.0	3.0	2.1	5.3	3.9	2.1	1.3
C. ovalis	5.1	3.3	6.6	5.2	--	3.5	2.1	1.3
C. glabra	5.1	2.9	3.0	1.6	5.3	2.3	--	1.9
Nyssa sylvatica	3.4	5.7	3.9	5.7	--	1.2	--	--
Quercus alba	4.2	3.3	4.2	5.7	1.8	0.8	4.2	1.3
Magnolia acuminata	0.9	0.4	0.9	--	1.8	3.1	2.1	1.9
Cornus florida	0.9	2.9	2.7	1.0	1.8	2.3	--	3.2
Acer rubrum	2.5	4.1	3.9	1.6	1.8	0.8	--	0.6
Quercus velutina	4.2	3.3	3.9	1.0	3.5	0.8	2.1	--
Ostrya virginiana	--	--	--	1.0	1.8	0.4	--	2.5
Juglans cinerea	--	0.8	1.5	0.5	1.8	1.6	--	0.6
J. nigra	0.9	0.4	--	1.0	--	--	--	--
Sassafras albidum	--	2.0	0.9	--	1.8	--	--	--
Carya sp.	--	--	--	0.5	--	0.4	--	--
Cladrastis lutea	--	--	--	--	--	--	--	--
Betula lenta	--	--	--	0.5	--	--	2.1	--
Quercus coccinea	1.7	--	0.3	--	--	--	--	--
Oxydendrum arboreum	--	--	0.3	--	--	--	--	0.6
Fagus grandifolia	0.9	--	--	--	--	--	--	--
Quercus Schumardii	1.7	0.4	--	--	--	--	--	--
Betula nigra	--	--	--	--	--	--	--	--

[a] Form

[b] Aspect

[c] Number of trees

[d] Absolute density (stems/acre)

TABLE XXI

RELATIVE DENSITIES OF THE TREE TAXA OF THE SUGAR MAPLE-RED OAK-TULIPTREE-BASSWOOD SEGREGATE (III)

Taxa	Lead[a] NNE[b] 63[c] 231[d]	Flat NNE 136 220	Flat N 197 307	Flat NW 91 225	Flat NNW 89 228
Acer saccharum	27.0	26.5	25.9	19.8	18.0
Quercus borealis var. maxima	17.5	12.5	14.2	20.9	15.7
Liriodendron tulipifera	7.9	13.2	12.7	9.9	13.5
Robinia pseudoacacia	6.4	1.5	3.6	5.5	5.6
Fraxinus americana	7.9	7.4	10.2	7.7	14.6
Quercus Prinus	--	--	--	--	--
Tilia sp.	9.2	4.4	5.6	6.6	7.9
Aesculus octandra	--	5.9	3.6	5.5	2.3
Carya cordiformis	1.6	2.2	1.0	1.1	1.1
Prunus serotina	3.2	2.2	2.5	2.2	4.5
Carya ovata	6.4	3.7	2.5	3.3	5.6
C. ovalis	1.6	3.7	3.1	3.3	2.3
C. glabra	--	1.5	1.0	3.3	--
Nyssa sylvatica	--	--	4.6	1.1	--
Quercus alba	--	--	--	--	--
Magnolia acuminata	1.6	5.2	1.0	2.2	2.3
Cornus florida	1.6	2.9	2.0	2.2	1.1
Acer rubrum	--	--	0.5	--	--
Quercus velutina	4.8	--	--	--	--
Ostrya virginiana	3.2	2.2	1.5	--	--
Juglans cinerea	--	2.9	1.0	2.2	3.4
J. nigra	--	0.7	1.5	2.2	2.3
Sassafras albidum	--	--	--	1.1	--
Carya sp.	--	0.7	1.0	--	--
Cladrastis lutea	--	0.7	1.0	--	--
Betula lenta	--	--	--	--	--
Quercus coccinea	--	--	--	--	--
Oxydendrum arboreum	--	--	--	--	--
Fagus grandifolia	--	--	--	--	--
Quercus Schumardii	--	--	--	--	--
Betula nigra	--	--	--	--	--

[a]Form

[b]Aspect

[c]Number of trees

[d]Absolute density (stems/acre)

TABLE XXII

RELATIVE DENSITIES OF THE TREE TAXA OF THE SUGAR MAPLE-TULIPTREE-BASSWOOD-BUCKEYE SEGREGATE (IV)

Taxa	Draw[a] NNE[b] 92[c] 208[d]	Draw N 346 254	Draw NW 268 210	Draw NNW 67 227	Pine[e] Mt. 140	Cowan[f] 74
Acer saccharum	25.0	18.5	7.5	14.0	21.4	8.1
Quercus borealis var. maxima	7.6	11.9	11.2	6.7	3.6	12.2
Liriodendron tulipifera	10.9	16.5	25.0	24.0	22.9	21.6
Robinia pseudoacacia	1.1	2.0	5.6	5.4	--	--
Fraxinus americana	21.7	12.1	9.0	9.0	7.0	1.3
Quercus Prinus	--	--	1.5	1.8	1.5	--
Tilia sp.	7.6	15.3	8.2	12.7	11.4	10.8
Aesculus octandra	9.8	5.5	7.8	10.9	13.6	8.1
Carya cordiformis	--	1.7	1.5	0.8	--	--
Prunus serotina	2.2	2.6	2.2	1.6	--	--
Carya ovata	3.3	2.6	2.2	1.3	2.1	6.8
C. ovalis	--	0.9	1.5	0.8	--	--
C. glabra	2.2	2.6	3.7	1.0	--	--
Nyssa sylvatica	1.1	--	0.8	0.8	1.5	2.7
Quercus alba	--	0.3	1.9	0.3	--	5.4
Magnolia acuminata	3.3	1.7	1.5	1.8	4.3	8.1
Cornus florida	3.3	2.3	0.4	0.3	--	--
Acer rubrum	--	--	0.4	--	--	--
Quercus velutina	--	--	1.1	0.3	--	--
Ostrya virginiana	--	2.0	1.1	2.8	--	--
Juglans cinerea	--	0.6	0.8	1.0	--	--
J. nigra	--	0.6	0.4	--	0.7	--
Sassafras albidum	--	--	1.1	--	1.5	--
Carya sp.	--	--	--	0.8	3.6	6.8
Cladrastis lutea	1.1	0.3	0.4	1.0	1.5	--
Betula lenta	--	--	1.9	1.0	--	--
Quercus coccinea	--	--	--	--	--	--

TABLE XXII (continued)

Taxa	Draw[a] NNE[b] 92[c] 208[d]	Draw N 346 254	Draw NW 268 210	Draw NNW 67 227	Pine[e] Mt. 140	Cowan[f] 74
Oxydendrum arboreum	--	--	0.4	--	--	--
Fagus grandifolia	--	--	0.4	--	3.6	--
Quercus Schumardii	--	--	--	--	--	--
Betula nigra	--	--	0.4	--	--	--
Quercus Muhlenbergii	--	--	--	--	--	8.1

[a]Form

[b]Aspect

[c]Number of trees

[d]Absolute density (stems/acre)

[e]Northwest slope of Pine Mountain, above Limestone Creek, Whitley County, Kentucky; data adjusted to exclude Castanea dentata. (E. L. Braun. 1950. Deciduous Forests of Eastern North America. New York: Hafner Publishing Company, 596 p.)

[f]West-facing escarpment of Cumberland Plateau, east of Cowan, Tennessee. (E. L. Braun. 1950. Deciduous Forests of Eastern North America. New York: Hafner Publishing Company, 596 p.)

TABLE XXIII

RELATIVE BASAL AREAS OF THE TREE TAXA OF THE CHESTNUT OAK-BLACK LOCUST SEGREGATE (I)

Taxa	Draw[a] SW[b] 27[c] 143[d]	Draw WSW 36 146	Lead SW 36 173	Lead WSW 48 169
Acer saccharum	--	--	6.7	0.5
Quercus borealis var. maxima	--	9.4	8.5	4.2
Liriodendron tulipifera	1.1	4.6	7.8	6.1
Robinia pseudoacacia	6.0	6.8	11.6	2.7
Fraxinus americana	--	--	--	--
Quercus Prinus	84.4	65.2	56.2	51.3
Tilia sp.	--	--	--	--
Aesculus octandra	--	--	--	--
Carya cordiformis	--	--	--	3.1
Prunus serotina	--	--	--	--
Carya ovata	--	--	--	--
C. ovalis	1.1	--	1.3	--
C. glabra	0.6	2.0	--	--
Nyssa sylvatica	1.8	3.9	5.2	21.5
Quercus alba	--	--	--	--
Magnolia acuminata	--	--	--	--
Cornus florida	0.6	0.7	1.3	--
Acer rubrum	1.1	2.9	1.3	7.5
Quercus velutina	--	3.9	--	--
Ostrya virginiana	--	--	--	--
Juglans cinerea	--	--	--	--
J. nigra	--	--	--	--
Sassafras albidum	--	--	--	--
Carya sp.	--	--	--	--
Cladrastis lutea	--	--	--	--
Betula lenta	--	--	--	--
Quercus coccinea	--	0.7	--	0.9
Oxydendrum arboreum	3.3	--	--	--
Fagus grandifolia	--	--	--	1.8
Quercus Schumardii	--	--	--	0.5
Betula nigra	--	--	--	--

[a]Form

[b]Aspect

[c]Number of trees

[d]Absolute basal area (ft.^{2}/acre)

TABLE XXIV

RELATIVE BASAL AREAS OF THE TREE TAXA OF THE RED OAK-SUGAR MAPLE-BLACK LOCUST SEGREGATE (II)

Taxa	Lead[a] W[b] 118[c] 148[d]	Lead WNW 245 208	Wilson[e] Mt. 105 91	Lead NW 333 200	Draw WNW 193 154	Draw W 57 153	Lead NNW 256 177	Flat WNW 48 231	Lead N 158 156
Acer saccharum	10.0	9.4	--	11.6	12.4	14.1	23.4	5.7	19.7
Quercus borealis var. maxima	9.9	19.5	4.4	26.3	17.2	13.8	11.1	31.8	35.5
Liriodendron tulipifera	1.3	1.2	19.7	4.4	15.4	15.4	4.4	6.5	1.8
Robinia pseudoacacia	6.7	6.2	--	7.2	3.7	11.1	9.5	7.0	4.2
Fraxinus americana	--	1.1	8.7	0.7	4.9	0.8	7.0	7.3	4.7
Quercus Prinus	35.9	17.9	17.6	7.3	4.0	12.5	9.7	5.5	4.3
Tilia sp.	--	1.4	2.0	2.5	2.9	1.3	3.4	10.2	5.0
Aesculus octandra	--	0.8	1.4	0.7	2.1	--	0.6	7.8	1.4
Carya cordiformis	2.4	7.3	1.0	6.4	10.3	7.4	3.9	5.4	1.1
Prunus serotina	3.7	5.8	--	4.3	1.9	2.6	4.6	0.3	7.2
Carya ovata	0.6	0.7	--	3.2	2.8	4.9	5.8	1.5	1.0
C. ovalis	2.7	2.7	8.7	4.2	5.3	--	4.1	4.5	1.2
C. glabra	3.1	4.6	4.5	2.2	2.8	3.3	4.1	--	1.6
Nyssa sylvatica	4.9	7.0	1.4	5.2	0.5	--	1.4	--	--
Quercus alba	7.0	5.1	5.6	4.8	5.6	4.9	0.4	0.9	3.7
Magnolia acuminata	0.4	0.5	--	0.7	--	0.4	2.4	0.6	4.6
Cornus florida	0.1	0.5	--	0.7	0.2	0.4	0.6	--	0.5
Acer rubrum	0.8	4.8	9.4	3.0	2.0	1.4	1.6	--	0.5
Quercus velutina	4.3	2.1	--	2.1	0.2	1.2	0.7	2.8	--
Ostrya virginiana	--	--	--	--	0.3	2.0	0.1	--	1.3
Juglans cinerea	--	0.6	--	1.3	0.5	2.0	0.9	--	0.3
J. nigra	0.6	0.1	--	--	0.4	--	--	--	--
Sassafras albidum	--	0.3	--	1.0	--	0.4	--	--	--
Carya sp.	--	--	--	--	0.2	--	0.6	--	--
Cladrastis lutea	--	--	--	--	--	--	--	--	--
Betula lenta	--	--	--	--	0.2	--	--	2.1	--
Quercus coccinea	3.1	--	1.0	0.3	--	--	--	--	--

TABLE XXIV (continued)

Taxa	Lead[a] W[b] 118[c] 148[d]	Lead WNW 245 208	Wilson[e] Mt. 105 91	Lead NW 333 200	Draw WNW 193 154	Draw W 57 153	Lead NNW 256 177	Flat WNW 48 231	Lead N 158 156
Oxydendrum arboreum	--	--	--	0.1	--	--	--	--	0.5
Fagus grandifolia	2.3	--	2.7	--	--	--	--	--	--
Quercus Schumardii	0.3	0.6	--	--	--	--	--	--	--
Betula nigra	--	--	--	--	--	--	--	--	--
Pinus virginiana	--	--	1.3	--	--	--	--	--	--
P. strobus	--	--	1.0	--	--	--	--	--	--
Liquidambar styraciflua	--	--	3.0	--	--	--	--	--	--

[a]Form

[b]Aspect

[c]Number of trees

[d]Absolute basal area ($ft.^2$/acre)

[e]North-facing draws of Wilson Mountain. (W. H. Martin. 1966. Some Relationships of Vegetation to Soil and Site Factors on Wilson Mountain, Morgan County, Tennessee. Master's thesis, The University of Tennessee, Knoxville, p. 81.)

TABLE XXV

RELATIVE BASAL AREAS OF THE TREE TAXA OF THE SUGAR MAPLE-RED OAK-TULIPTREE-BASSWOOD SEGREGATE (III)

Taxa	Lead[a] NNE[b] 63[c] 217[d]	Flat NNE 136 218	Flat N 197 283	Flat NW 91 189	Flat NNW 89 206
Acer saccharum	35.3	40.7	30.0	25.4	21.8
Quercus borealis var. maxima	29.4	17.2	11.7	23.9	15.7
Liriodendron tulipifera	1.9	8.0	10.7	12.8	11.1
Robinia pseudoacacia	2.6	1.0	1.8	3.7	2.8
Fraxinus americana	3.2	5.5	7.8	3.6	14.5
Quercus Prinus	--	--	--	--	--
Tilia sp.	7.5	1.2	9.5	7.3	9.9
Aesculus octandra	--	6.7	3.9	4.0	5.0
Carya cordiformis	1.1	3.1	1.2	0.4	0.2
Prunus serotina	2.0	1.7	2.2	2.8	3.8
Carya ovata	11.6	2.0	4.6	0.8	8.6
C. ovalis	0.5	2.6	3.3	4.1	1.7
C. glabra	--	0.7	2.2	4.1	--
Nyssa sylvatica	--	--	3.6	0.4	--
Quercus alba	--	--	--	--	--
Magnolia acuminata	1.6	3.4	1.4	0.9	0.5
Cornus florida	0.2	0.5	0.4	0.4	0.2
Acer rubrum	--	--	0.5	--	--
Quercus velutina	1.6	--	--	--	--
Ostrya virginiana	1.5	0.8	0.6	--	--
Juglans cinerea	--	2.5	0.8	1.6	3.1
J. nigra	--	0.9	2.8	3.7	1.3
Sassafras albidum	--	--	--	0.2	--
Carya sp.	--	1.5	1.5	--	--
Cladrastis lutea	--	0.1	0.3	--	--
Betula lenta	--	--	--	--	--
Quercus coccinea	--	--	--	--	--
Oxydendrum arboreum	--	--	--	--	--
Fagus grandifolia	--	--	--	--	--
Quercus Schumardii	--	--	--	--	--
Betula nigra	--	--	--	--	--

[a]Form

[b]Aspect

[c]Number of trees

[d]Absolute basal area (ft.^{2}/acre)

TABLE XXVI

RELATIVE BASAL AREAS OF THE TREE TAXA OF THE SUGAR MAPLE-TULIPTREE-BASSWOOD-BUCKEYE SEGREGATE (IV)

Taxa	Draw[a] NNE[b] 92[c] 162[d]	Draw N 346 225	Draw NW 268 142	Draw NNW 67 193
Acer saccharum	19.3	25.2	4.5	7.2
Quercus borealis var. maxima	9.9	13.2	17.5	7.2
Liriodendron tulipifera	16.9	17.0	19.2	18.4
Robinia pseudoacacia	0.4	1.1	5.3	4.3
Fraxinus americana	25.8	10.4	7.2	6.9
Quercus Prinus	--	--	3.1	3.3
Tilia sp.	11.1	7.3	8.6	14.2
Aesculus octandra	8.5	7.5	12.0	13.0
Carya cordiformis	--	2.4	2.6	1.4
Prunus serotina	1.1	4.2	1.6	1.5
Carya ovata	2.5	3.8	1.8	2.2
C. ovalis	--	0.7	1.1	1.1
C. glabra	0.4	3.3	6.2	0.5
Nyssa sylvatica	0.2	--	1.5	0.8
Quercus alba	--	0.6	3.5	1.6
Magnolia acuminata	1.4	0.9	1.1	1.0
Cornus florida	0.8	0.5	0.1	0.1
Acer rubrum	--	--	0.1	--
Quercus velutina	--	--	0.7	+
Ostrya virginiana	--	0.6	0.7	1.4
Juglans cinerea	--	0.3	0.6	0.6
J. nigra	--	0.9	0.2	--
Sassafras albidum	--	--	0.2	--
Carya sp.	--	--	--	1.6
Cladrastis lutea	1.7	0.2	0.1	1.0
Betula lenta	--	--	0.5	0.4
Quercus coccinea	--	--	--	--
Oxydendrum arboreum	--	--	0.1	--
Fagus grandifolia	--	--	0.2	--
Quercus Schumardii	--	--	--	--
Betula nigra	--	--	0.1	--

[a]Form

[b]Aspect

[c]Number of trees

[d]Absolute basal area (ft.^{2}/acre)

arrangement was complete. The Importance Value peaks of the major taxa showed that their ranking, from least mesophytic to most mesophytic, was approximately that observed before (form alone and aspect alone). The aspects and forms were united into logical groups, here designated "segregates," for ease of handling. Such taxa as Quercus Prinus, Robinia pseudoacacia, Nyssa sylvatica, Acer rubrum, Quercus velutina, Oxydendrum arboreum, Carya glabra, Quercus coccinea, Q. Schumardii, Fagus grandifolia, and Cornus florida peaked in both segregates I and II or on the boundary between them. Quercus borealis var. maxima, Carya cordiformis, Prunus serotina, Carya ovalis, Quercus alba, Magnolia acuminata, Sassafras albidum, and Betula lenta peaked in segregate II, Liriodendron tulipifera in II and IV, and Ostrya virginiana on the II-III boundary. Acer saccharum, Carya ovata, Juglans cinerea, and J. nigra peaked in segregate III, and Carya sp. peaked at the III-IV boundary. Fraxinus americana, Tilia sp., Aesculus octandra, and Cladrastis lutea (and Liriodendron tulipifera and Cornus florida each with a second peak) reached maximum values in segregate IV. Halesia carolina did not appear here as the set of points in which it occurred was judged inadequate because of its small size.

The xeric to mesic arrangement of form (lead, flat, draw) and aspect (SW to NNE) was, in this arrangement, maintained in an overall fashion. However, the interplay of the two factors was such that neither could be assigned the controlling role over the entire gradient. Segregates I and II (on the xeric side) contained a high proportion of leads and few draws and flats. Segregate I contained only southwest and west-southwest aspects. The aspects in segregate II ranged from

west to north. Segregate III was confined largely to flats and segregate IV occurred exclusively in draws. The aspects of all of the stands in segregates III and IV contained a northerly component. On the basis of these observations, it was maintained that, toward the xeric end of the vegetational gradient, form had little effect on species segregation and aspect was the controlling factor. Toward the mesic terminus, form was the major controlling factor, and the segregates were more or less separated on the basis thereof.

One of the elements which comprised the Importance Value was relative density; see Tables XIX to XXII (pages 62 to 66) which were arranged in the same manner as the previous Importance Value tables.

Examination of the relative density values showed that draws of north aspect supported vegetation similar to that of the northwest slope of Pine Mountain, near Limestone Creek, Whitley County, Kentucky (Braun, 1950). Braun designated this as a Sugar Maple-Basswood-Buckeye-Tuliptree segregate. Relative densities appear in Table XXII, page 65.

The vegetation of draws of northwest aspect were found to be similar to those described by Braun (1950) from the west-facing escarpment of the Cumberland Plateau, near Cowan, Tennessee (Table XXII). Major differences were the high value of Magnolia acuminata and the low value of Fraxinus americana in the Cowan, Tennessee, community as compared with the Ash Log Mountain community.

Another component of the Importance Value is relative basal area (Tables XXIII to XXVI, pages 67 to 71). On the basis of this element, leads of west-northwest aspect on Ash Log Mountain were found

to correspond to draws of north aspect on Wilson Mountain (Martin, 1966). This correspondence of vegetation on sites of dissimilar form and aspect was believed to reflect differential protection. As stated in the description, the study area was protected by high ridges within 2 miles on all aspects but the west. The slopes of Wilson Mountain were relatively exposed, the ridges being 2.5 to 4.5 miles apart.

The Association-Segregates

The arrangement of synthetic stands in the previous tables into groups and their notation as segregates implies the writer's belief that the vegetation at hand should best be considered segments of a vegetational gradient. Four segregates have been recognized on the basis of the species with the highest Importance Values across forms and aspects. For the purposes of description, a dominant is here defined as a taxon with an Importance Value greater than twenty units.

Chestnut Oak-Black Locust Segregate (I)

This segregate was dominated by *Quercus Prinus* and *Robinia pseudoacacia*. *Quercus borealis* var. *maxima*, *Liriodendron tulipifera*, *Nyssa sylvatica*, and *Acer rubrum* may become prominent. This segregate occurred on leads and in draws of westerly and southwesterly aspect. No single species in this or in any other segregate here considered had an Importance Value as high as that reached by *Quercus Prinus* on these sites. The closest numerical values to those in the present study were reported by Caplenor (1965) on southwest-facing talus slopes at Fall Creek Falls State Park. However, this first segregate was

doubtless a variant of the chestnut oak forest which occurred widely in the Appalachians (from southern New England into Georgia and Alabama; designated Type 44 by the Society of American Foresters, 1954). This segregate was unique in several ways. Of all the segregates, it supported the highest mean density (250 stems/acre) but showed the widest range from minimum to maximum density (160-307 stems/acre, Table XIX, page 62). Absolute basal area (157 ft.^{2}) was lower than in any other segregate (Table XXIII, page 67). Mean (10), maximum (11), minimum (9), and total number of taxa (16) were also lower than in any other segregate (Table XIX). Herb cover averaged about 10 per cent, and shrub cover averaged about 25 per cent (Table XXVII). These were, respectively, the highest and lowest values found and constitute a reversal of the situation encountered in the other segregates. Shrub cover in this segregate consisted largely of ericacious shrubs (Vaccinium spp., Kalmia latifolia) and Smilax rotundifolia, but Acer rubrum often formed a dense understory. Quercus borealis var. maxima had the highest seedling count (5 seedlings/plot), and Q. Prinus was second (4 seedlings/plot) (Table XIX). Quercus Prinus was the most dense single species in the sapling class (5 saplings/plot) in Table XXVIII but the frequencies of Acer rubrum and Quercus velutina were higher.

Examination of the seedling (Table XXVII) and sapling (Table XXVIII) counts in this segregate shows all but two of the dominants occurring in one or both classes. Quercus borealis var. maxima did not occur in the sapling class but was the most important taxon in the seedling class. Robinia pseudoacacia and Liriodendron tulipifera occurred in neither the seedling nor the sapling class. This indicates

TABLE XXVII

MEAN COUNT AND FREQUENCY, BY SEGREGATE, OF SEEDLINGS OF TREE TAXA, MEAN PER CENT HERB COVER, AND MEAN PER CENT SHRUB COVER WITHIN HERB PLOTS

Taxa	I[a] 2[b]		II 10		III 10		IV 15	
	Count	Freq.	Count	Freq.	Count	Freq.	Count	Freq.
Acer saccharum	1	0.50	8	0.30	13	0.60	18	0.75
Quercus borealis var. maxima	5	0.50	1	0.20	-	--	+	0.13
Robinia pseudoacacia	-	--	+	0.10	-	--	+	0.13
Fraxinus americana	-	--	+	0.20	4	0.40	2	0.40
Quercus Prinus	4	0.50	1	0.10	1	0.10	-	--
Carya cordiformis	-	--	-	--	+	0.10	-	--
Prunus serotina	-	--	-	--	-	--	+	0.07
Carya ovata	-	--	+	0.10	-	--	-	--
Nyssa sylvatica	-	--	-	--	+	0.10	+	0.07
Magnolia acuminata	-	--	+	0.10	-	--	+	0.07
Cornus florida	+	0.50	-	--	-	--	+	0.13
Acer rubrum	2	0.50	+	0.10	-	--	+	0.07
Ostrya virginiana	-	--	-	--	-	--	+	0.07
Sassafras albidum	-	--	+	0.10	-	--	-	--
Betula lenta	-	--	-	--	-	--	+	0.07
Oxydendrum arboreum	-	--	+	0.10	-	--	-	--
	Herb Cover (%)							
All taxa	10.0		34.2		68.6		37.0	
	Shrub Cover (%)							
All taxa	25.0		10.0		3.6		8.5	

[a] Segregate

[b] Number of plots

+Present, but fewer than 0.5 per plot

TABLE XXVIII

MEAN COUNT AND FREQUENCY, BY SEGREGATE, OF SAPLINGS OF TREE TAXA WITHIN SAPLING PLOTS

Taxa	I[a] 3[b]		II 18		III 16		IV 13	
	Count	Freq.	Count	Freq.	Count	Freq.	Count	Freq.
Acer saccharum	2	0.33	14	0.83	18	1.00	4	0.69
Quercus borealis var. maxima	-	--	1	0.28	1	0.33	+	0.08
Liriodendron tulipifera	-	--	+	0.06	-	--	+	0.23
Robinia pseudoacacia	-	--	+	0.22	1	0.17	-	--
Fraxinus americana	-	--	2	0.56	2	0.50	1	0.69
Quercus Prinus	5	0.67	1	0.39	-	--	1	0.15
Tilia sp.	-	--	1	0.33	1	0.50	+	0.15
Aesculus octandra	-	--	+	0.22	1	0.33	+	0.31
Carya cordiformis	-	--	+	0.11	-	--	-	--
Prunus serotina	-	--	+	0.06	-	--	+	0.08
Carya ovata	1	0.67	+	0.17	-	--	+	0.08
C. ovalis	-	--	+	0.06	+	0.17	+	0.08
Nyssa sylvatica	2	0.33	+	0.11	2	0.17	-	--
Quercus alba	-	--	+	0.06	-	--	-	--
Magnolia acuminata	-	--	+	0.06	1	0.16	+	0.08
Cornus florida	3	0.67	1	0.39	2	0.50	1	0.31
Acer rubrum	2	0.10	2	0.22	-	--	-	--
Quercus velutina	2	0.10	+	0.22	-	--	+	0.08
Ostrya virginiana	-	--	+	0.11	-	--	+	0.23
Sassafras albidum	-	--	1	0.33	+	0.17	-	--
Cladrastis lutea	-	--	-	--	1	0.17	+	0.08
Betula lenta	-	--	-	--	-	--	+	0.23
Oxydendrum arboreum	1	0.67	1	0.17	-	--	-	--
Quercus coccinea	-	--	+	0.06	-	--	-	--
Q. Schumardii	+	0.33	+	0.06	-	--	-	--
Castanea dentata	-	--	+	0.17	+	0.17	+	0.23

[a]Segregate

[b]Number of plots

+Present, but fewer than 0.5 per plot

their failure to reproduce successfully and means that their place among the dominant taxa is temporary and may have resulted from previous disturbance.

Red Oak-Sugar Maple-Black Locust Segregates (II)

This segregate was dominated by Quercus borealis var. maxima, Acer saccharum, and Robinia pseudoacacia. Liriodendron tulipifera, Quercus Prinus, and Carya cordiformis were important associates. Fraxinus americana, Tilia sp., and Prunus serotina were minor associates and 18 other tree taxa occur. This segregate occurred on all of the topographic forms considered. On leads it occurred from westerly to northerly aspects; in draws on westerly and west-northwesterly aspects, and on flat slopes, on west-northwesterly aspects. None of the representatives of this segregate were deemed comparable to communities described by Braun (1950), Caplenor (1965), or Martin (1966).

Mean (226 stems/acre) and maximum (268 stems/acre) density values were slightly less than in segregate I; minimum density (165 stems/acre) was slightly lower. Basal area values, mean (178 ft.^{2}/acre), minimum (148 ft.^{2}/acre) and maximum (231 ft.^{2}/acre) were intermediate between those of segregates I and III (described below). Mean number of taxa (21) and maximum number of taxa (27) was high, and probably reflects the large size of the sample (1,388 stems) rather than any floristic diversity associated with this segregate.

Excepting Carya cordiformis, Tilia sp., Liriodendron tulipifera, and Prunus serotina, all of the important taxa occurred in both sapling and seedling classes. The above four taxa occur only in the sapling class.

They were regarded as associates which occasionally assumed dominant status--not dominants characteristic of the segregate. Their failure to appear in the seedling class is regarded as a result of sampling more than a uniform failure to reproduce. Robinia pseudoacacia appeared in both seedling and sapling classes but counts were low (lower, in fact, than stem numbers of taxa which were less important in the overstory). Here, though the taxon was reproducing, the writer questions its ability to maintain itself as a dominant with such low rates of reproduction, and suggests that, as in segregate I, its role as a dominant is temporary.

Sugar Maple-Red Oak-Tuliptree-Basswood Segregate (III)

This segregate occurred largely on flat slopes whereon aspects had a northerly component. Acer saccharum, Quercus borealis var. maxima, Liriodendron tulipifera, and Tilia sp. were the dominants. Fraxinus americana and Carya ovata were the principal associates and 17 other taxa occur in the canopy. A striking feature of this segregate was that there was little variation in the ranking of the dominants. Acer saccharum was generally the leading dominant and Quercus borealis var. maxima was the second most important species, except on the NW flat, where the importance values of the two were nearly the same. Liriodendron tulipifera and Tilia sp., though ranking as dominants, never moved beyond the third rank, and the former was generally more important than the latter.

A feature of this segregate was the absence of Quercus Prinus and the increased importance of recognized mesophytes such as Aesculus octandra and Ostrya virginiana.

Mean density (242 stems/acre) was intermediate among segregates but mean (221 ft.^{2}) maximum (283 ft.^{2}) and minimum (189 ft.^{2}) basal area were the highest among the segregates. Numbers of taxa was intermediate as would be expected from the intermediate numbers of trees sampled (576). Three of the four dominants, Acer saccharum, Quercus borealis var. maxima, and Tilia sp., appear in the sapling sample, but only Acer saccharum was found in the seedling class. No evidence for successful reproduction by Liriodendron tulipifera was found, suggesting that its role as a dominant was temporary or that reproduction was cyclic.

Sugar Maple-Tuliptree-Basswood-Buckeye Segregate (IV)

This segregate was considered by the writer to be the closest approximation of the conceptual Mixed Mesophytic forest community within the study area. First, it contained more dominants than any other segregate considered. Second, it was, in a sense, the most homogeneous; through all the synthetic stands, the dominants were invariably the same: Acer saccharum, Aesculus octandra, Fraxinus americana, Liriodendron tulipifera, Quercus borealis var. maxima, and Tilia sp. Although all of the dominants occurred in all of the synthetic stands of this segregate, in no case was the ranking of the dominants the same in any of the synthetic stands.

It will be noted that Aesculus octandra and Tilia sp. occurred as a block and had low to intermediate importance values, and that Liriodendron tulipifera usually had a higher importance value than either Tilia or Aesculus. Furthermore, no taxon other than the six

enumerated above attained dominant status. As already noted, two of Braun's stands resembled portions of this one: the NNW draw simulates the northwest slope above Limestone Creek, on Pine Mountain, Kentucky (Braun, 1950).

Density, basal area, and numbers of taxa were mostly intermediate to low in this segregate compared to the other three. Only the maximum number of taxa per stand (28) and the total number (29) were extreme values. Herb and shrub cover values were intermediate. All of the dominants occurred in the sapling class. Only Acer saccharum, Fraxinus americana, and Quercus borealis var. maxima occurred in the seedling class.

This segregate occurs exclusively in draws wherein aspects contained northerly components.

Diameter Distribution

The distribution of tree diameters in the stand is a source of information not always tapped in ecological studies. Reconnaisance of the area revealed Quercus borealis var. maxima with diameters to 51.6 dbh. However, the largest trees measured in the study were 38-40 inches and doubtless over 200 years of age. The recent death of Castanea dentata may have had profound effects upon stand history and stability.

Comparison of all stems, leads, flat and draw stems, and of Robinia and Liriodendron stems was instructive (Table XXIX). The general negative slope often shown (Meyer, 1952) appears in all cases--suggestive of a forest composed of non-cyclic, reproducing, shade-tolerant trees.

TABLE XXIX

DIAMETER DISTRIBUTION OF TREE TAXA AS A PER CENT OF TOTAL NUMBER OF STEMS

dbh (in.)	Total 3617[a]	Leads 1307[a]	Flats 599[a]	Draws 1311[a]	Robinia Total 280[a]	Liriodendron Total 393[a]	Claiborne County[b] All Hardwoods dbh (in.)	14.5x10[6a]
4- 5.9	20.0	18.9	19.2	21.4	23.9	17.0	5- 6.9	44.6
6- 7.9	16.0	16.7	16.5	15.1	24.6	18.1	7- 8.9	22.6
8- 9.9	14.4	14.2	14.2	14.7	21.4	15.0	9-10.9	13.7
10-11.9	12.9	13.2	9.5	14.1	18.2	16.5	11-12.9	7.9
12-13.9	10.9	10.8	11.5	10.8	7.5	15.8	13-14.9	4.5
14-15.9	7.5	8.4	7.0	6.7	2.9	8.4	15+	6.6
16-17.9	5.3	4.6	7.2	5.0	0.7	3.1	--	--
18-19.9	4.3	4.4	5.5	3.7	0.4	1.5	--	--
20-21.9	3.4	3.3	3.5	3.4	0.4	2.3	--	--
22-23.9	1.9	1.7	2.7	1.7	--	1.5	--	--
24-25.9	1.6	2.0	1.2	1.3	--	0.3	--	--
26-26.9	0.8	0.8	0.2	1.1	--	0.3	--	--
28-29.9	0.5	0.5	0.8	0.3	--	--	--	--
30-31.9	0.4	0.3	0.5	0.4	--	--	--	--
32-33.9	0.1	0.2	--	0.2	--	--	--	--
34-35.9	0.2	0.1	0.3	0.2	--	0.3	--	--
36-37.9	--	--	--	--	--	--	--	--
38-39.9	0.1	--	0.2	--	--	--	--	--

[a]Number of stems in the sample

[b]R. Kilbourne. 1960. Forest Inventory Statistics for Claiborne County, Tennessee. Tennessee Valley Authority, Forest Bulletin No. 79, Norris, Tennessee, pp. 16.

Diameter distribution of Robinia and Liriodendron exhibited peaks in the 4-16 inch diameter classes (Robinia 4-11; Liriodendron, 6-15.9) in contrast to all taxa (Table XXIX, page 82). These small diameters are suggestive of wind seeding following death of Castanea in the 1930's.

The diameter distribution of the stand on Ash Log Mountain was compared with the diameter distribution of the merchantable hardwood forests of Claiborne County (Kilbourne, 1960). The differences were striking. The forests of Claiborne County had over twice the proportion of small trees (5-6.9 inches) than had the Ash Log Mountain study area. Furthermore, the decrease in the number of stems with increase in diameter was much more rapid in the Claiborne County forest data. Finally, the number of trees 15 in. dbh and over was extremely small (6.6 per cent in Claiborne County compared against 18.6 per cent on Ash Log Mountain). It is believed this is most probably due to short cutting cycles resulting in many young, secondary stands throughout Claiborne County.

Veracity of the Segregates

The occurrence of the chestnut oak forest (Segregate I), in view of its wide Appalachian distribution, is not surprising here. The occurrence of more or less typical undifferentiated Mixed Mesophytic so close to its type area indeed was to be expected in mid elevation, protected, north-facing slopes.

The importance of Robinia in two of the segregates is attributed to death of chestnut or small-scale selective cutting.

The apparent absence of the red oak-sugar maple-black locust (II) and sugar maple-red oak-tulip tree-basswood (III) segregates in the southern Appalachian ecological literature is surprising. Many segregates have been described or at least noted (Braun, 1950). The proximity of fields now dominated by Liriodendron suggests the possibility that these may be the result, in part, of disturbance. Evidence supporting disturbance includes the presence of stumps and of fire damage, but tree size and age, size-inferred age distribution and reproduction argues against disturbance.

Stump density for the area as a whole was 1.4 per cent of the live tree density (3 stumps/acre) and equal to 3.6 per cent (6.8 ft.^{2}/acre) of the live tree basal area. No stumps were found in segregate I. In segregate II, the stump density was 4 stumps/acre (1.7 per cent of live tree density) and stump basal area is 7.5 ft.^{2}/acre (4.2 per cent of live tree basal area). Segregate III had a stump density of two stumps/acre (0.7 per cent of live tree density with a stump basal area of 2.2 ft.^{2}/acre (1 per cent of live tree basal area). Stump density in segregate IV was 1.8 per cent of the live tree density (4 stumps/acre) and stumps accounted for 7.2 ft.^{2}/acre of basal area (4 per cent of the live tree basal area). The absence of stumps in segregate I suggested that these were not stumps of Castanea dentata removed after its death, but that other prominant taxa in the segregates have been selectively removed.

That ground fires had occurred in the study area was evidenced by scars on a number of living trees. Over the entire area, 7.4

per cent of the trees sampled bore apparent fire scars. By segregate, the values were as follows: Segregate I, 4.1 per cent (10 trees/acre); segregate II, 8.7 per cent (20 trees/acre); segregate III, 7.1 per cent (17 trees/acre); segregate IV, 5.4 per cent (12 trees/acre). The decrease in fire damage from segregates II to IV was to be expected on the grounds that the increasingly mesic conditions would have been less conducive to the persistance and spread of fire. The low value obtained in segregate I is surprising in view of the fact that it occupies the most xeric sites, whereon fire would be most likely to occur. The explanation for this is not known, nor does the writer wish to advance a hypothesis at this time. These above figures include upslope basal overgrown dead areas. Whether independently diseased boles were included in the fire-scarred bole-count is not known, but such an inclusion would increase the percentages cited above. Aspectually, the area gives no evidence of repeated ground fires but the possibility of periodic ground fire exists nonetheless. The effect of light understory burns would be that of reducing understory density probably allowing more shade intolerant taxa, such as Robinia and Liriodendron, to survive. It should be noted that, during at least 8 years prior to its destruction by logging and strip-mining, the study area was free from fire (personal communication, Otis J. Carroll, June, 1968).

Climax Adaptation Numbers of the Tree Taxa

On the basis of the position of their Importance Value peaks in the form and aspect arrangement, most taxa have been assigned climax

adaptation numbers (Curtis and McIntosh, 1951). Quercus Prinus and Tilia sp. were selected as the taxa for the xerix and mesic terminals of the arrangement. Q. Prinus was assigned a climax adaptation number of two (H. R. DeSelm, personal communication, May, 1969) and Tilia sp. a number of 10, as suggested by Brown and Curtis (1952). The numbers appear in Table XXX along with some of the values obtained by other workers. Some taxa were omitted because they occurred only in a group of sample points which were too few to be considered an adequate sample of the site type they represented. Also, the values obtained for the several species of Carya were dubious because of the difficulties encountered in determining species within this genus.

Brown and Curtis (1952) state that the climax adaptation numbers should be regarded as relative rather than absolute values, and that they are indicative of the ability of different species to compete successfully with each other. Species which have similar climax adaptation numbers are more likely to occur together than species with widely differing numbers since the former will be effective competitors in the same environment. No explanation can be presented for the disagreements in the values of Acer saccharum and A. rubrum with those of Brown and Curtis since very similar values were obtained for these taxa in Wisconsin and in the southern Blue Ridge (Great Smoky Mountains). It is suggested that a part of the answer may be that there exist several races within the species and that the differences are reflected in the different climax adaptation numbers found in the several regions. Kriebel (1957) found statistically significant ecotypic variation,

TABLE XXX

CLIMAX ADAPTATION NUMBERS OF TREE TAXA OF ASH LOG MOUNTAIN AND OTHER STUDY AREAS

Taxa	Ash Log Mountain	Great Smoky Mountains[a]	SW Wisconsin[a]	N Wisconsin[a]	New Jersey[b]
Quercus Prinus	2.0	--	--	--	2.0
Cornus florida	2.0	--	--	--	7.0
Oxydendrum arboreum	2.0	--	--	--	--
Quercus velutina	2.4	3.9	2.0	--	7.0
Carya glabra	2.4	--	--	--	--
Robinia pseudoacacia	2.8	--	--	--	--
Acer rubrum	3.1	6.4	7.0	6.0	7.0
Quercus Schumardii	3.1	--	--	--	--
Nyssa sylvatica	3.1	--	--	--	4.0
Quercus alba	3.5	4.1	4.0	4.0	6.0
Q. coccinea	3.5	--	--	--	2.0
Sassafras albidum	3.9	--	--	--	4.0
Carya cordiformis	4.3	--	--	8.0	8.0
C. ovalis	4.3	--	--	--	--
Betula lenta	5.8	--	--	--	5.0
Quercus borealis var. maxima	6.2	6.8	6.0	6.0	4.0
Prunus serotina	6.2	--	--	4.0	4.0
Carya ovata	6.6	--	--	--	--
Acer saccharum	6.9	9.4	10.0	10.0	9.0
Juglans cinerea	6.9	--	--	5.0	4.0
Magnolia acuminata	6.9	--	--	--	--
Juglans nigra	7.7	--	--	--	4.0
Fraxinus americana	8.5	--	--	8.0	8.0
Cladrastis lutea	8.5	--	--	--	--
Liriodendron tulipifera	9.2	--	--	--	6.0
Betula nigra	9.2	--	--	--	--
Tilia sp.	10.0	--	--	8.0	9.0
Aesculus octandra	10.0	--	--	--	--
Ostrya virginiana	10.0	--	--	9.0	9.0
Carya sp.	10.0	--	--	--	5.0

TABLE XXX (continued)

[a]R. T. Brown and J. T. Curtis. 1952. The upland conifer-hardwood forests of northern Wisconsin. Ecol. Monog. 22(3):217-234.

[b]M. F. Buell, A. N. Langford, D. W. Davidson, and L. F. Ohmann. 1966. The upland forest continuum in northern New Jersey. Ecology 47:416-432.

with respect to seed source, in Acer saccharum for susceptability to sun-scorch, for frost hardiness, initiation of growth, and drought resistance. This last is of particular interest since a moisture gradient is here postulated.

Conclusions

The upper north-facing slope of Ash Log Mountain supported a vegetation which changed perceptibly along environmental gradients. Several elements comprised the total vegetation as evidenced by the fact that a comparable stand could be obtained only by combining geographically and ecologically distinct communities already described in the literature (Braun, 1950).

Grouping samples by topographic form revealed incipient segregation. Liriodendron tulipifera, Fraxinus americana, Tilia sp., and Aesculus octandra reached their greatest importance in the draws. Quercus borealis var. maxima, Robinia pseudoacacia, Quercus Prinus, and Carya cordiformis were most important on leads. Acer saccharum reached its highest value on flat slopes. It was suggested that taxa which exhibit a wide change in Importance Value per unit change in topographic form are more site sensitive than those taxa which suffer smaller changes. Certain of the synthetic draw and flat stands were found to be similar to communities described by Braun (1950) at Pine Mountain and Log Mountain in the Kentucky portion of the Cumberland Mountains.

When aspect was considered alone, it was found that Acer saccharum, Quercus borealis var. maxima, Liriodendron tulipifera, Fraxinus

americana, Tilia sp., and Aesculus octandra and several other mesophytes of minor importance were most prominent on sites with northerly aspects. Quercus Prinus, Nyssa sylvatica, Acer rubrum, Cornus florida, Oxydendrum arboreum, and Quercus coccinea attained their greatest importance on sites of southwesterly and west-southwesterly aspect. Robinia pseudo-acacia, Carya cordiformis, C. ovalis, C. glabra, Quercus alba, Q. velutina were prominent on intermediate sites.

Aesculus octandra and Quercus borealis var. maxima exhibited double Importance Value peaks around the peak of Acer saccharum. This is interpreted as the result of shade-dependent interference, by A. saccharum, with seedling survival of the other taxa.

Samples were grouped by aspect and form, and the array divided into four "segregates" designated, from zeric to mesic, I to IV. It is maintained that, toward the xeric end of the gradient, aspect is more important than form in controlling species segregation, but toward the mesic terminus, form is the major controlling factor.

Leads of west-northwest aspect at Ash Log Mountain supported vegetation similar to that of the north draws of Wilson Mountain (Martin, 1966). The similarity in vegetation in dissimilar sites is thought to reflect the differences in protection and maximum elevation of the slopes of the two mountains.

Of the four segregates recognized in the study area on Ash Log Mountain, segregate I was dominated by Quercus Prinus and Robinia pseudoacacia. It was considered a variant of Appalachian chestnut oak forest rather than a derivative of the Mixed Mesophytic forest. This segregate had the highest mean density and the lowest mean basal area

of all segregates, and herb cover was exceeded by shrub cover which consisted largely of ericads. Robinia pseudoacacia was not found in the understory, suggesting that its dominance was temporary. The occurrence of this segregate is largely controlled by aspect as it is found only on sites facing southwest and west-southwest.

Segregate II was dominated by Quercus borealis var. maxima, Acer saccharum, and Robinia pseudoacacia. It occurred on all topographic forms and from westerly to northerly aspects. Mean density was low among the segregates, and mean basal area was intermediate. Mean number of tree taxa was high, but total number of tree taxa was intermediate (the high mean most probably reflects the large sample size). Robinia pseudoacacia was thought to be a temporary dominant here too, since it played only a minor role in the understory.

Segregate III was dominated by Acer saccharum, Quercus borealis var. maxima, Liriodendron tulipifera, and Tilia sp. and occurred largely on flat slopes of northerly aspect. There was very little variation in the ranking of the dominants. This segregate supported the highest basal area of any considered here. Mean density was intermediate among that of the other segregates.

Segregate IV was regarded by the writer to be the closest approximation of the conceptual Mixed Mesophytic forest community in the study area. The dominants were Acer saccharum, Aesculus octandra, Fraxinus americana, Liriodendron tulipifera, Quercus borealis var. maxima, and Tilia sp. Among the four synthetic stands, the ranking of the dominants in each was different. Two of the synthetic stands were similar to the Mixed Mesophytic communities described by Braun (1950) at

Pine Mountain, Kentucky, and at Cowan, Tennessee. This segregate was restricted exclusively to draws of northerly aspect.

Examination of the diameter distribution of all taxa indicated that the forest was composed of largely non-cyclic reproducing, shade-tolerant taxa. By contrast, Robinia pseudoacacia and Liriodendron tulipifera exhibited unusually high densities in the 4-16 inch diameter classes suggesting that these taxa had increased in density after some previous disturbance. Evidence existed in the study area for two types of disturbances--selective cutting and fire. Segregates II and IV had the highest stump densities which indicated that taxa prominant in those segregates had experienced some selective cutting. No stumps occurred in segregate I which area also showed the least fire damage. This was surprising since it was the most xeric of the segregates. The decrease in fire damage with increasingly mesic conditions that occurred across the other three segregates was to be expected. No fires occurred during the 8 year period prior to the study and the study area did not appear to have experienced repeated ground fires.

Climax adaptation numbers (Curtis and McIntosh, 1951) were assigned to most of the taxa. Values calculated for taxa at Ash Log Mountain were generally in agreement with those obtained by other workers for the same taxa in other areas. Acer saccharum and A. rubrum were notable exceptions. It was postulated that these disagreements may result from the existence of several races of different geographic distribution since ecotypic variation has already been found in the former taxon with respect to several environmental factors (Kriebel, 1957).

VI. SUMMARY

The quarters plotless sampling method was applied to a stand of Mixed Mesophytic forest vegetation. Sample points were grouped on the basis of specified physical characteristics to obtain synthetic stands, and the vegetational features of these stands were examined. The following statements can be made with regard to the study area:

1. This Mixed Mesophytic forest community is here not homogeneous but shows variation in composition on different site types.

2. The pattern of variation is not without order but follows a clearly distinguishable gradient, believed to be determined primarily by availability of moisture.

3. The association-segregates defined here represent various segments of the vegetational continuum. That is, there exists within the study area no physically or compositionally central forest type from which the association-segregates arise. What exists is, instead, a spectrum of forest types, and the association-segregates are segments thereof. Since no distinct bounds exist between the parts of the continuum, in agreement with Braun's concept, no rigid limits can be set on the number of dominants or the areal extend of the association-segregates.

4. In light of the gradational nature of the variations in vegetation found by this writer and by several others (Curtis and McIntosh, Mowbray and Oosting, Whittaker), by induction, it is maintained that Braun's proposal of an undifferentiated forest type as the

source of the association-segregate is incorrect. Instead, it is believed that the association-segregates proposed by Braun, in fact, represent segments of a vegetational continuum and are not simplified derivatives of a compositionally central community.

5. Four segregates have been described, and these may be recognized in the field by the density of certain taxa in each. In segregate I, Quercus Prinus is overwhelmingly important and Robinia pseudoacacia and Nyssa sylvatica are also important. In segregates II and III, Acer saccharum and Quercus borealis var. maxima usually exceeds that of A. saccharum, but it may be equal of or less, in which case the importance of Liriodendron tulipifera and R. pseudoacacia increases. In segregate III the importance of A. saccharum exceeds that of Q. borealis var. maxima, but L. tulipifera and Tilia sp. are both also important. In segregate IV, L. tulipifera, A. saccharum, and Fraxinus americana are the most important taxa. Q. borealis var. maxima, Aesculus octandra, and Tilia sp. are also dominants.

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APPENDIXES

APPENDIX A

FORMULAS USED IN COMPUTATION

Key:

A.D.:	absolute density
R.D.:	relative density
A.B.A.:	absolute basal area
R.B.A.:	relative basal area
M.B.A.:	mean basal area
d:	distance, $\bar{d}$ mean distance, $\bar{x}d^2$ mean distance squared
F:	frequency
R.F.:	relative frequency
n:	number of observations
I.V.:	importance value
cos a:	cosine of slope angle "a"

$$\text{A.D.}_{\text{all taxa}} = \frac{43560}{\overline{d}^2_{\text{point-tree, corrected}}}$$

$$\text{R.D.}_{\text{taxon a}} = \frac{n_{\text{observations, taxon a}}}{n_{\text{observations, all taxa}}}$$

$$\text{A.D.}_{\text{taxon a}} = \text{A.D.}_{\text{all taxa}} \times \text{R.D.}_{\text{taxon a}}$$

$$\text{R.B.A.}_{\text{taxon a}} = \frac{\text{sum n B.A. taxon a}}{\text{sum n B.A. all taxa}}$$

$$\text{M.B.A.}_{\text{taxon a}} = \frac{\text{sum n B.A. taxon a}}{n_{\text{observations, taxon a}}}$$

$$\text{A.B.A.}_{\text{taxon a}} = \text{A.D.}_{\text{taxon a}} \times \text{M.B.A.}_{\text{taxon a}}$$

$$\text{A.B.A.}_{\text{all taxa}} = \text{A.B.A.}_{\text{taxon a}} + \text{A.B.A.}_{\text{taxon b}} + \cdots\cdots\cdots\cdots$$

$$F_{\text{taxon a}} = \frac{n_{\text{points or plots at which taxon a occurs}}}{n_{\text{total number of points or plots}}}$$

$$\text{R.F.}_{\text{taxon a}} = \frac{F._{\text{taxon a}}}{F._{\text{taxon a}} + F._{\text{taxon b}} + F._{\text{taxon c}} + \cdots\cdots\cdots\cdots}$$

$$\text{I.V.+}_{\text{taxon a}} = \text{R.D.}_{\text{taxon a}} + \text{R.B.A.}_{\text{taxon a}} + \text{R.F.}_{\text{taxon a}}$$

$$d_{\text{corrected: flat slopes}} = d_{\text{observed}} \sqrt{(.71 \cos a)^2 + (.71)^2}$$

$$d_{\text{corrected: leads, draws}} = d_{\text{observed}} \sqrt{(.67 \cos a)^2 + (.67)^2}$$

$$\text{\% change in I.V. per unit change in an environmental gradient} = \frac{\frac{\text{I.V. max} - \text{I.V. min}}{\text{I.V. max}}}{\text{number of units spanned from I.V. max to I.V. min}}$$

APPENDIX B

TABLE XXXI

RELATIVE FREQUENCIES OF THE TREE TAXA ON ASH LOG MOUNTAIN; NO SUBDIVISION (3,264 TREES)

Taxa	Relative Frequency
Acer saccharum	12.5
Quercus borealis var. maxima	13.2
Liriodendron tulipifera	11.7
Robinia pseudoacacia	8.6
Fraxinus americana	6.9
Quercus Prinus	4.8
Tilia sp.	6.0
Aesculus octandra	4.4
Carya cordiformis	3.5
Prunus serotina	3.3
Carya ovata	3.0
C. ovalis	3.0
C. glabra	2.7
Nyssa sylvatica	2.4
Quercus alba	1.5
Magnolia acuminata	1.9
Cornus florida	2.3
Acer rubrum	1.7
Quercus velutina	1.4
Ostrya virginiana	1.1
Juglans cinerea	1.2
J. nigra	0.5
Sassafras albidum	0.5
Carya sp.	0.3
Cladrastis lutea	0.4
Betula lenta	0.4
Quercus coccinea	0.5
Oxydendrum arboreum	0.3
Fagus grandifolia	0.1
Quercus Schumardii	0.1
Betula nigra	+
Halesia carolina	+

+Present, but value less than 0.05.

TABLE XXXII

RELATIVE FREQUENCIES OF THE TREE TAXA OF SAMPLE POINTS GROUPED BY FORM

Taxa	Lead[a] 1277[b]	Flat 602	Draw 1393
Acer saccharum	10.6	16.2	13.4
Quercus borealis var. maxima	15.4	15.2	10.7
Liriodendron tulipifera	6.2	9.3	16.1
Robinia pseudoacacia	13.0	5.6	5.4
Fraxinus americana	3.3	9.0	9.7
Quercus Prinus	7.9	1.9	2.8
Tilia sp.	3.2	6.8	8.6
Aesculus octandra	0.5	5.3	7.8
Carya cordiformis	5.0	2.5	2.6
Prunus serotina	4.4	2.5	2.7
Carya ovata	2.9	4.5	2.7
C. ovalis	4.4	3.4	1.6
C. glabra	3.5	1.2	2.4
Nyssa sylvatica	3.8	0.6	1.8
Quercus alba	1.8	0.6	1.5
Magnolia acuminata	1.5	3.4	1.8
Cornus florida	2.8	2.5	1.8
Acer rubrum	3.1	0.6	0.8
Quercus velutina	2.4	0.3	0.7
Ostrya virginiana	0.6	0.6	1.7
Juglans cinerea	1.1	2.8	0.9
J. nigra	0.3	1.6	0.5
Sassafras albidum	0.9	0.3	0.3
Carya sp.	+	0.6	0.4
Cladrastis lutea	--	0.6	0.6
Betula lenta	--	0.6	0.7
Quercus coccinea	1.0	--	0.1
Oxydendrum arboreum	0.2	0.3	0.3
Fagus grandifolia	0.2	--	0.1
Quercus Schumardii	0.3	--	--
Betula nigra	--	--	0.1
Halesia carolina	--	0.3	--

[a]Form

[b]Number of trees

+Present, but value less than 0.05

TABLE XXXIII

RELATIVE FREQUENCIES OF THE TREE TAXA OF THE SAMPLE POINTS GROUPED BY ASPECT

Taxa	SW[a] 63[b]	WSW 95	W 187	WNW 485	NW 667	NNW 732	N 701	NNE 291	NE 57
Acer saccharum	2.5	1.5	8.5	9.9	9.9	14.1	19.6	20.2	14.3
Quercus borealis var. maxima	7.5	5.8	10.6	13.0	15.4	11.8	15.5	12.6	16.7
Liriodendron tulipifera	10.0	5.8	7.0	5.7	11.2	11.9	10.6	11.7	11.9
Robinia pseudoacacia	17.5	11.6	12.7	11.2	9.2	9.6	5.3	2.2	4.8
Fraxinus americana	--	--	0.7	4.4	5.4	8.7	10.6	12.1	2.4
Quercus Prinus	32.5	31.9	14.1	6.5	3.1	2.7	0.8	--	--
Tilia sp.	--	--	2.1	3.4	6.5	8.7	7.6	7.2	4.8
Aesculus octandra	--	--	--	2.6	4.7	6.8	4.9	6.7	7.1
Carya cordiformis	--	1.5	4.9	8.1	3.4	2.5	1.8	1.8	4.8
Prunus serotina	--	--	3.5	3.6	3.1	3.2	4.5	3.1	2.4
Carya ovata	--	--	2.1	2.3	2.9	3.4	3.1	4.9	7.1
C. ovalis	5.0	--	3.5	4.4	4.3	2.1	2.2	2.7	2.4
C. glabra	2.5	2.9	5.6	2.3	3.4	2.3	1.8	1.4	2.4
Nyssa sylvatica	7.5	15.9	2.1	5.7	2.2	0.9	1.2	0.5	--
Quercus alba	--	--	4.2	4.2	1.6	0.4	0.6	--	--
Magnolia acuminata	--	--	1.4	0.5	1.5	2.5	2.2	4.0	2.4
Cornus florida	5.0	1.5	2.1	2.3	2.2	1.4	3.1	3.6	2.4
Acer rubrum	5.0	8.7	3.5	3.6	2.2	0.4	0.4	--	--
Quercus velutina	--	2.9	2.1	1.8	2.4	0.5	--	1.4	2.4
Ostrya virginiana	--	--	0.7	0.5	0.5	1.8	1.8	0.5	2.4
Juglans cinerea	--	--	0.7	0.8	1.5	2.0	1.0	1.8	--
J. nigra	--	--	0.7	0.8	0.5	0.4	1.0	0.5	2.4
Sassafras albidum	--	--	0.7	1.3	1.3	--	--	--	--
Carya sp.	--	--	--	0.3	--	0.7	0.2	0.5	2.4
Cladrastis lutea	--	--	--	--	0.2	0.7	0.4	0.9	2.4
Betula lenta	--	1.5	--	0.5	0.5	0.7	--	--	--
Quercus coccinea	--	4.4	4.9	--	0.2	--	--	--	--
Oxydendrum arboreum	5.0	1.5	--	--	0.4	--	0.2	--	--
Fagus grandifolia	--	1.5	0.7	--	0.2	--	--	--	--
Quercus Schumardii	--	1.5	0.7	0.3	--	--	--	--	--
Betula nigra	--	--	--	--	0.2	--	--	--	2.4
Halesia carolina	--	--	--	--	--	--	--	--	2.4

[a]Aspect

[b]Number of trees

TABLE XXXIV

RELATIVE FREQUENCIES OF THE TREE TAXA OF THE CHESTNUT OAK-BLACK LOCUST SEGREGATE (I)

Taxa	Draw[a] SW[b] 27[c]	Draw WSW 36	Lead SW 36	Lead WSW 48
Acer saccharum	--	--	4.4	2.8
Quercus borealis var. maxima	--	8.3	13.0	2.8
Liriodendron tulipifera	11.8	4.2	8.7	5.6
Robinia pseudoacacia	11.8	12.5	21.7	11.1
Fraxinus americana	--	--	--	--
Quercus Prinus	35.3	33.3	30.4	30.6
Tilia sp.	--	--	--	--
Aesculus octandra	--	--	--	--
Carya cordiformis	--	--	--	2.8
Prunus serotina	--	--	--	--
Carya ovata	--	--	--	--
C. ovalis	5.9	--	4.4	--
C. glabra	5.9	8.3	--	--
Nyssa sylvatica	5.9	8.3	8.7	25.0
Quercus alba	--	--	--	--
Magnolia acuminata	--	--	--	--
Cornus florida	5.9	4.2	4.4	--
Acer rubrum	5.9	8.3	4.4	8.3
Quercus velutina	--	8.3	--	--
Ostrya virginiana	--	--	--	--
Juglans cinerea	--	--	--	--
J. nigra	--	--	--	--
Sassafras albidum	--	--	--	--
Carya sp.	--	--	--	--
Cladrastis lutea	--	--	--	--
Betula lenta	--	--	--	--
Quercus coccinea	--	4.2	--	5.6
Oxydendrum arboreum	11.8	--	--	--
Fagus grandifolia	--	--	--	2.8
Quercus Schumardii	--	--	--	2.8
Betula nigra	--	--	--	--

[a]Form

[b]Aspect

[c]Number of trees

TABLE XXXV

RELATIVE FREQUENCIES OF THE TREE TAXA OF THE RED OAK-SUGAR MAPLE-BLACK LOCUST SEGREGATE (II)

Taxa	Lead[a] W[b] 118[c]	Lead WNW 245	Lead NW 333	Draw WNW 193	Draw W 57	Lead NNW 256	Flat WNW 48	Lead N 158
Acer saccharum	5.7	6.9	9.0	13.8	13.0	14.8	8.8	19.2
Quercus borealis var. maxima	11.4	13.8	16.1	10.7	8.7	17.2	20.6	21.6
Liriodendron tulipifera	3.4	1.1	5.5	12.0	15.2	3.9	2.9	2.4
Robinia pseudoacacia	13.6	14.9	39.3	6.3	10.9	14.8	14.7	9.6
Fraxinus americana	--	2.1	1.2	5.7	2.2	5.9	11.8	8.0
Quercus Prinus	18.2	10.1	5.1	3.1	4.4	4.9	2.9	3.2
Tilia sp.	--	2.1	3.1	4.4	6.5	3.5	5.9	6.4
Aesculus octandra	--	0.5	0.8	2.5	--	0.5	2.9	0.8
Carya cordiformis	4.5	9.0	5.5	7.6	6.5	4.9	5.9	1.6
Prunus serotina	3.4	4.8	3.9	2.5	4.4	4.4	2.9	8.8
Carya ovata	1.1	2.1	3.1	2.5	4.4	4.4	2.9	1.6
C. ovalis	5.7	4.3	7.1	5.0	--	3.9	2.9	1.6
C. glabra	5.7	3.2	3.6	1.9	6.1	4.4	--	2.4
Nyssa sylvatica	2.3	5.9	3.9	6.9	--	1.0	--	--
Quercus alba	5.7	2.7	2.0	5.7	2.2	0.5	5.9	1.6
Magnolia acuminata	1.1	0.5	1.2	--	2.2	3.0	2.9	2.4
Cornus florida	1.1	3.7	3.5	1.3	2.2	3.0	--	3.2
Acer rubrum	3.4	5.3	4.3	2.5	2.2	1.0	--	0.8
Quercus velutina	2.3	2.1	4.3	1.3	2.2	0.1	2.9	--
Ostrya virginiana	--	--	--	1.3	2.2	0.5	--	3.2
Juglans cinerea	--	1.1	1.6	0.6	2.2	2.0	--	0.8
J. nigra	1.1	0.5	--	1.3	--	--	--	--
Sassafras albidum	--	2.7	1.6	--	2.2	--	--	--
Carya sp.	--	--	--	0.6	--	0.5	--	--
Cladrastis lutea	--	--	--	--	--	--	--	--
Betula lenta	--	--	--	0.6	--	--	2.9	--
Quercus coccinea	8.0	--	0.4	--	--	--	--	--
Oxydendrum arboreum	--	--	0.4	--	--	--	--	0.8
Fagus grandifolia	1.1	--	--	--	--	--	--	--
Quercus Schumardii	1.1	0.5	--	--	--	--	--	--
Betula nigra	--	--	--	--	--	--	--	--

[a]Form

[b]Aspect

[c]Number of trees

TABLE XXXVI

RELATIVE FREQUENCIES OF THE TREE TAXA OF THE SUGAR MAPLE-RED OAK-TULIPTREE-BASSWOOD SEGREGATE (III)

Taxa	Lead[a] NNE[b] 63[c]	Flat NNE 136	Flat N 197	Flat NW 91	Flat NNW 89
Acer saccharum	19.2	20.4	23.0	17.8	15.9
Quercus borealis var. maxima	17.0	13.0	12.9	19.2	14.5
Liriodendron tulipifera	8.5	12.0	7.2	9.6	8.7
Robinia pseudoacacia	6.4	0.9	6.5	6.9	7.3
Fraxinus americana	8.5	8.3	8.6	8.2	13.0
Quercus Prinus	--	--	--	--	--
Tilia sp.	10.6	4.6	7.9	8.2	10.2
Aesculus octandra	--	7.4	4.3	5.5	2.9
Carya cordiformis	2.1	2.8	1.4	1.4	1.5
Prunus serotina	4.3	2.8	2.9	1.4	4.4
Carya ovata	8.5	3.7	3.6	2.7	7.3
C. ovalis	2.1	4.6	4.3	4.1	2.9
C. glabra	--	1.9	1.4	2.7	--
Nyssa sylvatica	--	--	4.3	1.4	--
Quercus alba	--	--	--	--	--
Magnolia acuminata	2.1	5.6	1.4	1.4	2.9
Cornus florida	2.1	3.7	2.9	2.7	1.5
Acer rubrum	--	--	0.7	--	--
Quercus velutina	6.4	--	--	--	--
Ostrya virginiana	2.1	1.9	2.2	--	--
Juglans cinerea	--	3.7	1.4	2.7	4.4
J. nigra	--	0.9	2.2	2.7	2.9
Sassafras albidum	--	--	--	1.4	--
Carya sp.	--	0.9	0.7	--	--
Cladrastis lutea	--	0.9	0.7	--	1.4
Betula lenta	--	--	--	--	--
Quercus coccinea	--	--	--	--	--
Oxydendrum arboreum	--	--	--	--	--
Fagus grandifolia	--	--	--	--	--
Quercus Schumardii	--	--	--	--	--
Betula nigra	--	--	--	--	--

[a]Form

[b]Aspect

[c]Number of trees

TABLE XXXVII

RELATIVE FREQUENCIES OF THE TREE TAXA OF THE SUGAR MAPLE-TULIPTREE-BASSWOOD-BUCKEYE SEGREGATE (IV)

Taxa	Draw[a] NNE[b] 92[c]	Draw N 364	Draw NW 268	Draw NNW 67
Acer saccharum	20.1	17.9	8.4	7.3
Quercus borealis var. maxima	8.6	13.8	13.3	2.5
Liriodendron tulipifera	13.0	17.7	18.2	18.3
Robinia pseudoacacia	1.4	2.4	5.8	6.6
Fraxinus americana	20.1	13.0	9.3	9.7
Quercus Prinus	--	--	1.8	1.7
Tilia sp.	8.6	8.1	9.8	12.1
Aesculus octandra	10.0	7.3	8.9	12.1
Carya cordiformis	--	2.3	1.8	1.0
Prunus serotina	2.9	3.3	2.7	2.1
Carya ovata	4.3	3.7	2.7	1.7
C. ovalis	--	1.2	1.3	0.7
C. glabra	1.4	1.6	3.6	1.4
Nyssa sylvatica	1.4	--	0.4	1.0
Quercus alba	--	0.4	1.8	0.3
Magnolia acuminata	2.9	2.4	1.8	2.1
Cornus florida	4.3	3.3	0.4	0.3
Acer rubrum	--	--	0.4	--
Quercus velutina	--	--	0.9	0.3
Ostrya virginiana	--	0.8	1.3	3.1
Juglans cinerea	--	0.8	0.9	1.4
J. nigra	--	0.8	0.4	--
Sassafras albidum	--	--	0.9	--
Carya sp.	--	--	--	1.0
Cladrastis lutea	--	0.4	0.4	1.4
Betula lenta	--	--	1.3	1.4
Quercus coccinea	--	--	--	--
Oxydendrum arboreum	--	--	0.4	--
Fagus grandifolia	--	--	0.4	--
Quercus Schumardii	--	--	--	--
Betula nigra	--	--	0.4	--

[a]Form

[b]Aspect

[c]Number of trees

VITA

Homero Cabrera was born in the City of New York on July 24, 1946. He received his elementary education in the public schools of that city and was graduated from the High School of Commerce in June, 1963. In September of the same year he entered the City College of New York, and in September, 1967, received therefrom a Bachelor of Science degree in Biology. While attending the City College of New York, he held a New York State Regents Scholarship and was employed through the Federal Work-Study Program as a research assistant to Professor Lawrence J. Crockett in the Department of Biology.

He entered the Graduate School at The University of Tennessee in September, 1967, and was awarded a National Science Foundation Traineeship.