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Forest Cover Photo-Interpretation Key for the Ridge and Valley Forest Habitat Region in Alabama

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Forest Cover Photo-Interpretation For The Ridge and Valley Forest Habitat Region In Alabama

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INTRODUCTION

RELATIVELY FEW forest cover type photo-interpretation keys have been developed for civilian use anywhere and, as far as can be determined from an extensive search of the literature, only two (Parker and Johnson, 1969; and Northrop and Johnson, 1970) have been developed for conditions in Alabama. Furthermore, these two keys are applicable only to very small areas and both require special photography. In order to fill this gap and make aerial photographs more valuable to forest land managers, the Department of Forestry in Auburn University's Agricultural Experiment Station has embarked on a program to construct a key for each of the state's forest habitat regions. This is the third regional key of the series. (Johnson and Sellmann, 1974 and 1975).[1]

The keys represent a departure from current practice in that they are designed for use by humans, not automatic data processing devices, and that they are based primarily on ecological relationships rather than spectral signatures. This general design was chosen because it was felt that the keys should be of use to any land manager in the regions covered, not only to those with access to special aerial photography and to the complex and expensive equipment needed when reflectance patterns are used as the basis for interpretations. In addition, the keys are designed in such a manner that they can be used with either prints or transparencies and with photography taken under a wide range of film-filter-season-scale combinations. They should therefore be of value to most land managers in the areas covered.

Initially, the objective was to prepare keys so that U.S. Department of Agriculture-Agricultural Stabilization and Conservation Service (USDA-ASCS) photographs could be used to stratify forest cover into meaningful cover types. The USDA-ASCS aerial photographic program began operating in the early 1930's with the advent of federal crop control programs. Until recently, these photographs have been made using panchomatic film in cameras equipped with an 8.25-inch focal length lens and a Wratten No. 12 (minus-blue) filter. The photographic scale has been 1:20,000 at approximately mean ground elevation and format size, except for the very earliest photographs, has been 9 x 9 inches. Photographic specifications have recently been changed, for reasons of economy, to a scale of 1:40,000 and the focal length of the camera lens to 6 inches. This key has been developed using the 1:20,000 photographs. However, the key is designed so that it can be used with little or no modification with photographs taken at other scales. Scales larger than 1:10,000, however, would probably display an insufficient area of ground surface on a single stereopair to permit accurate evaluations of topographic positions. This problem would be aggravated if small format sizes (e.g., 70 mm photography) were used. It is possible that the keys could be used with scales as small as 1:100,000 if the base-height ratio was such that a good stereo-image of the ground surface could be obtained. With such small scales, the major problems probably would be associated with branchbottom conditions where evaluations are based on apparent stream width.

The key probably could be used, with little or no modification, with black and white infrared photography, either conventional (exposed through a deep red filter, such as the Wratten 89B) or modified (exposed through a deep yellow filter, such as the Wratten No. 12 "minus-blue" filter). The key undoubtedly could also be used with normal color or infrared color photography.

Because of their flexibility, the keys can be used by organizations electing to obtain their own photography. It is likely that there will be an increase in the use of such photography as a consequence of the decision of the USDA-ASCS to change the scale of its photographs. This decision will reduce agency costs but will increase the costs and inconvenience of its customers. Another factor operating to reduce utilization of USDA-ASCS photography by the forest industry is absence of customer control over photographic contrast and season of photography.

The keys have been designed to indicate probable species composition of the stands being examined. They provide no information on the condition of the stands (i.e., the sizes of trees making up the stands or their density). Stand conditions can be evaluated using a number of procedures that have been described elsewhere (Avery, 1966 and 1968; Moessner, 1960; Spurr, 1960; Wilson *et al*, 1960). Aerial photographs record a situation as of a given point in time.

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[1]It is intended that the publication containing the key for any given forest habitat region be an independent unit incorporating all the information needed for the use of the key for that region. However, much of the written material will be essentially common to several, if not all, of the regions. It would be very difficult to rephrase this material in enough different ways so that the wording would be different from region to region. As a consequence, no attempt will be made to rephrase these common sections nor will they be set off with quotation marks.

The longer the time between film exposure and photo-interpretation, the greater is the probability of errors in interpreting current conditions. Forests are dynamic and change with time. Natural events such as plant succession, insect or disease attacks, or wind-storms may change the species composition in a given area after the photographs are taken. Man-caused changes, such as logging, clearing, planting, or burning, may be even more extensive and profound. For example, introducing species into areas in which they are not native or planting species off their normal sites will completely invalidate any interpretation based on normal species occurrence-site relationships. For these reasons, one must not expect these keys to yield accurate results when photographs are old or where land use has tended to destroy the usual species occurrence-site relationships.

DESCRIPTION OF THE REGION

The location of the Ridge and Valley Forest Habitat Region is shown in generalized form in Figure 1 and in detail on the county maps in Appendix IV. The region abuts the Mountain Forest Habitat Region on the east with the boundary between the two regions coinciding with the base level line (figures 20 and 21) at the base of the slopes. The Ridge and Valley Region surrounds some of the Weisner quartzite outliers and penetrates deep into the Mountain Region along some of the streams (Figure 2).

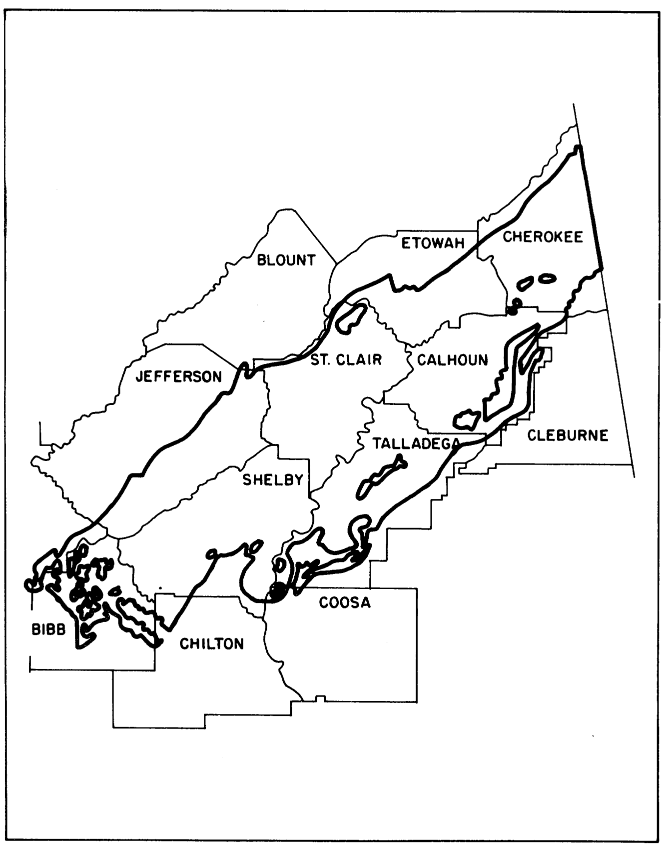

Figure 1. Map of the Ridge and Valley Forest Habitat Region

To the south the Ridge and Valley Region fades into the Coastal Plain along an irregular line, with many outliers of both adjacent regions. To the west the Ridge and Valley Region adjoins the Warrior Basin and Cumberland Plateau Forest Habitat regions. At the south end of this boundary the line of division is topographically indistinct. Just west of Greely, in Tuscaloosa County, the boundary becomes visible with the appearance of Rock Mountain, a narrow ridge which runs northeasterly into the Birmingham area. If it had no breaks, this ridge would form the watershed boundary between the Warrior Basin to the west and the Cahaba River drainage to the east. However, there are several water gaps along its length through which some of the streams east of the ridge drain into the Warrior Basin. This complicates the species distribution pattern since several species that are typical of the Warrior Basin occur along some of the westward flowing streams. Species associations, however, are not clearly those of the Warrior Basin. In short, an ecotone between the two regions called for an arbitrary decision, which placed the regional boundary along the base level line at the foot of the eastern slope of Rock Mountain and its extension to the north, West Rock Mountain. At the north end of West Rock Mountain, just south of Hueytown, the boundary is again indistinct as it crosses Opossum Valley and Village Creek to the eastern face of the southern extension of Sand Mountain. Since the area is heavily urbanized and the actual boundary is of little significance, the line was arbitrarily defined as running due east from the north end of West Rock Mountain to the Louisville and Nashville and the Southern Railroad tracks, and from there northeasterly along the tracks to the east face of Sand Mountain adjacent to U.S. Highway 78. Northward from this point the boundary is the base level line on the east of Sand Mountain to the Crosston-Pinson Road. From this point it runs eastward across the mouth of Murphree Valley to Pinson, and then along the base level line of the hills to the east and north of Pinson to the north end of Village Mountain. The boundary then follows the western shores of Mountain Lake and the western and southern shores of Zamora Lake to the eastern escarpment of Blount Mountain and, from this point, is the base level line at the foot of the escarpment to U.S. Highway 431 west of Gadsden. Chandler Mountain, which is part of the Cumberland Plateau Forest Habitat Region, lies east of this line and is enclosed by a Regional boundary line at the foot of its escarpment. Highway 431 was arbitrarily chosen as the boundary across the mouth of Wills Valley in the absence of any clear topographic bound. In Gadsden the regional boundary meets the eastern escarpment of Lookout Mountain, the boundary of the Cumberland Plateau Forest Habitat Region, and coincides with its base level line to the Alabama-Georgia Line.

The Ridge and Valley Forest Habitat Region encompasses the extension of the Great Appalachian Valley into Alabama. It is essentially coincident with the Valley and Ridge Physiographic Province described by Johnston (1930) and more recently by Sapp and Emplaincourt (1974), differing only in that the Weisner quartzite areas are excluded. The region differs from both the Ridge and Valley Forest Habitat Province described by Hodgkins (1965) and the Great Appalachian Valley Forest Habitat Province described by Hodgkins, Cannon, and Miller (1976), because neither fitted the species distribution patterns found in the field.

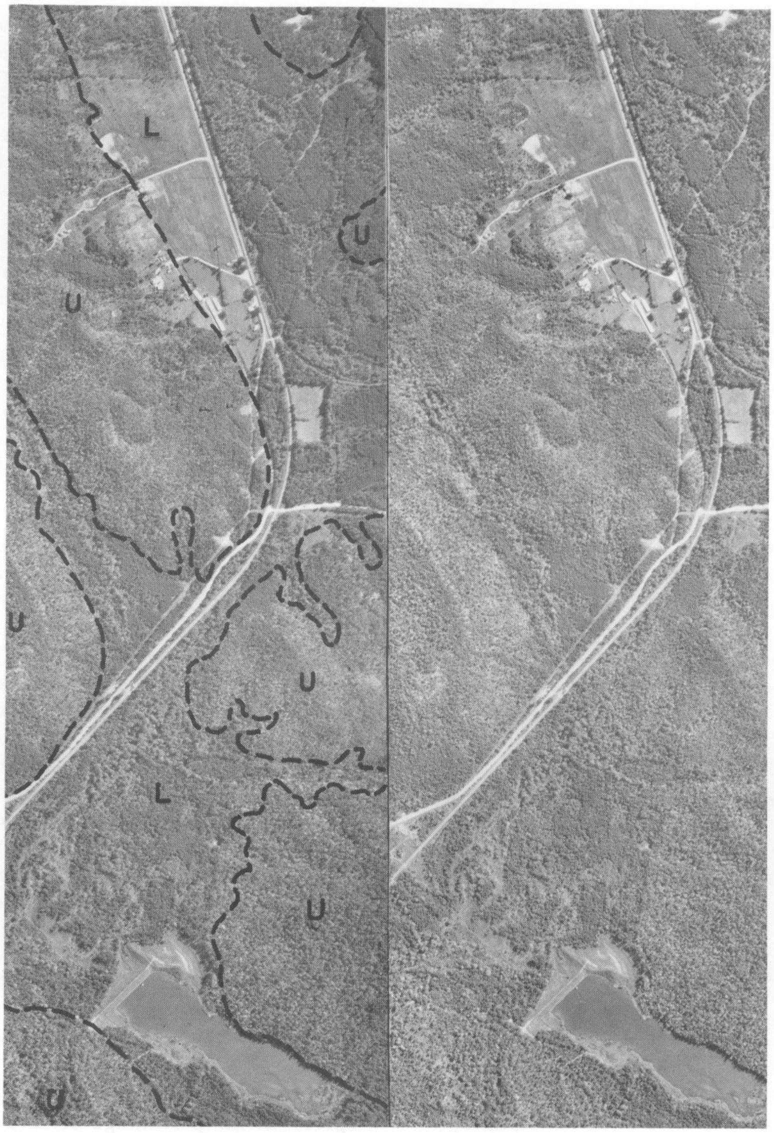

Figure 2. Stereogram of an area with Weisner Quartzite uplands (U) and Shady limestone bottomlands (L). The Shady limestone areas are part of the Ridge and Valley Forest Habitat Region while the Weisner Quartzite areas are part of the Mountain Forest Habitat Region. This is in the Indian Mountain area of Cherokee County. (GT-1LL-39, 40)

Coordination with one or the other of these land classification efforts would have been highly desirable. They probably are the foundations on which site evaluations and land management operations will be built in the years to come.

The Ridge and Valley Forest Habitat Region is complex both geologically and topographically (Adams, *et. al.,* 1926). Its rocks are sedimentary and have been intensely folded and faulted. Subsequent erosion of rocks of differing strengths has produced a multiplicity of landforms. In areas dominated by weak limestones and shales the erosional process has gone far toward development of flat peneplains. The Coosa River Valley is the largest example, but the same situation on a smaller scale is found along the Cahaba River, in the Birmingham-Big Canoe Valley, and in other smaller drainages. In these areas the surface is generally level, especially in the "flatwoods" portion of the Coosa Valley, but enough relief often is present to form a rolling rather than a flat surface.

In some areas rocks that are more resistant to erosion than limestones and shales of the valley floors dominate the surface. These give rise to northeasterly striking ridges. The highest and boldest of these are monoclinal ridges capped by sandstone. There are three concentrations of these ridges: the Cahaba ridges, lying between the Birmingham-Big Canoe Valley and the Cahaba River Valley; the Coosa ridges, lying between the Cahaba River and the main Coosa River Valley; and Tucker (Dirtseller Mountain) and Gaylord (Bogan Mountain)[2] Ridges, which lie north of Weiss Lake in Cherokee County. These are steep ridges rising to elevations as high as 1,500 feet, some 500

[2]The names of topographic features often vary from map to map, even those of the U.S. Geological Survey. When such multiple names occur in the area associated with this publication the less commonly used name will be shown in parentheses each time the feature is mentioned.

to 800 feet above the adjacent valley floors. In addition to the three principal ridges there are many other ridges scattered over the region. Some of these are formed from sandstone and shale, some limestone and dolomite, and some are made up of chert-bearing dolomites. Among the most prominent of these ridges is Red Mountain, which is primarily made up of sandstone and shale but is capped with chert. It is from the formations making up Red Mountain that iron ore is obtained in the Birmingham area.

In broad terms the Ridge and Valley Region slopes slightly toward the southwest. The elevations along the main Coosa Valley floor range from about 650 feet above mean sea level in the north along the Alabama-Georgia line to about 500 feet as the region merges into the Coastal Plain. The main ridges in the Coosa and Cahaba Ridge areas may reach elevations of 1,500 feet and Scraper Mountain, a part of Gaylord Ridge (Bogan Mountain), reaches 1,670 feet. The ridges are lower in other areas.

The Ridge and Valley Region is drained primarily, but not entirely, by the Coosa River. The Cahaba River drains roughly the southwestern quarter of the region while some of the headwaters of the Black Warrior extend into the extreme western portion of the Ridge and Valley Region. Stream gradients on the ridges are steep but on the valley floors may be very gentle. These gentle gradients give rise to meandering streams and poorly drained or swampy areas. Along the Coosa River a number of dams have been built, so that very little of the original first bottoms are not inundated. Consequently, site conditions along the shores of the Coosa lakes are those of slopes rather than bottoms, and this must be taken into consideration when the key is used.

ECOLOGICAL FOUNDATION OF THE KEY

All persons concerned with plant ecology are aware of correlations between species occurrence and site characteristics. Site characteristics that can be used in a photo-interpretation key for forest cover types are essentially topographic in nature. The main influence of topography is its effect on plant moisture regime. Upland sites can be distinguished from bottomland sites on aerial photos with little difficulty. In the uplands, the moisture depends on position on the slope, degree of slope, and aspect, all of which can be evaluated on the photographs. Bottomlands can be classified by position within the drainage system and size of the associated stream and its attendant floodplain. Again, all these can be evaluated on the photographs.

Certain geologic factors also influence the moisture regime. Poor sites and rough topography usually are associated with rocks that resist weathering, while better sites usually are associated with weaker rocks. This relationship has been found to be significant in all of the regions so far studied. In the Ridge and Valley Forest Habitat Region, four geologic conditions were recognized. In order to keep terminology reasonably consistent from key to key in this series, these conditions will be referred to as "zones" in this report. One of these zones is associated with Fort Payne chert, which is resistant to weathering and usually produces rough topography, dry sites, and thin soils. Another is associated with resistant sandstones and has a very rough topography and relatively poor sites. The third is associated with various mixes of limestones, dolomites, and chert which are fairly resistant and produce topography less rough than that associated with the sandstones. Site quality on these limestone-dolomite-chert areas is generally better than that found in the first two zones. The last zone is made up of the main valley floors, which are composed of soils derived from weak shales or limestones. In some areas the terrain is almost level, while in others the valley floors undulate forming low hills and shallow valleys. Because the valley floor zone has the best sites and favorable topography, it is heavily farmed. These four zones cannot be distinguished from one another with any certainty on aerial photographs; consequently, maps are used to show their location.

Plant communities tend to change with time, but species composition becomes increasingly stable. This natural phenomenon is called plant succession. There is no single most stable species composition or climax community. The climax varies from site to site within a region. Successional stages are difficult to determine from aerial photographs. Little more can be done than to assume that the pine cover types represent earlier stages and the pine hardwood and hardwood cover types represent later stages. These assumptions seem reasonable. Pines are light-seeded, shade intolerant, pioneer species that occupy areas soon after forest cover has been removed. There are, however, light-seeded intolerant hardwood species that may invade a denuded area along with the pines, creating a mixed forest cover. In time, however, heavier seeded, more tolerant species become established beneath the pioneer species, and the stand eventually becomes a pure hardwood stand made up of heavy seeded, tolerant species. Therefore, the percentage of dark crowns (pine) in a stand may be used as a rough measure of the stage of succession. Man's activities in the woods will not modify these general conclusions to any great extent. If a stand is clearcut and residual hardwoods are heavily damaged or eliminated by mechanical or chemical means, the new stand probably will be pine. If there is no site preparation, it is likely that hardwoods, because of their sprouting capability, will almost completely take over the new stand. In any case, it is logical to expect an increasing percentage of heavy-seeded, tolerant species as the percentage of dark-toned crowns in the stand canopy decreases. This is the only means by which the photo-interpreter can judge stage of succession.

The combination of topographic, geological, and broad species range information can lead to reasonably reliable estimates of forest cover type occurrence when used in conjunction with tonal differences on the photographs.

DEVELOPMENT OF THE KEY

It was accepted initially that habitat-species occurrence relationships exist and that the problem was to determine which of these relationships could be used by a photo-interpreter attempting to determine the species composition of stands imaged on aerial photographs. The information needed to determine these relationships was obtained during extensive field operations of a reconnaissance nature. Formal statistical testing procedures were not used in any phase of the work leading to the construction of the key. This follows the pattern evolved during the development of the previous keys in this series (Johnson and Sellman, 1974 and 1975).

An initial reconnaissance of the region was made for the purpose of gaining a working knowledge of its geography and species complexes. No quantitative information was gathered during this stage of the operation. Instead, emphasis was placed on becoming sufficiently familiar with the situation so that planning of subsequent field operations would be facilitated.

In the course of this reconnaissance, relationships were sought between species complexes and the characteristics of the sites where those species complexes occurred. Attention was paid to bedrock geology, topographic positions, aspects, steepness of slopes, and other factors that might be used to assist in the photo-interpretation of the stands. Certain relationships quickly become apparent.

It was obvious that the region would have to be subdivided into zones, based on bedrock geology. In addition, topographic position and aspect had considerable influence on the occurrence of the species complexes. Steepness of the slope and crest width, however, had little or no influence.

Following the preliminary reconnaissance, a more intensive study of the species complex—site relationships was initiated. The planning for this study was based on the knowledge obtained in the course of the reconnaissance. For this study, transects were run across representative terrain, in such a manner as to cross the contours at approximately right angles, from the crests to the bases of the ridges. These transects were widely dispersed across the region with the purpose of covering as many conditions as feasible. These transects were initially laid out on aerial photographs, chosen in such a manner that they were reasonably accessible, and appeared to include a wide variety of stands[3] on different sites. The transects were traversed on foot and the species composition and topographic situation were evaluated and recorded for each stand along each transect. Species composition was evaluated by means of a point sampling with a 10-factor prism to obtain estimates of basal areas per acre, by species, in the overstory. Sampling points were arbitrarily selected to represent typical parts of the stands. No attempts were made to use any form of formal probability sampling.

Data from these transects fell into certain patterns which, when combined with the subjective knowledge obtained during the reconnaissance and subsequent field work, provided first approximations for the variables which eventually were incorporated into the key. The forest cover types defined in Appendix II and shown in diagram form in figures 3, 4, and 5 constitute descriptions of species complexes which occurred repeatedly. These were tentatively described at an early stage, and the descriptions were perfected after further field work provided a stronger base.

As previously mentioned, slope position and aspect has powerful effects on the species occurrence patterns, but crest width and degree of steepness did not influence the distribution of species in the Ridge and Valley Forest Habitat Region as they did in the Piedmont and, consequently, were not used as variables in the key.

After the preliminary relationships described above had been tentatively organized into a key, field operations were modified to provide a basis for checking and improving the key. For this purpose, a large portion of the roads in the region were systematically travelled and the forest cover alongside the roads was compared to the key, site by site. In order to avoid the biasing effect of human activities near well-travelled roads, most of this checking was done on back country and woods roads, passable only with a pickup truck or an all-terrain vehicle. In addition to this vehicular reconnaissance, much work was done on foot. Several hills in each of the zones were explored in detail on foot to make sure that the slope position-aspect-species occurrence relationships indicated in the key were correct. A motorboat was used to gain access to the shores of the Coosa River impoundments. Field crews would stop at intervals along the shore and record conditions along transects run away from the water's edge. Whenever the key was found lacking it was expanded or modified. This process was continued until it appeared that the key yielded correct results in all parts of the region.

[3]For this work the term "stand" was defined as an area of forest land which appeared to have, on the photographs, a more or less homogeneous character with respect to species, tree sizes, and crown closure.

DESCRIPTION OF THE KEY

The key consists of two parts (see Appendix 1). The first is a dichotomous elimination key which leads either directly to a forest cover type or to a diagram of a hill. If one is referred to the hill diagram he should determine, from the photographs, the topographic position of the plot or stand in question and then he should locate that point on the diagram. The probable forest cover type occupying that position would then be read directly from the diagram. For example, if the first part of the key referred the interpreter to Figure 54A and the stand in question was on the lower slope facing northeast, the forest cover type would be P (3), which is basically a loblolly pine type.[4]

FOREST COVER TYPES

The forest cover types recognized by the key are shown in figures 3, 4, and 5, and are formally described in Appendix II.

The development of these type descriptions was a complex operation carried out simultaneously with development of the key. Initially a few broad types were recognized. However, as the need for subdivision of the region into zones became evident, it also became evident that the cover types could be correspondingly refined. As work progressed zone patterns became firmer and cover type descriptions followed the same pattern.

The data upon which the cover type descriptions are based are of two types. As has been described, sampling points were established in what were considered representative stands. Initially all points were located along transects but when supplemental information was needed, additional points were located without reference to transects. At each of these points a sweep was made with a prism using a basal area factor of 10. The trees selected by the prism were tallied by species. In addition, a supplementary tally was made of the species occurring in the stand but not detected by the prism sweeping process. No attempt was made in this sampling process to conform to the rules of formal probability sampling. The impossibility of developing a sampling frame in an exploratory study of this type precluded the use of formal sampling procedures..

The results of sampling are summarized within the context of the final cover types in tables 1, 2, and 3. These tables, under the column heading "P", show the *rate of occurrence* of each species in the form of a percentage of the stands sampled. This percentage was calculated from

[4]See appendix III for the scientific names of the species mentioned.

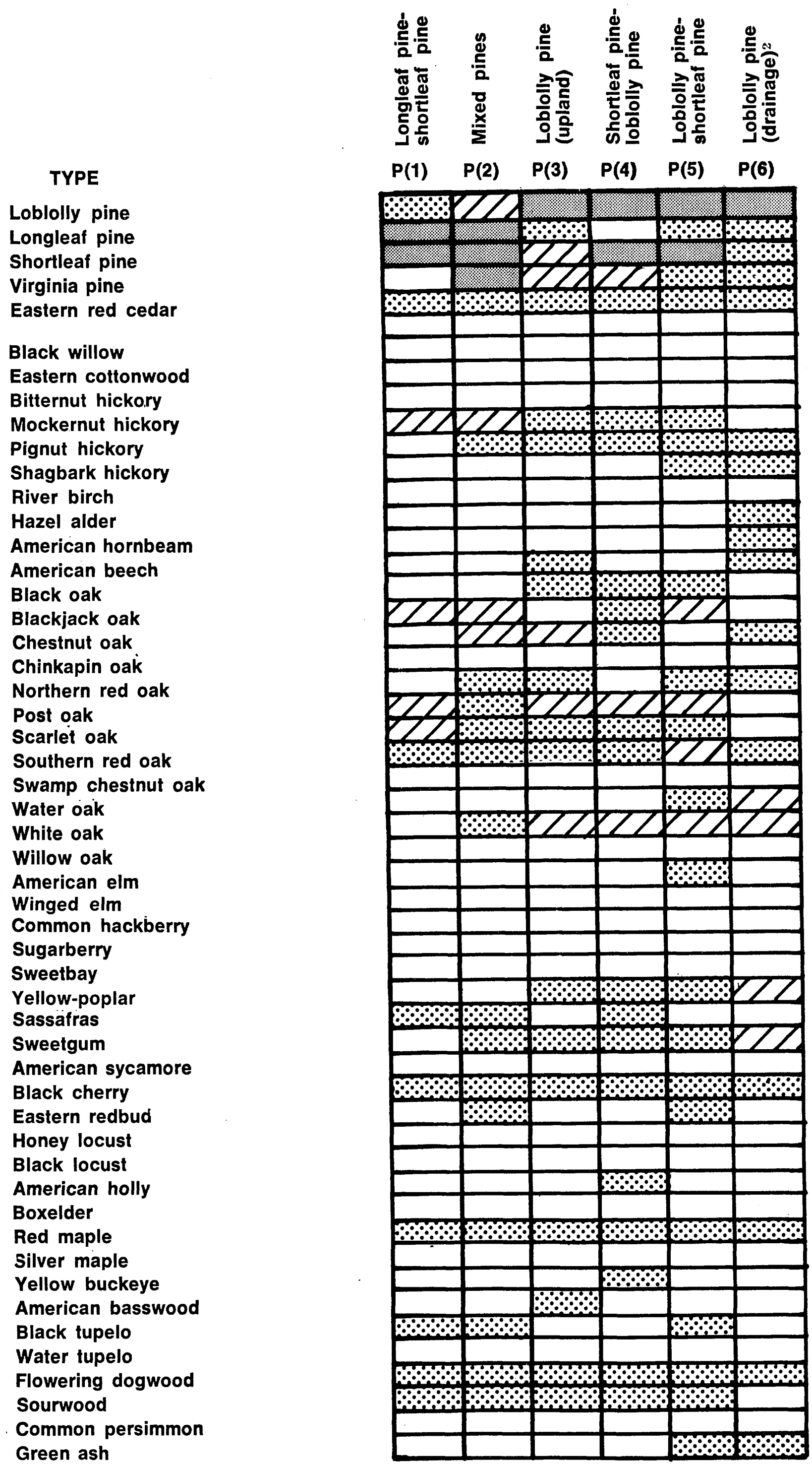

Figure 3. Diagram showing relative importance of species within the pine cover types.[1]

[1]Black blocks indicate the most important species, vertically cross-hatched blocks indicate common associates, and speckled blocks indicate species which occur only sporadically or which usually contribute little to the overstory basal area per acre.
[2]This forest cover type was never encountered. The description is speculative, based on the evidence from pine hardwood stands found growing on bottomland sites.

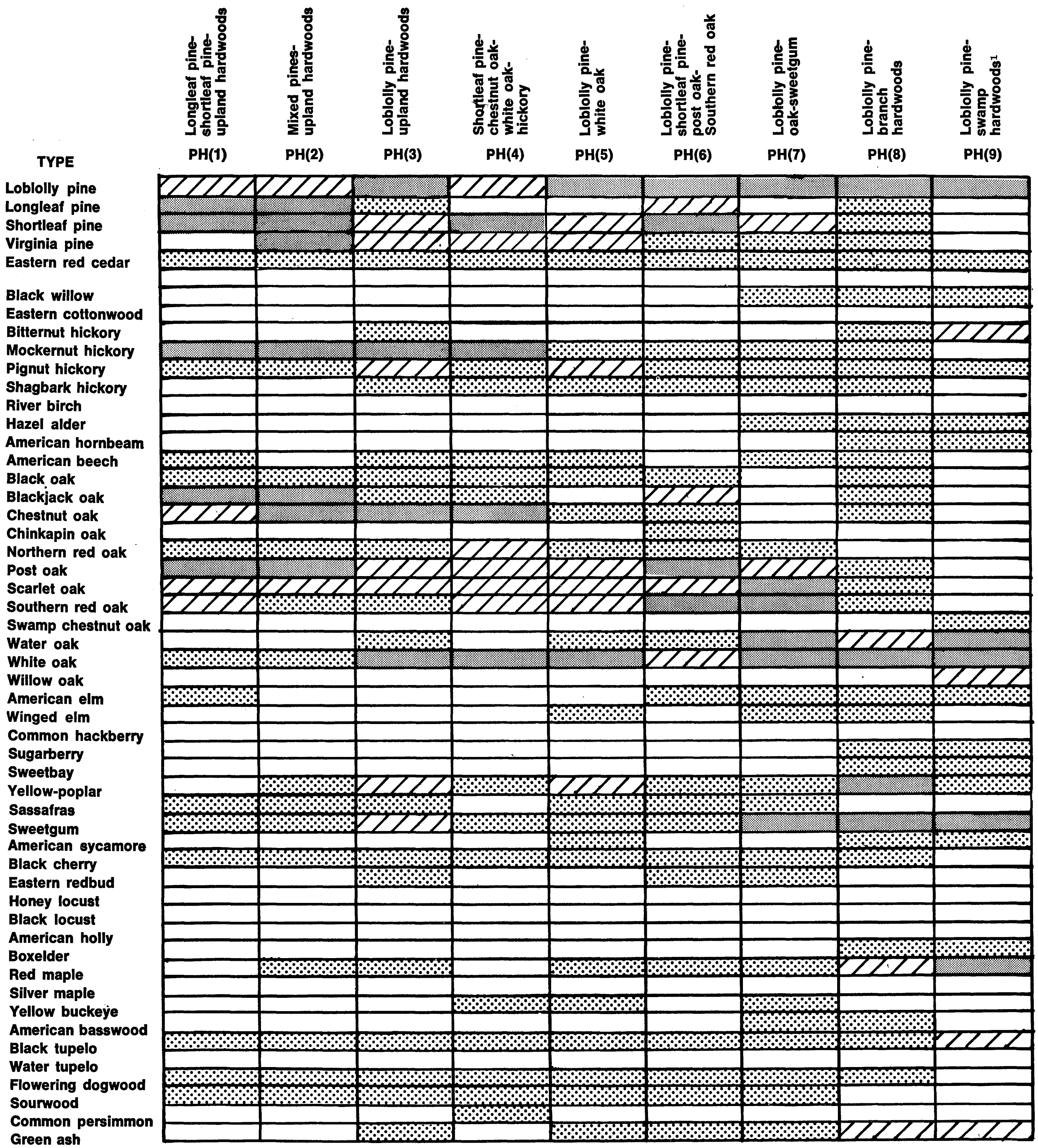

Figure 4. Diagram showing relative importance of species within the pine-hardwood cover types.

[1]This forest cover type was never encountered. The description is speculative, based on the evidence from hardwood stands found growing on swamp sites.

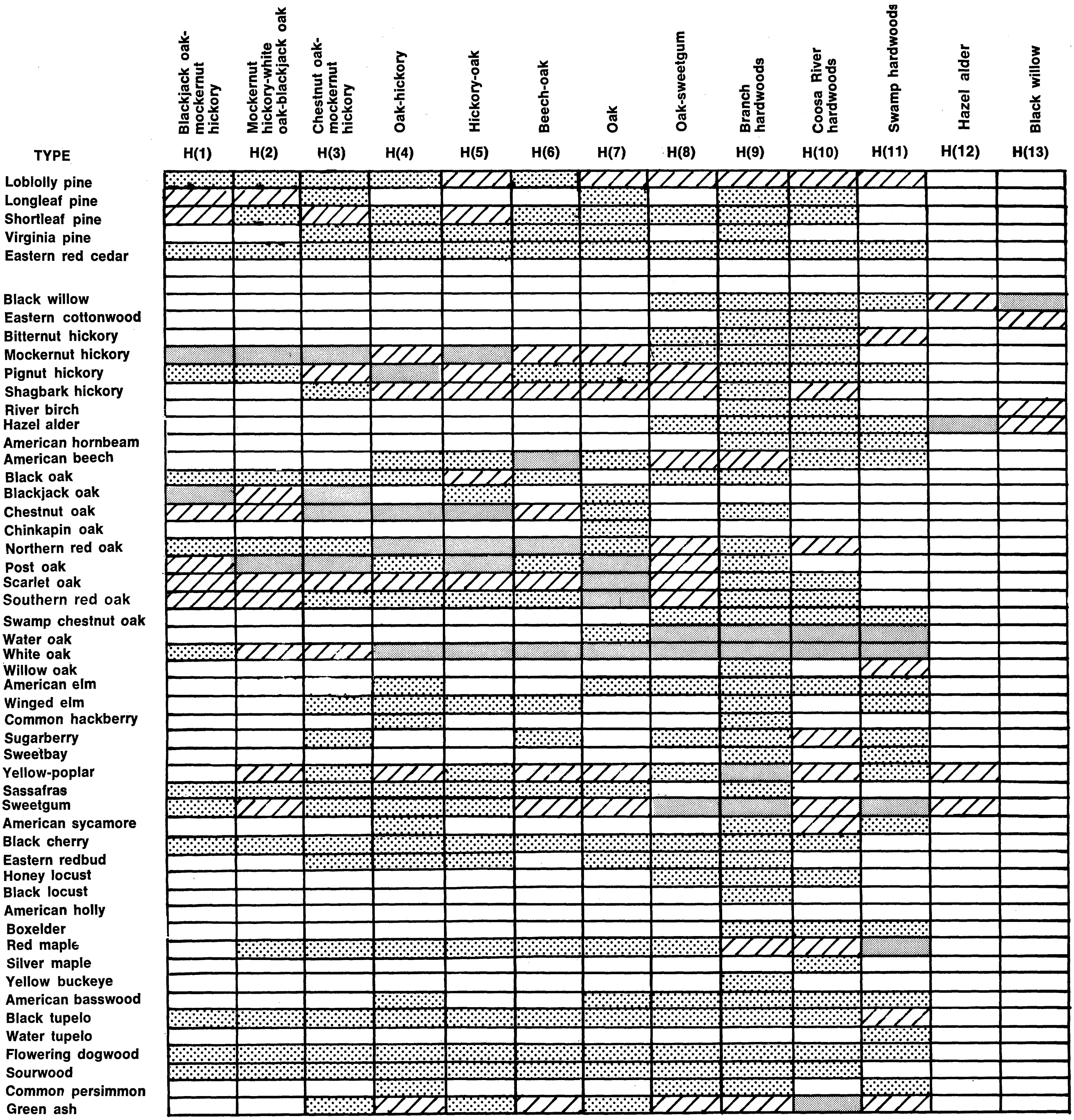

Figure 5. Diagram showing relative importance of species within the hardwood cover types.

TABLE 1. OCCURRENCE AND DOMINANCE VALUES FOR SPECIES WITHIN THE PINE COVER TYPES.[1]

TYPE	P(1)		P(2)		P(3)		P(4)		P(5)	
Sample	13		16		11		7		20	
	P	D	P	D	P	D	P	D	P	D
Loblolly pine			38	14	73	48	57	23	95	51
Longleaf pine	84	62	30	15					20	<1
Shortleaf pine	46	19	88	44	36	19	86	49	90	39
Virginia pine			25	15	45	21	50	13	25	<1
Eastern red cedar	31	<1	13	<1	18	<1	14	<1	55	<1
Black willow										
Eastern cottonwood										
Bitternut hickory										
Mockernut hickory	85	4	69	5	45	<1	29	<1	30	<1
Pignut hickory					27	<1	43	<1	10	<1
Shagbark hickory									5	1
River birch										
Hazel alder										
American hornbeam										
American beech					9	<1				
Black oak					9	<1	14	3		
Blackjack oak	53	7	44	3			29	<1	35	3
Chestnut oak			57	5	64	5	29	<1		
Chinkapin oak										
Northern red oak			19	<1					5	<1
Post oak	38	3	31	<1	45	1	57	2	45	1
Scarlet oak	38	4			18	2	29	<1	40	<1
Southern red oak	31	<1	13	<1	27	2	57	<1	70	2
Swamp chestnut oak										
Water oak									5	<1
White oak			6	<1	45	2	43	8	30	1
Willow oak										
American elm									5	<1
Winged elm										
Common Hackberry										
Sugarberry										
Sweetbay										
Yellow-poplar					18	<1				
Sassafras	23	<1	25	<1			29	<1		
Sweetgum			19	<1	36	<1	29	2	50	<1
American sycamore										
Black cherry	8	<1	19	<1	36	<1	29	<1	25	<1
Eastern redbud			6	<1						
Honey locust										
Black locust										
American holly							14	<1		
Boxelder										
Red maple			19	<1	64	<1	29	<1	5	<1
Silver maple										
Yellow buckeye							14	<1		
American basswood					9	<1				
Black tupelo			19	<1						
Water tupelo										
Flowering dogwood	15	<1	25	<1	45	<1	100	<1	10	<1
Sourwood	15	<1	25	<1	36	<1	43	<1		
Common persimmon										
Green ash									20	<1

[1]The rate of occurrence, in terms of percent of stands sampled, is listed under column head "P". The degree of dominance, in terms of average percent of overstory basal area per acre, is listed under column head "D".

both the prism data and the supplementary stand data previously mentioned. The tables also show, under the column heading "D", the *degree of dominance* of each species in terms of the average percent of the total basal area of the overstory. These values are based only on the prism data. Including supplemental data in the rate of occurrence, computations resulted in apparent anomalies where occurrence rates were high but dominance rates were low. Flowering dogwood is an excellent example of such a species. It occurs widely but rarely are overstory concentrations of dogwood trees found.

The second source of information used in developing cover type descriptions was the accumulated experience of persons doing the field work. These people were professionally trained foresters who were well prepared to accumulate mental impressions of cover type-site relationships and species associations. This accumulation of knowledge was referred to extensively. It was used to confirm the evidence of the prism data and to bolster prism data when the latter were scarce. Total dependence sometimes had to be placed on this non-quantitative information when prism data were totally lacking.

The scarcity or absence of prism data for some cover types is the result of several factors. First, forest cover in much of zones III and IV is limited because of the heavy agricultural use. Related to this is the difficulty of securing access to much of this land. Another reason is the scarcity of occurrence of certain conditions. For example, no pine or pine-hardwood stands were found on swamp sites. Loblolly pine was present in the stands examined, however, and it is possible that this loblolly pine component occasionally might become large enough to justify classifying the stand as pine or pine-hardwood. Types P (6) and PH (9) were synthesized from data obtained in relevant hardwood stands (see P [6] and PH [9]). Only a few prism points were established in types with very low rates of occurrence, because the cost of locating additional stands was considered to be excessive (see PH [4] and H [6]).

The diagrams in figures 3, 4, and 5 represent the final cover types. The black blocks represent species that usually are dominant, the vertically cross-hatched blocks represent species that are common associates, and the stippled blocks represent species that occur sporadically or contribute little to stand basal area. Generally, the diagrams are arranged with cover types associated with poorer sites on the left and cover types associated with better sites on the right. This provides a visualization of shifts in species importance as site quality changes.

A total of 28 cover types have been defined: 6 pine types, 9 pine-hardwood types, and 13 hardwood types. It is recognized that this is more detail than is needed by most persons involved with land management. It was decided, however, to be as detailed as practical. A few users will need the detail, while those who do not can make groupings to suit their purpose.

The reason for detail can best be seen in figures 3, 4, and 5, which show the relative importance of species within the types. For example, Figure 4 shows the list of species occurring in PH (3) and PH (4) are practically the same. However, in PH (3) the dominant pine is loblolly while in PH (4) it is shortleaf. Furthermore, longleaf pine may occur in PH (3) but is never encountered in PH (4). Among hardwoods, dominant species are the same, but northern red oak and southern red oak are more apt to occur in PH (4) while pignut hickory is more apt to occur in PH (3).

TABLE 2. OCCURRENCE AND DOMINANCE VALUES FOR SPECIES WITHIN THE PINE-HARDWOOD COVER TYPES.

TYPE	PH(1)		PH(2)		PH(3)		PH(4)		PH(5)		PH(6)		PH(7)		PH(8)	
Sample	25		30		16		7		15		22		18		21	
	P	D	P	D	P	D	P	D	P	D	P	D	P	D	P	D
Loblolly pine	24	3	17	3	75	30	43	9	87	26	68	20	100	44	90	40
Longleaf pine	76	24	23	6							18	5			5	2
Shortleaf pine	64	21	93	36	75	19	86	35	33	12	68	19	11	3	5	2
Virginia pine			10	2	31	8	50	9	67	12					14	2
Eastern red cedar	16	<1							13	<1	18	<1	6	<1	10	<1
Black willow															5	<1
Eastern cottonwood																
Bitternut hickory					6	<1									5	<1
Mockernut hickory	88	16	87	16	81	9	100	10	13	<1	50	2			10	2
Pignut hickory	8	<1	2	<1	12	4			53	3	23	<1	39	<1	19	2
Shagbark hickory							14	<1	13	<1	18	2	11	2	19	2
River birch																
Hazel alder																
American hornbeam															33	<1
American beech	4	<1			12	<1			7	<1			11	<1	19	<1
Black oak	4	<1							7	<1						
Blackjack oak	76	14	50	8	12	<1	14	<1			23	3			5	<1
Chestnut oak	20	5	60	10	25	9	57	11	13	<1	5	<1			10	2
Chinkapin oak																
Northern red oak	4	2	3	<1	19	<1	29	3	7	<1	5	1	6	2	19	3
Post oak	64	9	83	15	38	5	29	3	13	3	64	12	22	2	5	<1
Scarlet oak	40	3	30	3	19	3	57	6	53	7	14	3	28	6	5	<1
Southern red oak	32	2	37	2	19	<1	29	5	40	6	68	21	33	6	14	<1
Swamp chestnut oak																
Water oak					6	<1			7	<1	5	<1	78	10	38	5
White oak	8	<1			38	6	57	10	73	18	36	3	67	11	57	10
Willow oak																
American elm	4	<1									9	<1	11	<1	5	<1
Winged elm									13	<1			22	<1	5	<1
Common hackberry																
Sugarberry															5	<1
Sweetbay																
Yellow-poplar			3	<1	44	3	14	<1	40	5	5	<1	11	<1	52	9
Sassafras	12	<1	17	<1	6	<1			27	<1	5	<1				
Sweetgum	4	<1	3	<1	31	2			20	<1	27	<1	67	11	81	9
American sycamore									7	<1					33	<1
Black cherry	12	<1	13	<1	38	<1	29	<1	67	2	41	<1	39	<1	24	<1
Eastern redbud					6	<1							17	<1		
Honey locust																
Black locust																
American holly																
Boxelder															10	<1
Red maple			30	<1	38	<1			33	<1	23	2	33	<1	76	4
Silver maple																
Yellow buckeye							14	<1	27	<1			6	<1		
American basswood													6	<1		
Black tupelo			17	1					40	<1			33	<1	5	<1
Water tupelo																
Flowering dogwood	44	<1	33	<1	50	<1	57	<1	73	<1	23	<1	22	<1	43	<1
Sourwood	28	<1	33	<1	44	<1	29	<1	80	<1	5	<1	6	<1		
Common persimmon							14	<1								
Green ash									40	<1	9	<1	72	1	24	3

TABLE 3. OCCURRENCE AND DOMINANCE VALUE FOR SPECIES WITHIN THE HARDWOOD COVER TYPES.

TYPE	H(1)		H(2)		H(3)		H(4)		H(5)		H(6)		H(7)		H(8)		H(9)		H(10)		H(11)	
Sample	8		6		62		56		13		7		11		13		92		21		11	
	P	D	P	D	P	D	P	D	P	D	P	D	P	D	P	D	P	D	P	D	P	D
Loblolly pine	37	<1	50	<1	21	1	21	2	54	3	43	<1	91	8	69	13	55	5	24	2	91	13
Longleaf pine	75	4	100	7	6	<1											3	<1	5	<1		
Shortleaf pine	50	3	17	<1	46	3	16	<1	23	3			27	3			3	<1	5	<1		
Virginia pine					6	<1	7	<1	15	<1	20	<1					1	<1				
Eastern red cedar			17	<1	10	<1	7	<1					9	<1	23	<1	12	<1	10	<1	9	<1
Black willow																	7	<1	10	<1	9	<1
Eastern cottonwood																	1	<1				
Bitternut hickory																	1	<1	24	4	9	3
Mockernut hickory	88	29	100	29	89	30	47	5	62	21	14	4	45	6	31	<1	13	3	5	<1		
Pignut hickory					33	<1	43	9	31	6			27	<1			30	5	19	3	18	<1
Shagbark hickory							9	2	31	5	29	2	27	1	23	3	8	1	33	8		
River birch																	1	<1	5	<1		
Hazel alder															8	<1	12	<1			18	<1
American hornbeam															31	<1	30	<1	10	<1		
American beech							27	4	8	<1	100	32	9	<1	38	5	35	3	5	<1		
Black oak					11	3	9	1	31	5							2	<1				
Blackjack oak	88	47	50	15	39	9			8	<1							1	<1				
Chestnut oak	13	3	67	5	81	35	71	28	46	12	71	11	9	1			11	2				
Chinkapin oak																						
Northern red oak	25	3	17	<1	11	2	43	9	31	5	71	13	9	1	15	3	13	1	29	9		
Post oak	25	<1	50	9	50	7	7	2	38	8			73	22			3	<1				
Scarlet oak	25	3	33	<1	35	3	18	4	38	5	29	5	55	11	31	6	8	<1	10	<1		
Southern red oak	50	8	17	6	27	<1	11	1	15	1			73	29	23	7	17	2	5	<1	27	3
Swamp chestnut oak															15	1						
Water oak													27	1	62	25	47	12	52	11	100	35
White oak			50	25	15	2	80	19	54	17	71	12	45	9	54	11	72	15	48	10	91	16
Willow oak																	1	<1			9	3
American elm							4	<1					45	<1	46	<1	9	1	19	4	9	<1
Winged elm					2	<1	2	<1	8	1	14	<1					1	<1				
Common hackberry							2	<1														
Sugarberry					2	<1					14	<1			8	1	10	1	29	.7		
Sweetbay																	1	<1			27	<1
Yellow-poplar			33	3	10	<1	45	5	8	1	29	2	27	4	31	3	67	17	29	4	18	1
Sassafras	13	<1	17	<1	18	<1	5	<1									3	<1				
Sweetgum	13	<1	50	5	10	<1	29	<1	8	<1	43	4	64	3	92	13	86	19	33	4	91	12
American sycamore							29	<1									28	2	33	6		
Black cherry	13	<1	67	<1	40	<1	45	<1	15	1	57	<1	27	<1	23	<1	41	<1				
Eastern redbud					6	<1	39	<1							15	<1	8	<1				
Honey locust																						
Black locust					3	<1											3	<1				
American holly																						
Box elder																	7	<1	29	<1	9	<1
Red maple			67	<1	35	<1	70	1	31	<1	57	6	36	<1	69	2	71	5	57	17	73	7
Silver maple																						
Yellow buckeye																	4	<1				
American basswood							23	3							38	<1	11	1	14	<1		
Black tupelo	13	<1			16	<1	13	<1	23	4	14	<1			8	<1	10	<1	5	<1	27	5
Water tupelo																						
Flowering dogwood	37	<1	50	<1	48	<1	55	<1	69	<1	87	<1	45	<1	23	<1	57	<1	29	<1		
Sourwood	37	<1	17	<1	27	<1	16	<1	46	<1	57	<1	9	<1	15	<1	17	<1				
Common persimmon							2	<1							8	<1	3	<1				
Green ash							16	2	15	1	29	3			46	2	29	3	81	15	36	4

Since cover types are keyed from their topographic positions and percentage of dark-toned crowns, and not from actual species present, their stability with regard to species components depends on the number of species involved. Some cover types, such as pure pine types, are relatively simple and involve only one, two, or three critical species. Pine-hardwood and hardwood types involve many more species and can be very complex. Since species composition is controlled by a number of interacting factors including site quality, stand history, stage in succession, and proximity to seed sources, it is possible for species that are expected to be primary components to be reduced to a minor representation or even to be absent. It also is possible for species to occur as primary components when normally they would be minor components or absent. These aberrations cannot be avoided.

DESCRIPTIONS OF THE VARIABLES

Zones

In the Forest Habitat Regions previously studied (Johnson and Sellmann, 1974 and 1975) it was found that definite species association—bedrock geology relationships existed. In order to incorporate these relationships into keys, regions were subdivided into zones, based on geology and patterns of occurrence of species associations. Relationships of this type were found also to exist in the Ridge and Valley Region. Consequently, the region was divided into four zones. The locations of these zones are shown on the county maps in Appendix IV.

An examination of maps in Appendix IV will reveal that Zone IV predominates. Zones I, II, and III consist of many individual fragments, ranging in size from less than 1 square mile to several hundred square miles, imbedded in Zone IV. This condition reflects the extreme complexity of intensely folded, faulted, and differentially eroded sedimentary strata of the region.

Zone I includes the portions of the region in which the Fort Payne chert is the dominant geological formation. This formation gives rise to low hills or ridges and has a local relief of 100 to 500 feet. Relief may be linear (Figure 6), striking toward the northeast, or may be jumbled with little or no definite strike (Figure 7). The hills tend to erode more or less uniformly on both sides of the crests and show little tendency toward the asymmetry associated with monoclinal ridges (figures 6 and 7). A tendency toward asymmetry sometimes appears (Figure 8). In general, sites in Zone I are poor. Longleaf pine is the most common conifer and Virginia pine rarely, if ever, occurs except when planted.

Zone II includes portions of the region where the surface is dominated by sandstones and, to a lesser degree, shales. The most important of the sandstone formations are the Pottsville and the Red Mountain, while the most important shale formation is the Floyd. Fort Payne chert and certain limestones and dolomites are encountered in the zone but are of secondary importance. In Zone II, ridges usually are formed from sandstone (figures 9, 10, 11, 12, 13), while valleys have usually been formed on shale. In some cases, however, shale ridges or hills are encountered (Figure 14). The topography in the zone is generally rough, but the degree of roughness varies. Toward the southern end of the region, hills and ridges are low (Figure 9). Toward the north, ridges become higher, with maximum elevations in the Cahaba ridges reaching 1,200 feet; in the Coosa ridges 1,500 feet; and on Scraper Mountain, near the Alabama-Georgia line, 1,670 feet. Local relief varies from almost nothing to 500 feet in the Cahaba ridges, 600 feet in the Coosa ridges, and almost 1,000 feet at Scraper Mountain. The bulk of ridges in the zone are monoclinal with very steep side slopes; they were formed by beds of sandstone which have relatively steep dip angles (figures 10, 11, 12, and 13). Where the Pottsville and associated sandstones are dominant, mainly in the Cahaba and Coosa ridge areas, there is little or no overburden on sandstone beds and ridge surfaces often are bare rock (Figure 11). Soils are obviously thin or nonexistant in these areas. In some cases, weathering has weakened the rock to the extent that avalanching may occur (Figure 12).

In portions of Zone II, where ridges are formed on the Red Mountain formation rather than the Pottsville sandstone, the resistant sandstone strata lie under layers of weaker limestones, dolomites, cherts, and shales. Consequently, the erosion-developed surface takes on a different character from that found in the part of the zone controlled by the Pottsville formation. This can best be demonstrated by comparing the topography in the Coosa ridges (figures 11 and 12) with that of Tucker Ridge (Figure 13). Flanks of the Coosa ridges are smooth and the crests extend for relatively long distances without breaks. On Tucker Ridge, however, one can see the sandstone stratum, with its associated rimrock at the tip of the primary ridge, and the eroded remnants of the overburden forming a secondary ridge or series of hills. The portions of the sandstone bed from which the overburden has been stripped forms a flat, tilted surface reminiscent of the flanks of Coosa ridges but lying at less of an angle from the horizontal.

Both sides of Pottsville sandstone ridges have soils made of essentially the same material. In the case of the primary ridges formed from the Red Mountain formation the situation is more complex. On the broken side of the ridges, colluvium from the sandstone stratum usually covers the limestones and dolomites which might otherwise provide material for the soils, so the soil parent material on both sides of the crests is essentially homogeneous. Figure 15 shows such a situation with a limestone quarry cut into the strata below the sandstone cap. The secondary ridges or hills, formed from the original overburden, have soils from complexes of parent materials. Because shale components predominate, resulting sites differ little from sandstone sites, and the species complexes associated with both types of site are very similar.

Over most of the zone, soils are thin and quality is usually poor, especially on upper slopes and crests. Shortleaf pine is the most common conifer, but all the pines occur.

Zone II is the scene of extensive strip mining for coal, particularly in the area of the Cahaba ridges in Bibb and Jefferson counties. Mined areas are quite extensive (Figure 16) and existing vegetative conditions cannot be predicted by this key.

Zone III is the smallest of the four zones, and, except for a few small outlying areas in Etowah and St. Clair counties, is included in a single block that is essentially coincident with the Broomtown Valley, lying between Shinbone Ridge and Tucker Ridge (Dirtseller Mountain) north of Weiss Lake in Cherokee County. The zone has a surface dominated by the Chickamauga limestone formation or by the Chepultepec or Copper Ridge dolomite formations. The

Figure 6. Stereogram showing a northeasterly-striking linear ridge of Fort Payne chert in Zone I. Surrounding the ridge is the relatively flat terrain of Zone IX. Note the sharp boundary between the two zones. In addition, note the symmetry of the cross-section of the ridge, which is typical of chert ridges. (Calhoun County, GR-2LL-165, 166).

Figure 7. Stereogram showing jumbled hills of Fort Payne chert in Zone I. (Talladega County, HW-3LL-23, 24).

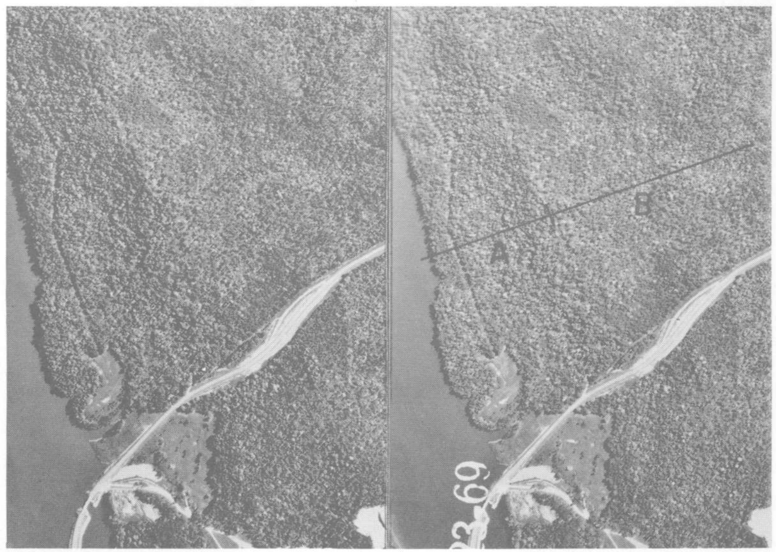

Figure 8. Stereogram showing a portion of Hines Mountain, a very long, linear, chert ridge. Unlike most chert ridges, Hines Mountain in places assumes a monoclinal cross-section, steep on one side (A) and less steep on the other (B). (St. Clair County, CAE-3LL-157, 158).

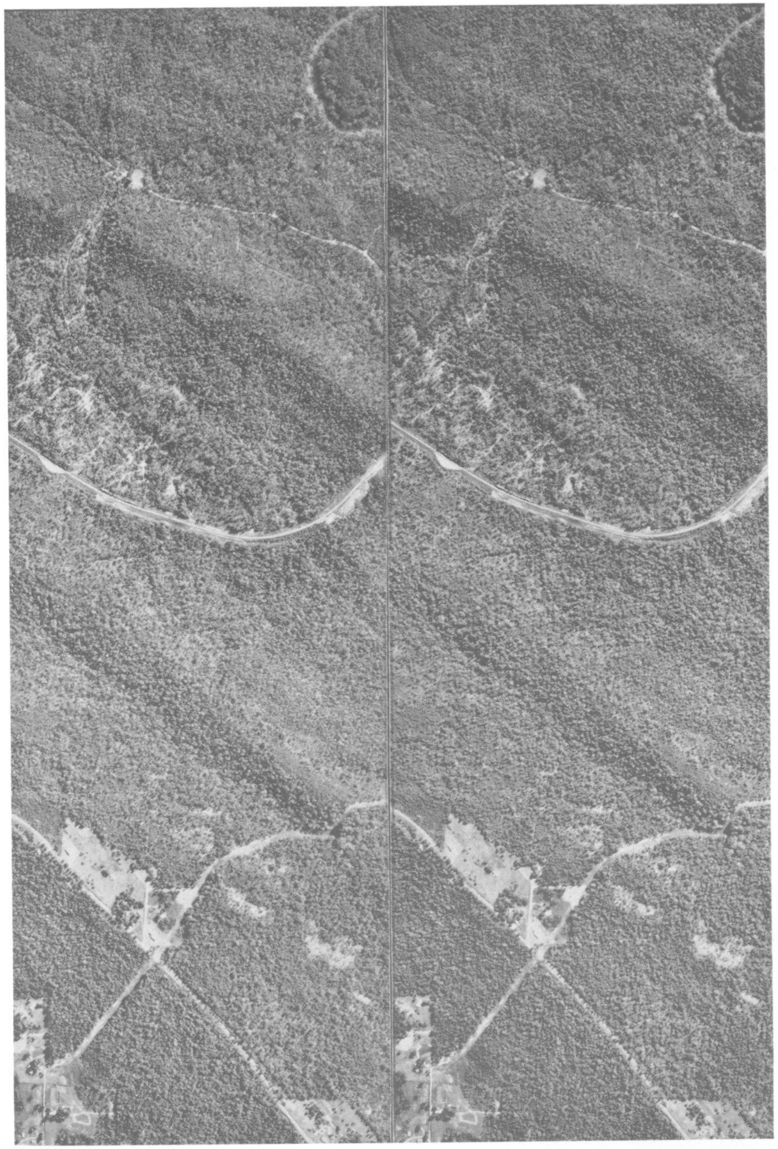

Figure 9. Stereogram showing northeasterly-striking parallel sandstone ridges in Zone II about 10 miles north of the boundary between the Ridge and Valley Forest Habitat Region and the Coastal Plain. Note that the relief is relatively slight but structure is plainly evident (Shelby County, CEB-1JJ-20, 21).

Figure 10. Stereogram showing a portion of Green's Creek Mountain (A), a sandstone ridge in Zone II, and a portion of Hines Mountain (B), a Fort Payne chert ridge in Zone I. Both are surrounded by the undulating main valley floor of Zone IV. Note the asymmetrical cross-section of the sandstone ridge indicating its monoclinal character. Also note the resistant stratum of sandstone in this ridge (C). The material above this stratum, probably shale, is being eroded away. In time, this weak material will be completely eroded, leaving a knife-edged ridge capped with sandstone. (Etowah County, HC-3LL-144, 145).

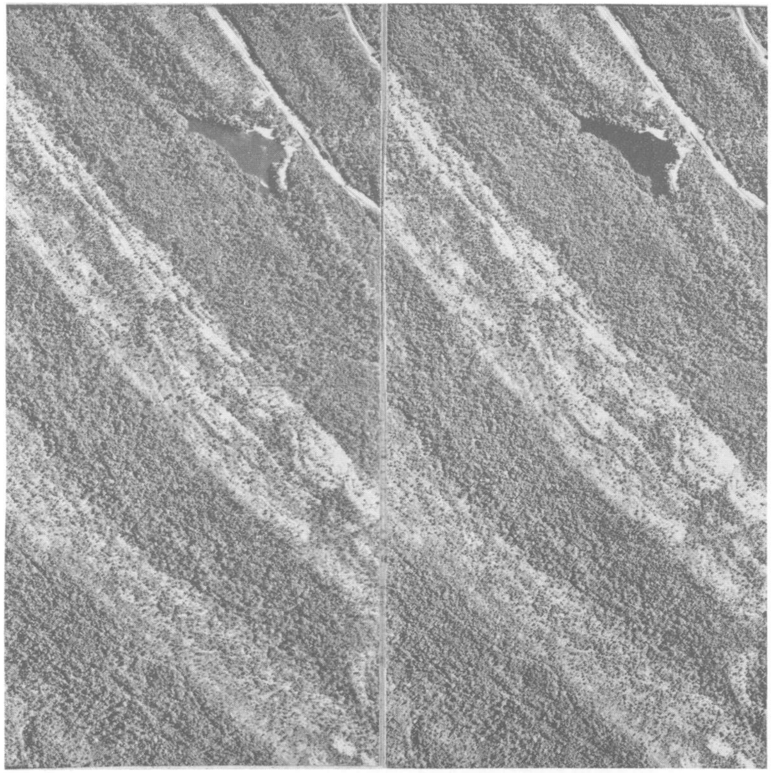

Figure 11. Stereogram showing a portion of the Coosa Ridges in Zone II. These are northeasterly striking parallel ridges of sandstone with extensive areas of bare outcrops. Note the asymmetrical (monoclinal) nature of these ridges, which is typical of sandstone. (Shelby County, CEB-1JJ-250, 251).

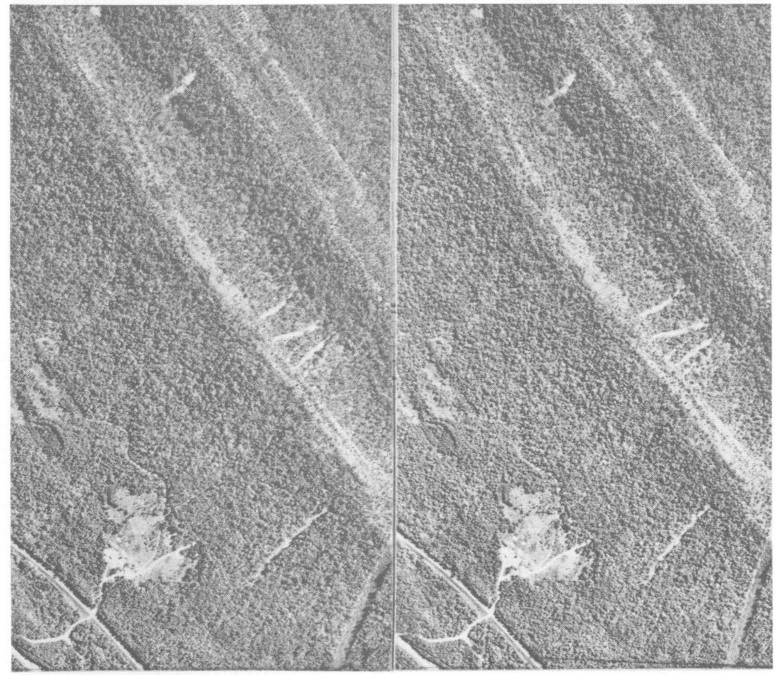

Figure 12. Stereogram showing avalanche tracks on a portion of the Coosa Ridges on Zone II. Such tracks indicate the extreme steepness of the slopes on both sides of the ridge. (Shelby County, CEB-1JJ-249, 250).

Figure 13. Stereogram showing a portion of Tucker Ridge (Dirtseller Mountain), a sandstone and shale ridge which lies between Weiss Lake and the Alabama-Georgia line and is included in Zone II. It is dissected in a different manner from most sandstone ridges further south. The flat, tilted, surfaces associated with the resistant Red Mountain sandstone stratum (A) are clearly visible. The overburden being eroded is primarily composed of Floyd shale, Tuscumbia limestone, and Fort Payne chert. (Cherokee County, GT-2LL-247, 248).

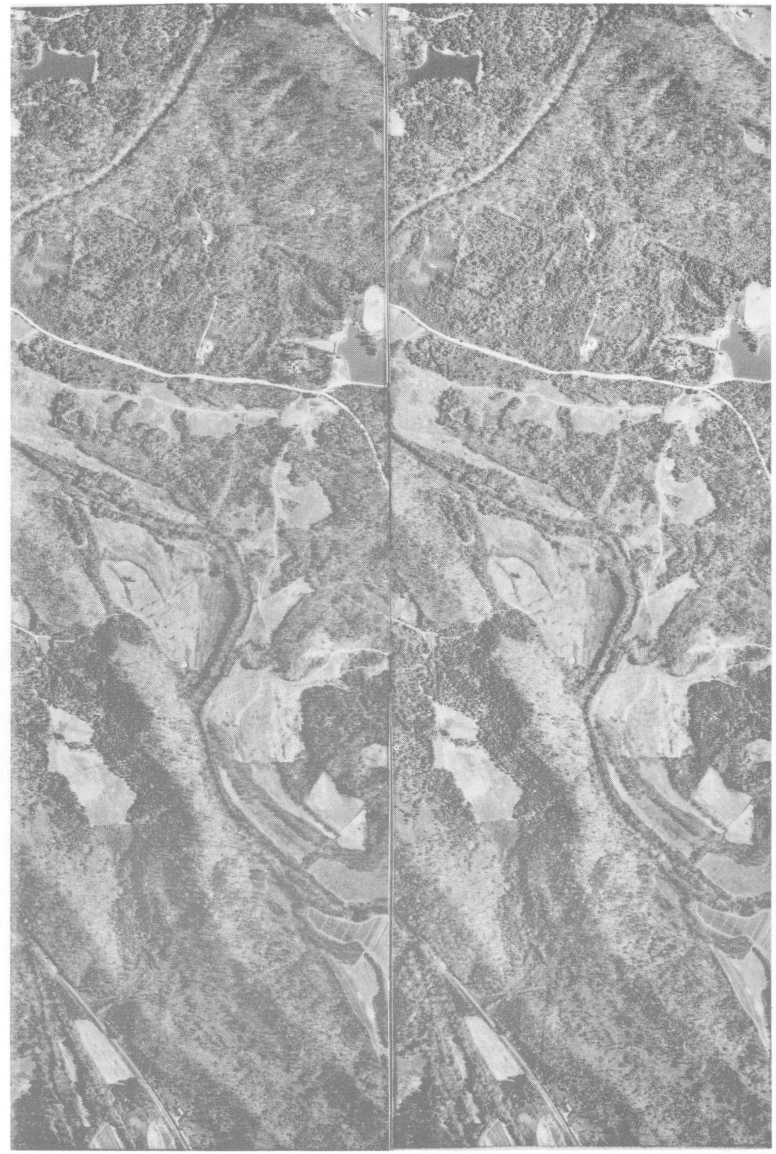

Figure 14. Stereogram showing ridges of shale in Zone II surrounded by the undulating to flat surface of Zone IV. (Calhoun County, GR-1JJ-134, 135).

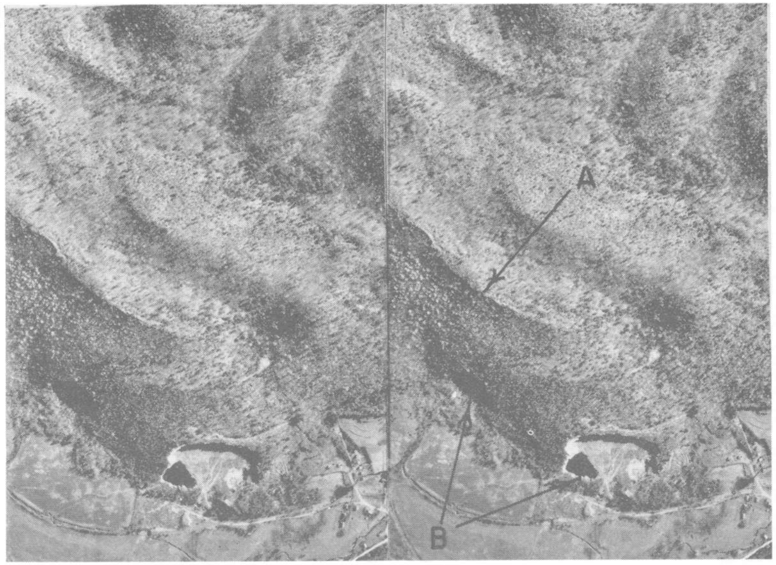

Figure 15. Stereogram showing monoclinal sandstone hills in Zone II. The relief is being developed in the same manner as in Figure 13. Note the resistant sandstone rimrock (A) and the limestone and dolomite quarries (B) at the foot of the broken slope. To reach the limestone and dolomite it was necessary to first remove the sandstone colluvium. (Etowah County, HC-3LL-80, 81).

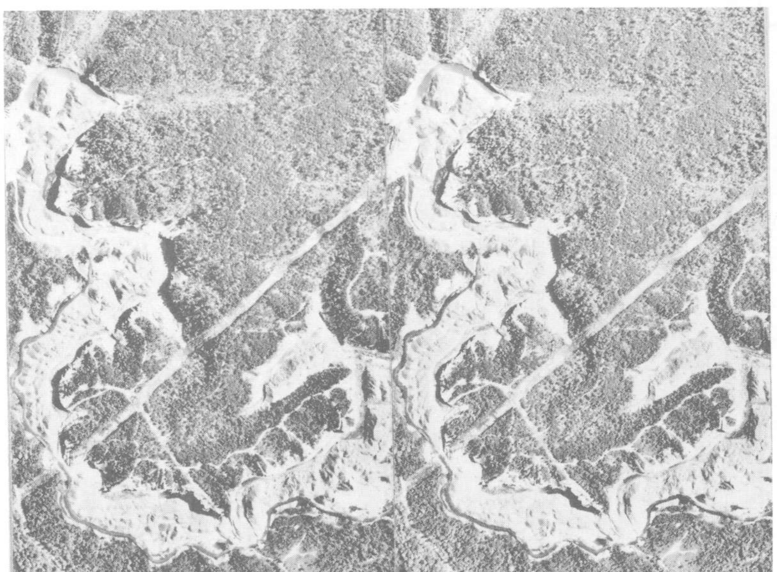

Figure 16. Stereogram showing a strip-mine in the Cahaba ridges portion of Zone II. Vegetative conditions in old mines of this sort cannot be predicted using this key. (Jefferson County, CPM-4JJ-195, 196).

Figure 17. Stereogram showing a ridge composed of limestone, dolomite, and/or chert, which is part of Zone III. The ridge is surrounded by the undulating to flat surface of Zone IV. Note the abrupt transition from one Zone to another. Also note the strips of trees along the drains. (Cherokee County, GT-2LL-250, 251).

zone's landscape is characterized by low hills or ridges, with a relief of 100 to 200 feet (Figure 17). The soils are calcareous and the sites are relatively good even though cherty in places. Longleaf pine does not occur in the zone, but Virginia pine is common.

Zone IV dominates the Ridge and Valley Forest Habitat Region, which generally consist of floors of valleys lying between ridges of the first three zones (figures 6, 10, 14, and 17). Toward the northern end of the region, from the vicinity of Gadsden to the Alabama-Georgia line, Zone IV is manifested by broad, relatively level areas developed from the weak shales of the Conasauga Formation. This area has been referred to as "flatwoods" (Johnston, 1930) (Figure 18). Most of the flatwoods area has been in cultivation but some forest is present (Figure 18). The forested portion is expanding as some lands previously used for cotton production are planted to pine. Toward the southern end of the region, valleys are narrower, and soils were derived from formations of limestone and dolomite as well as shale.

The floors of the valleys making up Zone IV, while level compared with terrain in the other zones, are rarely flat. Minor hills and valleys making up the main valley floor are termed "undulations" in this publication (figures 6, 14, 17, and 20). Although these undulations are minor, site quality is not constant. In the key, therefore, hills are recognized and slope position and aspect are considered in the same manner as they are on larger hills and ridges of the first three zones. It should be noted that the mapping of zones was done on U.S. Geological Survey topographic maps, which have a scale of 1:250,000 and a contour interval of 100 feet. In order for hills to be mapped as belonging to zones other than Zone IV they had to appear on the topographic map. Consequently, some of the undulations actually should have been assigned to zones other than Zone IV but were not because they did not have sufficient height to appear on the topographic map. However, their relief is so small that conditions on them are sufficiently like those on the undulations, making differentiation unnecessary.

Although regional and zone boundaries appear as lines on the maps of Appendix IV, these bounds are actually transition zones (ecotones) and conditions vary across them. In the Ridge and Valley Region, most of these transition zones are very narrow and conditions change abruptly. This abrupt transition is demonstrated in figures 6, 10, 17, 19, and 20. Errors in forest cover evaluations caused by transition zones should be minimal.

Topographic Positions on Hills

Upland sites have been divided into four classes: *crest, upper slope, middle slope,* and *lower slope;* as shown in Figure 21. The lower bound of the upland zone is the base level, which coincides with the upper edge of the overflow area (if one exists) or the bank of the stream if no overflow area is present. The crest extends across the hilltop and down to a point where the main downward slope of the hill begins.[5] The length of the slope between the base level and the lower edge of the crest is divided equally into the three slope classes, which are self-explanatory.

Figure 22 shows an area including portions of zones I, II, and IV, where zone boundaries, stream bottoms, and slope positions have been delineated for illustrative purposes. In practice an interpreter should do this delineating mentally to determine the topographic position on which the stand of interest occurs, recognizing that forest stands usually extend over more than one topographic situation, calling for a certain amount of averaging. Although the key undoubtedly would classify cover more accurately at points or on plots, an interpreter can achieve reasonable accuracy with stands by using good judgment.

[5]A more precise difinition of the crest is the convex portion of the hilltop.

Aspect

The key recognizes that moisture regimes and vegetation distribution patterns are influenced by the aspect of a slope. Theory and empirical evidence indicate that the coolest and dampest sites occur on northeast facing slopes, while the hottest and driest conditions are found on southwest facing slopes. The axis of maximum effect is therefore located along the N45°E-S45°W line. Distribution of species is essentially symmetrical on either side of this line, as is shown diagramatically in figures 53-56.

Bottomland and Sites

Sites that are adjacent to streams and subject to overflow from time to time, that is, sites below the base level previously described (Figure 21), have been divided into four categories:

(1) Sites along the free-flowing portions of the Coosa River (Figure 23). These areas are limited because the river has many dams behind which slack water almost reaches the foot of the next dam upstream. Where free-flowing, the Coosa River is relatively deeply incised into the valley floor and the bottomland forest sites occur only along the bank. Beyond the bank is the main valley floor of Zone IV.

(2) Sites along all other free-flowing streams with well defined channels (Figure 24). Included are the sites along the streams from their headwaters down to their junction with the Coosa River or where their drainage leaves the Forest Habitat Region. Unlike the situation in the Piedmont and Mountain Forest Habitat Regions, the species complex along the streams in the Ridge and Valley Forest Habitat Region exhibits little or no difference as the stream size changes. The same cover type therefore occurs along the whole drainage system, even in coves. At the headwaters, essentially intermittent streams, the branch bottom forest cover type will apply only to a narrow strip of trees, perhaps no more than one tree wide. As the streams become larger the accompanying bottomland site condition usually widens but it may never attain a width of more than two or three trees on each side if the stream is in a relatively deep channel with well defined banks. The valley floors of Zone IV or one of the other zones are beyond the banks.

(3) Sites along streams with gradients so slight that meandering multi-channelled streams have developed and swamp conditions occur (figures 25 and 26). Ground conditions within these swampy areas are not uniform, with the sites ranging from moist to standing water. This results in local groupings of species. For example, water tupelo may be found in areas with standing water but rarely, if ever, on sites that are only slightly less wet. Swampy conditions may be created by beaver dams. In such cases, the species mix will be abnormal because the vegetative cover requires considerable time to adjust.

Figure 18. Stereogram showing a portion of the "flatwoods" in Zone IV. The slight relief on this area is clearly evident. In the area labelled (A) the relief is so gentle that slope positions cannot be assigned. Consequently such areas have been classed as "flat." In the area labelled (B), relief is slight but hills can be distinguished. These should be recognized as such when using the key. (Cherokee County, GT-2LL-221, 222).

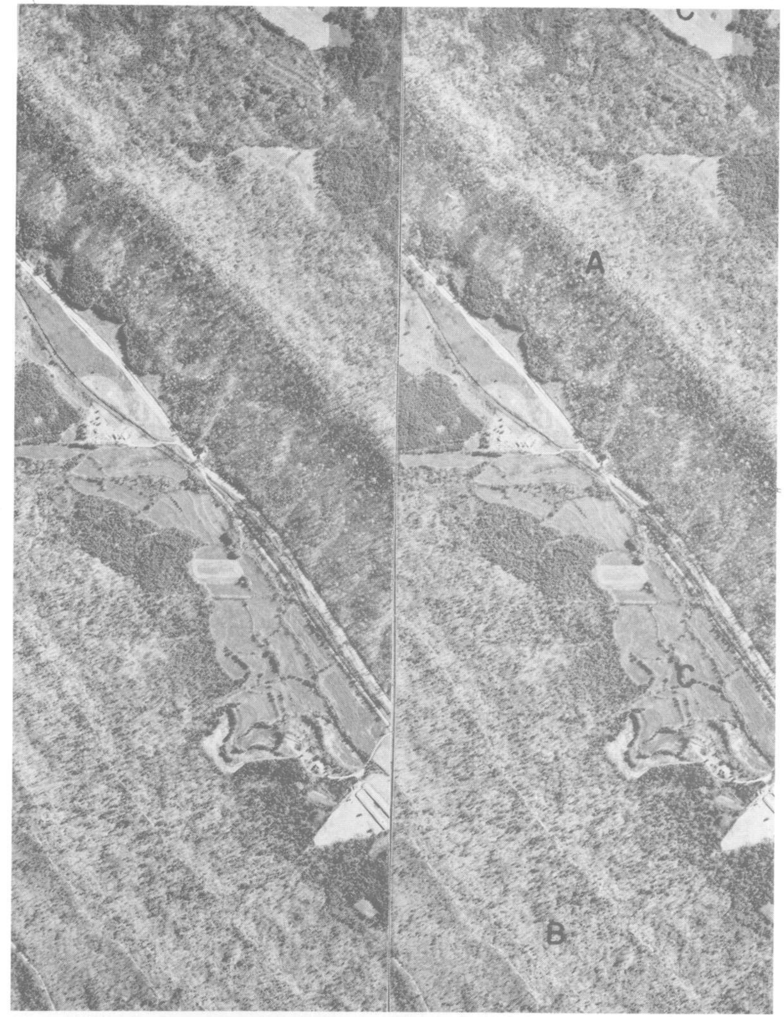

Figure 19. Stereogram showing a portion of Shinbone Ridge (A), a sandstone ridge in Zone II developed from the Red Mountain formation. The Ridge parallels the eastern escarpment of Lookout Mountain (B) which lies in the Cumberland Plateau Forest Habitat Region. The valleys to the east and west of Shinbone Ridge (C) are parts of Zone IV. Note the abrupt transitions between zones and between the regions. (Etowah County, HC-3LL-68, 69).

Figure 20. The boundary between the undulating floor (Zone IV) of the Coosa River Valley (A) in the Ridge and Valley Forest Habitat Region and the rough, highly dissected, Talladega Slate area (B) of the Mountain Forest Habitat is evident in this stereogram. (Calhoun County, GR-2LL-133, 134).

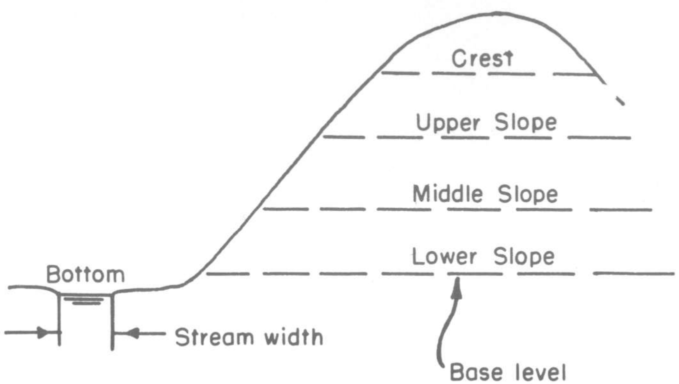

Figure 21. Idealized cross-section of a hill and valley showing the topographic positions and the base level.

Figure 22. Stereogram showing delineation of slope classes. The stereogram showing a portion of a sandstone and shale ridge in Zone II, (A), and a portion of a chert ridge in Zone I, (B). Both lie above Zone IV. Area C is a portion of Zone IV where the relief is so slight that no aspects can be determined, while in area D sufficient relief is present so that slope position and aspect should be evaluated. The stream overflow areas are delineated by dotted lines. Note that the overflow line at point E ends at the pond. Beyond this point the overflow boundary is below the water surface and its position must be estimated. Slope positions have been delineated on portions of ridges A and B. Crests are labelled "T", upper slopes "U", mid-slopes "M", and lower slopes "L". An interpreter should not draw lines of this type. Instead, the delineation should be performed mentally while viewing the scene stereoscopically. (Etowah County, HC-3LL-142, 143).

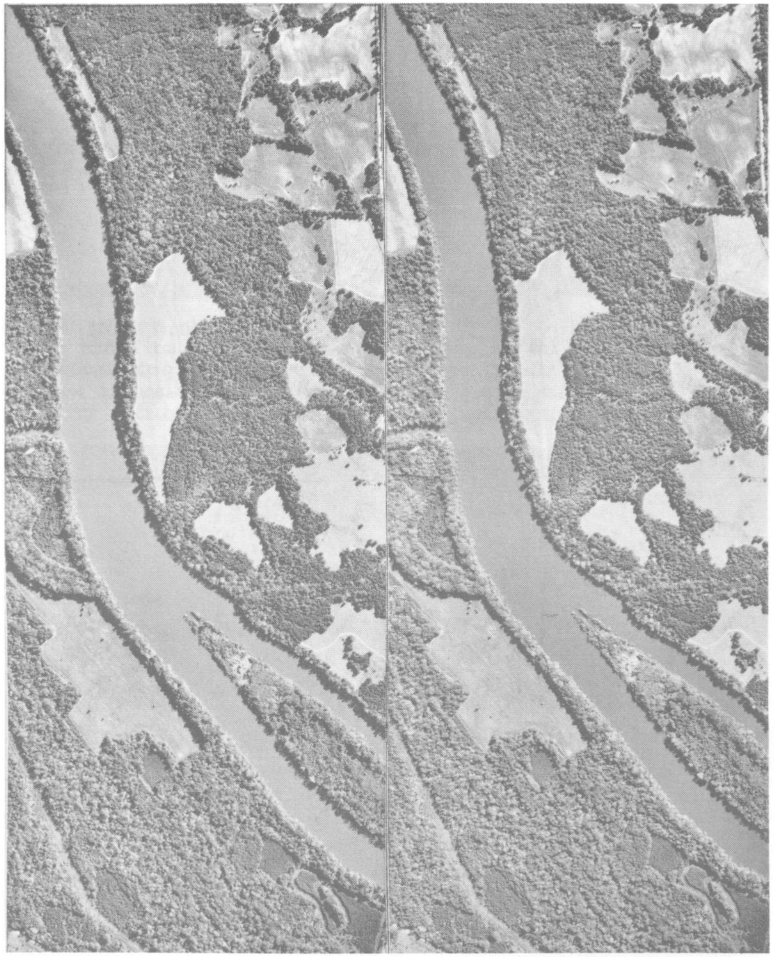

Figure 23. Stereogram showing one of the few segments of the Coosa River where the river flows freely within its natural banks. It is only along these segments that the forest cover types P (6), PH (9), and H (11) occur. (Shelby County, CEB-3JJ-110, 111).

Figure 24. Drainage involves streams of many sizes and degrees of visibility on the photographs. (A) is the largest stream on this stereogram. It has a well-defined channel that is relatively deeply incised into the land surface. The stands associated with it, such as (B), are linear, occurring right along the bank. Back of these linear streambank strands are other stands, such as (C) and (D) which are not to be considered drainage stands but belong to the appropriate upland categories. Some streams, such as (E), may have channels hidden under the trees. In such cases the presence of the stream is implied by the band-like stand of light-grey crowns. In some cases dependence must be placed on a band of tree crowns that are taller than the surrounding trees. In any case, the presence of the stream and the accompanying stands of trees usually can be determined without difficulty. (St. Clair County, CEA-3LL, 283, 284).

Figure 25. Stereogram showing a portion of the Ballplay swamp, probably the most extensive swamp in the Ridge and Valley Forest Habitat Region. Note the myriad stream channels within the swamp, indicating the lack of any strong tendency for the water to flow in any direction. (Etowah County, HC-4LL-70, 71).

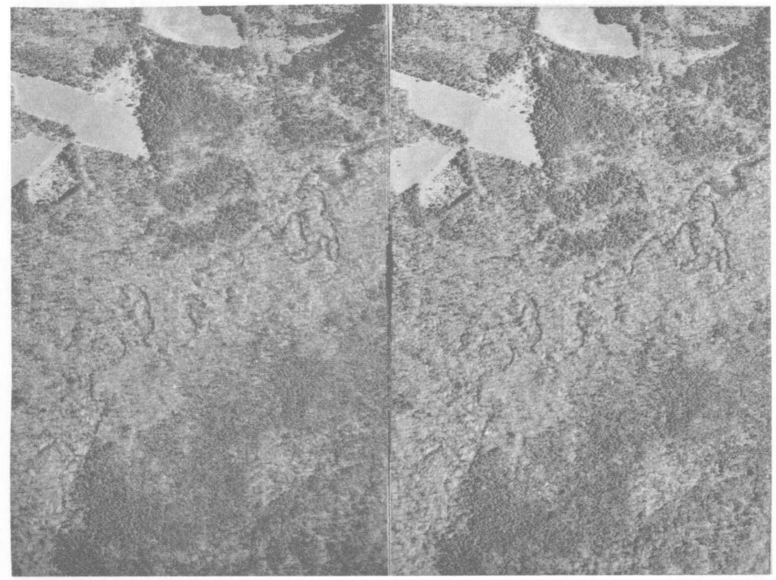

Figure 26. The overflow area associated with this meandering stream is sufficiently wide to qualify as a swamp. (Etowah County, HC-3LL-252, 253).

(4) Sites along the edges of artificial impoundments. The Coosa River, and many lesser streams, has been dammed at a number of places, creating lakes or ponds. Where streams enter the impoundments and where the water is so shallow that the bottom is exposed as the level of the impoundment fluctuates, stands of black willow or hazel alder or both, often occur (figures 27 and 28). In most cases, these are the only true wet-site conditions associated with the impoundments.

Forest cover along the margins of the lake is usually the type associated with the upland slope positions that the stands would have occupied if there were no lake (figures 28 and 51). The impoundment edges therefore cannot be classed as bottomland, as they occupy upland slope positions that must be estimated by the interpreter. The key returns the search to the upland portion of the key (see steps 24 and 30 in the key) if the interpreter mistakenly classifies pond or lake edges as bottomland. Although this provision violates rules for a truly dichotomous key, it was retained for the sake of efficiency in use.

Photographic Tone

The most valuable photo-image characteristic for distinguishing between softwoods and hardwoods on black and white aerial photographs is photographic tone. Hardwoods, as a group, reflect more light than softwoods, usually making them appear lighter in tone on photographic prints than the softwoods. This tendency can be accentuated by the appropriate choice of photographic specifications.

The photographic specifications used by the A.S.C.S. fail to produce photographs that are ideal for forest cover identification. While the film and filter combination is acceptable, the season of year may not be suitable because the agency requires photography that will merely distinguish field from forest. The only seasonal condition that interferes seriously with this requirement is snow cover, so most of the photographs made for the A.S.C.S. are taken in the summer in the North and in late fall, winter, or early spring in the South. Late fall, winter and early spring provide the worst possible conditions for taking aerial photographs that are to be used for forest cover evaluation because hardwood leaves are dying, have fallen, or are just developing. Photographic tone associated with hardwood cover is subject to wide variation; it therefore has been given minimal weight in the key. Tone nevertheless cannot be ignored completely because it is essential to the estimation of relative proportion of hardwoods and softwoods.

A further factor influencing photographic tone is contrast, which is defined as the range in grey tones from lightest to darkest appearing on a print. When this range is short, the print has low contrast and is termed a "soft" print (Figure 29). When the lightest tones are nearly pure white and the darkest tones are nearly black, the print has high contrast and is termed a contrasty, or "hard", print (Figure 30). Contrast is controlled in the printing process, and the usual objective is to choose a contrast level that will reveal maximum detail. If contrast is not optimum, maximum detail is not depicted and information is lost. The A.S.C.S. provides the buyer no opportunity to specify contrast level, and there is little or no effort to provide optimal contrast. Only rarely is contrast on an A.S.C.S. print suitable to a forest photo-interpreter. Tonal differences between hardwoods and softwoods are often minimal, making the photo-interpretation problem unnecessarily difficult. This problem has been accentuated in recent years with the advent of electronic "dodging" devices. When not appropriately programmed, these devices can produce photographs on which species differences have been completely obliterated.

The key in this publication recognizes three tonal situations, based merely on the proportion of dark (softwood) crowns in the stand canopy. (1) Seventy percent or more of the crowns are dark grey; (2) 30 to 70 percent of the crowns dark grey; and (3) less than 30 percent of the crowns dark grey. Neither season of photography nor contrast level of the print greatly affects the detectability of the dark grey crowns. However, the evaluation of the hardwood component of the canopy is strongly influenced by these factors.

In the fall, leaves of deciduous trees decline in vigor and die in a pattern that is far from uniform, leaving some crowns visible and others invisible, resulting in underestimation of the hardwood proportion. In addition, tonal differences between hardwoods and softwoods are reduced during this period, particularly when the contrast level is high (Figure 31).

In winter, when the deciduous trees bear no leaves, the crowns are invisible on photographs and the tone is a reflection of the ground cover and has little or no relation to hardwood trees. The only evidence of trees is the presence of shadows. When shadows of bare trees fall clear, as shown in Figure 32, they usually can be used to estimate the relative density of the hardwood component. Figure 33 shows a relatively dense stand of hardwoods whose presence is revealed by their shadows.

Some broadleaved tree species (e.g., sweetbay) are evergreen, and some (e.g., southern red oak) hold their dead leaves until new leaves appear in the spring. This causes no problem if photographs are made with panchromatic film, because both live and dead hardwood leaves usually appear lighter than softwood crowns. Black and white infrared film, however, provides little differentiation in tone between softwood crowns and dead hardwood leaves.

Tonal differences between hardwoods and softwoods appear to be at their maximum after the leafing-out process is essentially complete, but before the leaves are fully mature. There should be no difficulty in classifying a stand into one of the tonal classes on photographs made then. Unfortunately, A.S.C.S. photography in the South rarely is taken this late in the spring, and the interpreter must depend on the combination of tone and shadows (Figure 34).

Different stands having the same ratio of dark to light crowns may differ considerably in appearance because of difference in stand density. Figures 35 to 50 are stereograms that show examples of the three different tone classes caused by different density levels. Examples are also shown where the hardwood component must be evaluated from shadows.

Texture

To the experienced forest photo-interpreter, arrangement and character of fine detail of forest cover often yield valuable clues to the species composition and condition of forest stands. No uniform system of describing texture on photographs has been developed and accepted. Interpreters have no way of communicating with each other on the subject of texture with any degree of precision. For this reason, texture has not been used as a diagnostic tool in these keys.

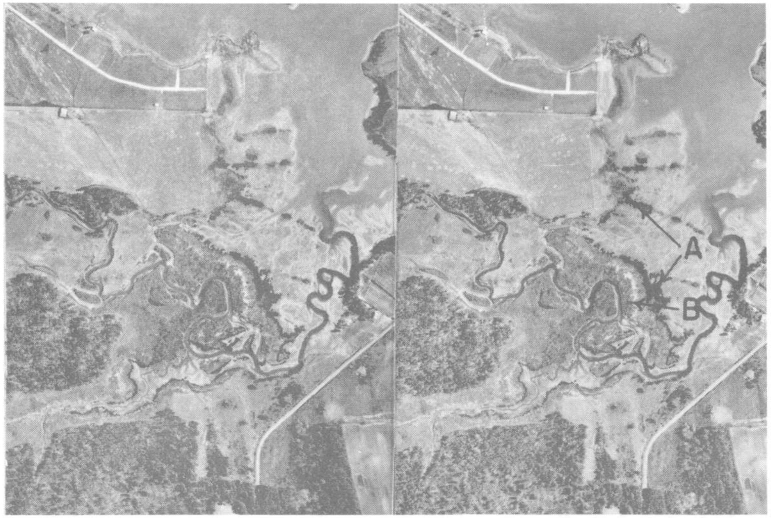

Figure 27. Stereogram showing an area of recently deposited alluvium at the mouth of a stream entering an impoundment of the Coosa River. The dark-toned crowns (A) are black willow, while the light-toned crowns (B) are hazel alder. (Etowah County, HC-3LL-253, 254).

Figure 28. Stereogram showing a pond formed by damming a minor stream. At the head of the pond (A) is recent alluvium bearing a sparse stand of hazel alder. The remainder of the pond-edge actually is an upland condition; to identify the stands along that edge, use the upland portion of the key. Tó obtain the slope position, estimate the position of the original base level under the surface of the pond. (Jefferson County, CPM-1JJ-23, 24).

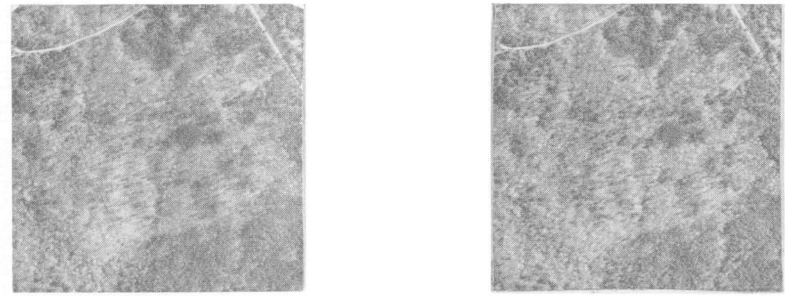

Figure 29. Stereogram with low contrast.

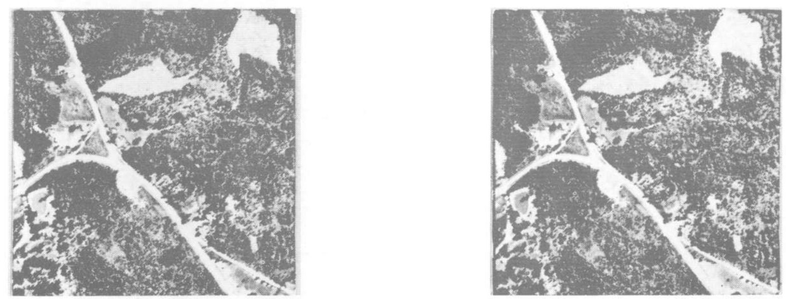

Figure 30. Stereogram with high contrast.

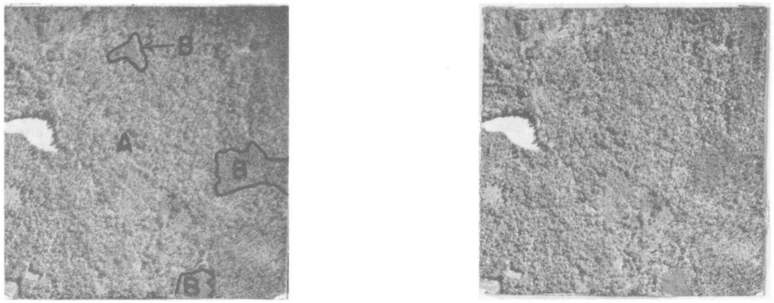

Figure 31. Stereogram showing hardwoods (A) and pine (B) during the fall color season.

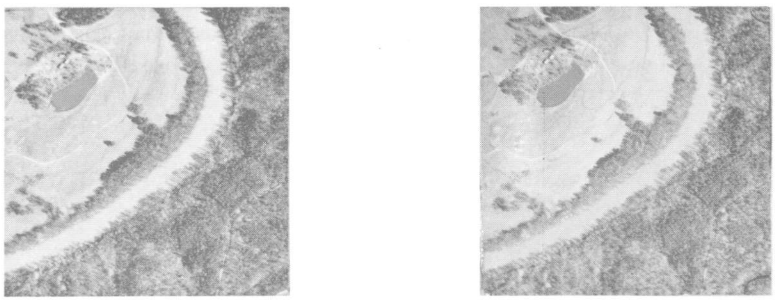

Figure 32. Stereogram showing shadows of hardwoods falling clear on the surface of a stream. Crown characteristics are quite clear.

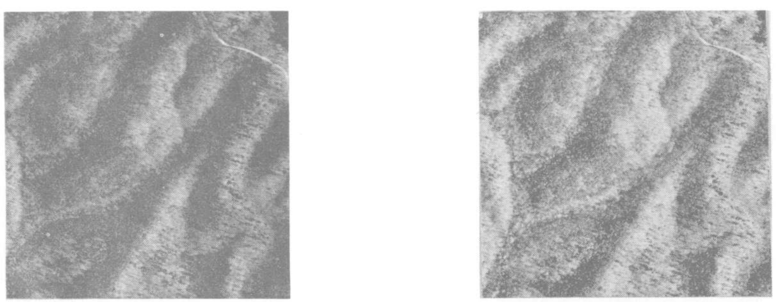

Figure 33. Stereogram showing shadows of hardwoods in a relative dense stand. Note the striated appearance of the shadows. Density of the striations is correlated with stand density.

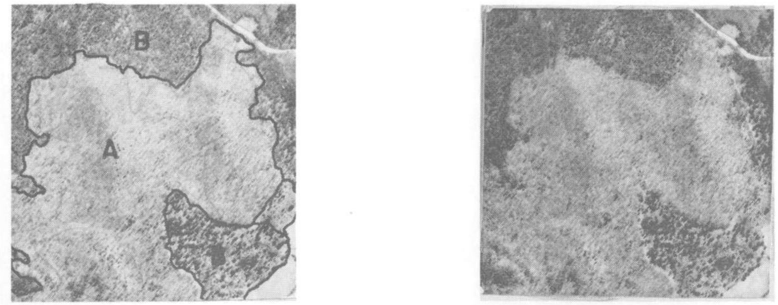

Figure 34. Stereogram showing the contrast between hardwoods (A) and pines (B) in early spring when the leaves are beginning to open.

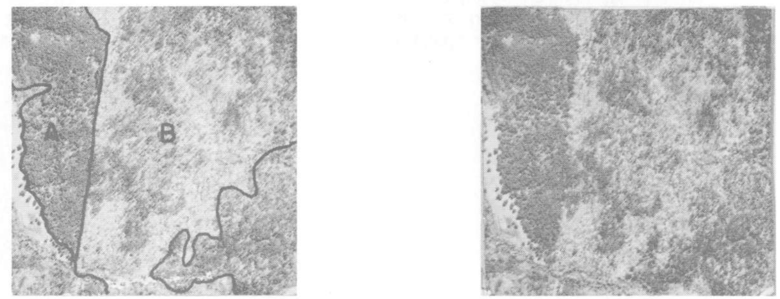

Figure 35. Stereogram of a dense stand of pine (A) adjacent to a stand of mixed pine and hardwoods (B).

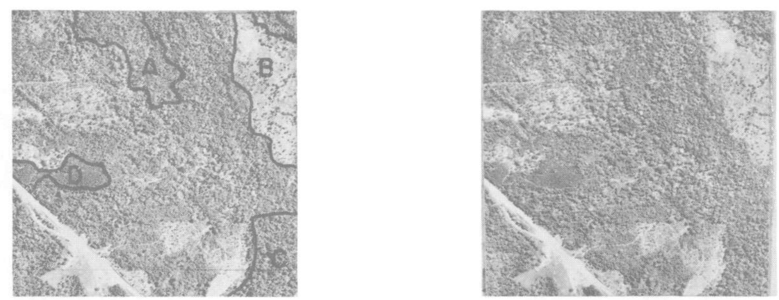

Figure 36. Stereogram of a medium dense stand of pine (A), a field restocking to pine (B), a dense stand of mixed pine and hardwoods (C), and a small, dense pine plantation (D).

Figure 37. Stereogram of an open stand of pine (A), with light-toned brush along the stream (B).

Figure 38. Stereogram of a dense mixed pine-hardwood stand. The photographs were taken during the fall color season. Discrimination between the pines and hardwoods would be on the basis of tones of grey.

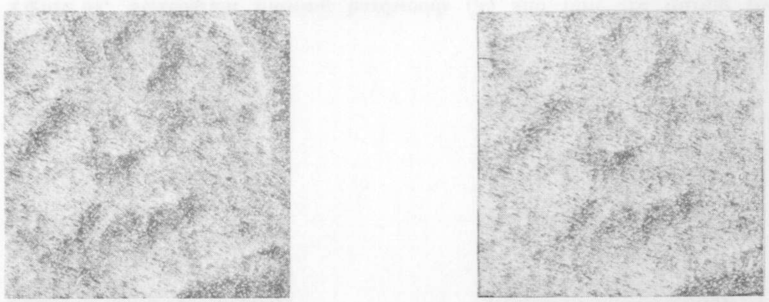

Figure 39. Stereogram of a dense mixed pine-hardwood stand. The photographs were taken during winter when leaves were off most of the hardwoods. The pine crowns are still full. The only evidence of hardwoods is the shadow pattern and a few light-toned crowns still holding leaves.

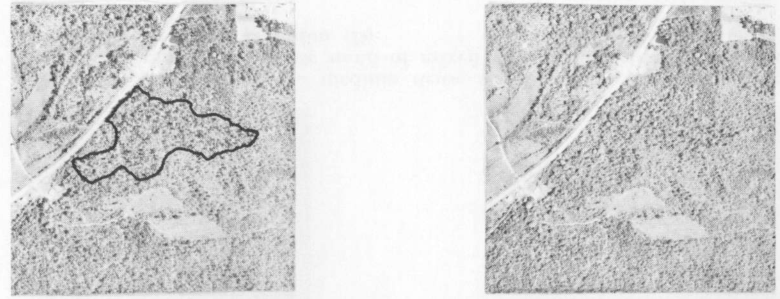

Figure 40. Stereogram of a two-storied, mixed pine-hardwoods stand. The overstory is medium stocked. The photographs were taken during the fall color season. Discrimination between pines and hardwoods is on the basis of tones of gray.

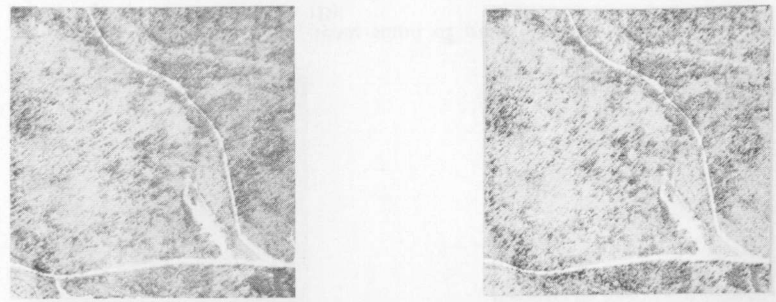

Figure 41. Stereogram of a medium-stocked, mixed pine-hardwood stand. The photographs were taken in the spring before leaf development was complete. The hardwood component is revealed primarily by shadows.

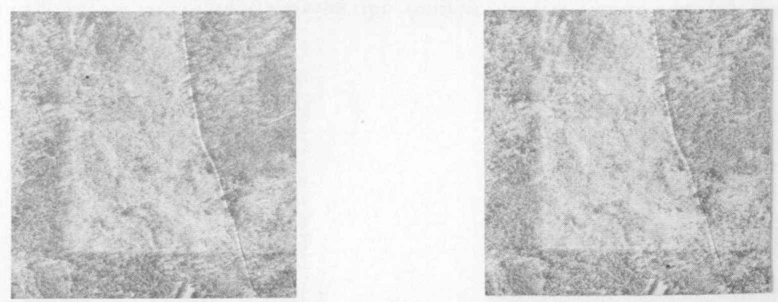

Figure 42. Stereogram of a cut-over area with a thin residual stand of mixed pines and hardwoods. The hardwood crowns are light-toned while the pine crowns are dark toned.

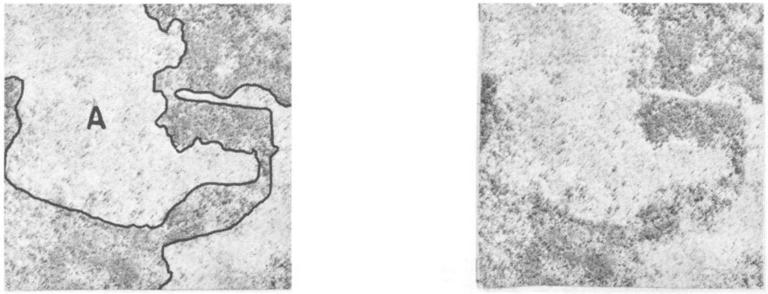

Figure 43. Stereogram of a thin stand of mixed pines and hardwoods (A). The hardwood component can be evaluated only by shadows. Though photographed in the spring when the leaves were developing, the hardwood crowns are not distinct because the understory is also light-toned.

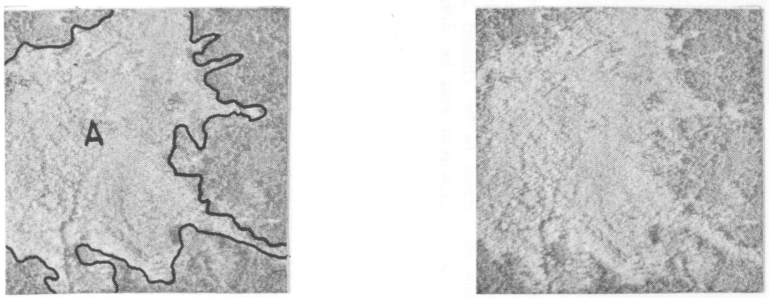

Figure 44. Stereogram of a dense stand of hardwoods (A). The photographs were taken in winter and nearly all of the hardwood leaves have fallen. Although the contrast level is low, the few remaining leaves cause the hardwood crowns to be distinctly lighter in tone than the pine crowns.

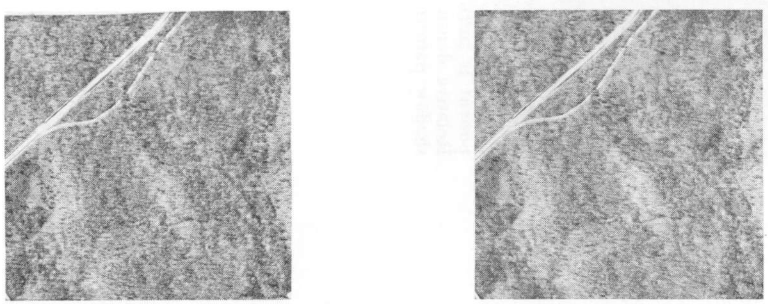

Figure 45. Stereogram of a dense stand of hardwoods. The photographs were taken in winter when few of the hardwood crowns still bore leaves. Density of the stand must be judged from the shadows.

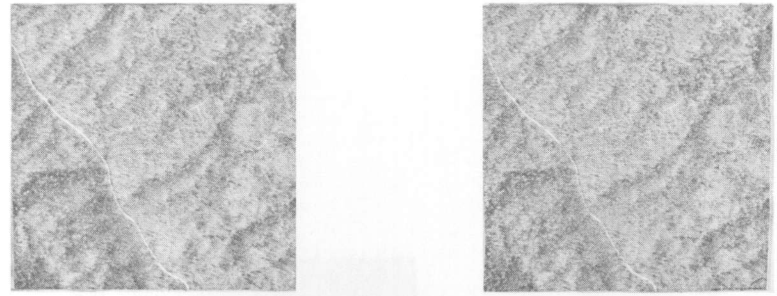

Figure 46. Stereogram of a patchy stand of hardwoods ranging from medium to high density. Though the photographs were taken in winter, many of the hardwoods still bear leaves. Density of the stand must be judged jointly from the crowns and shadows.

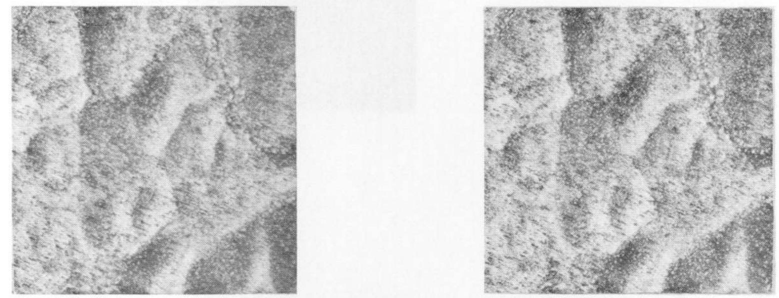

Figure 47. Stereogram of a medium dense hardwood stand. The density must be judged primarily from shadows.

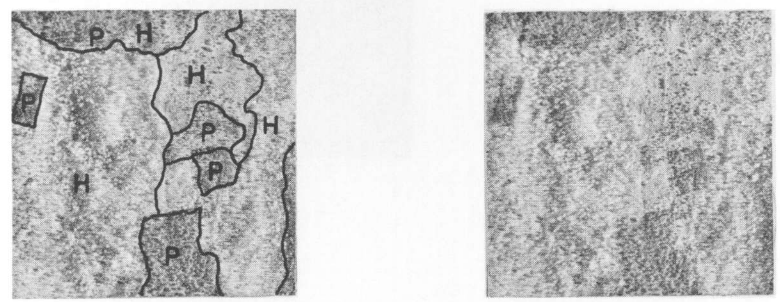

Figure 48. Stereogram showing a variety of hardwood and pine stands. The photographs were taken in winter, but many of the hardwoods still retain their leaves. Stand density must be judged from tones of crowns and shadow patterns.

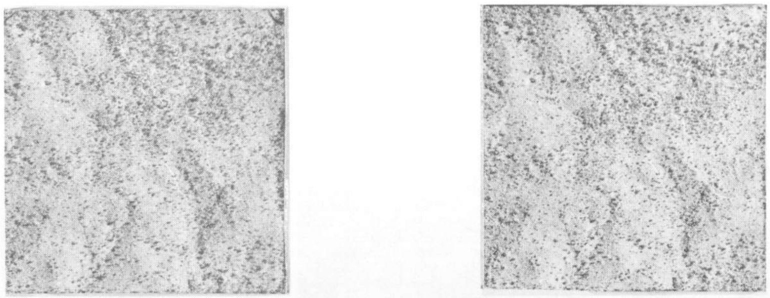

Figure 49. Stereogram of a thin stand of hardwoods in the fall color season. The hardwood crowns are visible and can be used to determine relative density of the hardwood component.

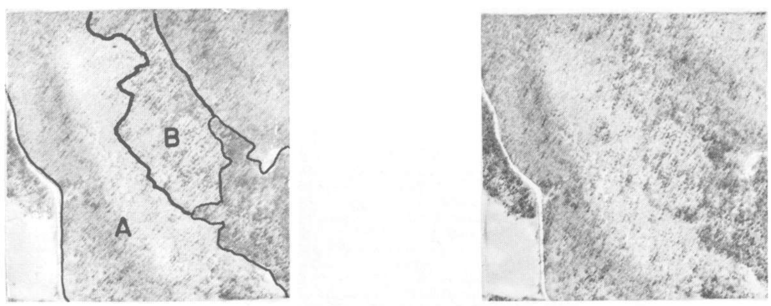

Figure 50. Stereogram of a medium to low density hardwood stand (A). The pine component of this stand is less than 30 percent of the stand basal area. In stand B, the density remains medium to low, but the pine component is sufficiently large for thc stand to be classed as pine-hardwoods. Relative density of the hardwood component can be determined from the shadow pattern.

Plantations

Pine plantations are found in many places in the Ridge and Valley Forest Habitat Region. Most are composed of loblolly pine, but Virginia pine has also been planted. Trees are often planted on sites where they would be unlikely to occur naturally (Figure 51). The key does not distinguish species of planted pines because it is based on natural occurrence patterns.

Young pine plantations are characterized by a comparatively high uniformity of stand density and tree height. In addition, the rows often can be distinguished (Figure 52). As the plantations grow older, they maintain uniformity of density and tree size, but the rows become less and less distinct. Nevertheless, a plantation is seldom hard to identify.

TESTING THE KEY

Objectives of the Testing Program

The primary objective of any test of a key should be to determine its validity. Does it invariably lead to the correct solution when there are no errors at the decision points?

A secondary but important objective of testing is to determine the ease of using the key and to discover which decision points are likely to present difficulties.

Test Program Rationale

The basic validity of an aerial photographic forest cover key can be evaluated only by sampling forest stands in the region under study. These stands would have to be visited to determine species composition and to evaluate or measure on the ground parameters used at every decision point in the key. The ground parameters then would be used to follow decision paths through the key. At the end of each decision path an estimate of species composition is obtained, which is then compared to the actual composition determined in the field. Since there are many paths that might be followed and all should be evaluated for validity, the sample must be widely dispersed geographically and must represent wide varieties of species groupings and topographic sites. To keep costs within reasonable limits, stands in the sample must be reasonably accessible, both physically and legally. These constraints render impractical the use of probability sampling in the testing program. If the sampling is unnecessarily selective, however, it might not truly represent the intended population. Bias should be avoided by selecting the sample in advance of field work. This probably can be accomplished best by using index mosaics to lay out logical routes of travel and photographs to locate sample stands.

Results of a testing program such as this would indicate error rate by condition or by condition group. These error rates would be point estimates of the true error rates. Valid confidence intervals could not be computed for these estimates because of the method of sampling. The estimates, nevertheless, should be of value because they indicate the approximate positions of weaknesses in the key. The Ridge and Valley Forest Habitat Region key was tested in this manner.

Obtaining accurate information regarding ease of using the key would require a representative sample of persons apt to use this type key to evaluate images of stands of known composition. Error rates, by decision paths, could serve as a measure of the ease of using the key. This sample set of stands also should include as many different cover types and occupy as many different site types as possible. This would increase the probability that most, if not all, decision paths would be explored and most points of ambiguity found.

A sampling design for testing ease of use with high precision, though it could be developed, would be far from simple. Persons making up the testing team would have to be drawn from the universe of potential key users but could not include anyone involved in developing the key. The team would have to consist of persons not associated with the developing organization (in this case Auburn University) and their participation would be at the pleasure of their employers. Experience with other key testing programs (Parker and Johnson, 1969; Northrop and Johnson, 1970) indicates that some organizations are willing to make certain of their personnel available for such purposes. The time that these organizations are willing to allot to this type of activity is understandably limited. Because the amount of time needed to test a key adequately is relatively great, particularly if the testers are not already familiar with the key and its terminology, it is almost impossible to assemble a team to do the work. As a result, no formal attempt was made to recruit a team to test this key for ease of use.

In the process of development, the key was continually subjected to testing and revision by the persons responsible for the project. In addition, a number of persons within the university community were asked to try the key and offer suggestions for possible revisions. Though no numerical records of these attempts were kept, comments of the testers received close attention and the key was modified accordingly. These modifications undoubtedly made the key easier to use than it otherwise might have been.

Test Results

The plan for developing the key included provisions for testing to determine its validity. Approximately half of the prism point data obtained in the field were reserved for this test. Table 4 summarizes the results. As can be seen in Table 4, three levels of accuracy were recognized: Correct, Qualify, and Wrong. In a stand identified as Correct, one or more of the primary species dominated; that is, such species comprised at least 50 percent of the stand basal area. If one or more of the secondary species dominated the stand and at least one of the primary species provided some appreciable portion of the stand basal area, the identification was considered to qualify. If none of the primary species were present in the stand, regardless of the dominance of secondary species, the identification was classed as Wrong.

Relatively few identifications were Wrong. Flexibility of pine-hardwood and hardwood type descriptions resulted in relatively high rate of correct identifications. Though flexibility of defining pine types was considerably less, the rate of Correct identifications was high. It thus appears that the key is constructed in such a manner as to facilitate recognition of occurrence patterns with considerable reliability.

It appears that the key is fundamentally valid. This does not mean, however, that everyone using the key would obtain similar results. The key must be used properly or

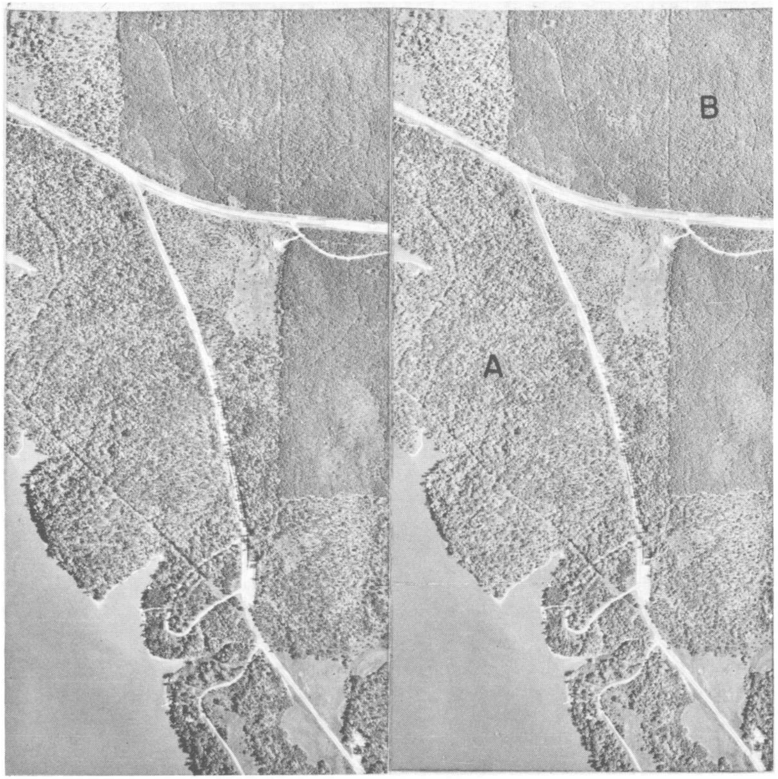

Figure 51. Stereogram of an area in Zone I where naturally occurring longleaf pine (A) is being replaced by plantations of loblolly pine (B). In cases like this the photo-interpretation key will yield false results because the loblolly pine is being planted off-site. In addition, note the stands along the edge of the lake. Although those stands are adjacent to the water, they are not made up of bottomland species. Instead they retain the upland character and can be evaluated using the key for upland sites, provided a good estimate of the slope position can be made. This may be difficult since the base level is at some unknown level below the lake surface. Talladega County, HW-2LL-62, 63).

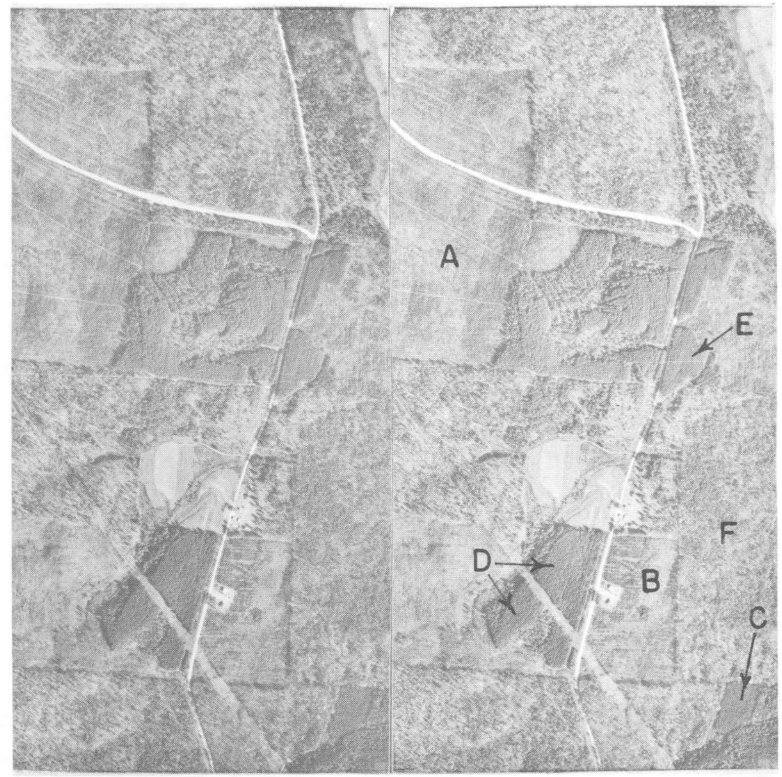

Figure 52. Stereogram showing plantations of pine of varying ages. (A) is a newly established plantation with very small trees. The planting follows the contour. (B) is made up of somewhat larger trees than in (A) and planting failure in places is evident. (C) is a plantation of sapling size with high survival and few gaps. The rows of trees are still distinguishable. (D) shows two stands that are reaching pulpwood size and the rows are still visible. (E) is a very dense pulpwood-sized stand where the rows are no longer visible. The extreme uniformity of the plantations contrast sharply with the much less uniform natural stand at (F). (Cherokee County, GT-2LL-192, 193).

TABLE 4. RESULTS OF THE TESTS MADE TO EVALUATE THE VALIDITY OF THE KEY.

		Pine			Pine-hardwoods			Hardwoods		
Zone	Site	Correct	Would[1] qualify	Wrong	Correct	Would[1] qualify	Wrong	Correct	Would[1] qualify	Wrong
I	Crest	----	----	----	1	0	0	0	0	3
	Upper slope	3	0	0	4	1	0	1	1	0
	Mid slope	1	0	0	9	0	0	3	1	0
	Lower slope	5	0	0	2	0	0	6	0	2
II	Crest	8	0	0	8	0	0	7	2	0
	Upper slope	3	0	0	12	0	1	15	2	2
	Mid slope	5	0	0	12	2	1	6	11	4
	Lower slope	----	----	----	5	3	0	20	14	1
III	Crest	----	----	----	----	----	----	2	3	0
	Upper slope	----	----	----	----	----	----	----	----	----
	Mid slope	2	0	0	2	1	0	3	4	3
	Lower slope	----	----	----	1	4	0	2	6	1
IV	Crest	2	0	0	4	2	0	2	0	0
	Upper slope	----	----	----	----	----	----	----	----	----
	Mid slope	4	0	0	2	0	2	3	8	2
	Lower slope	2	0	0	7	4	4	17	14	1
Stream bottoms (free flowing)		----	----	----	3	0	2	52	24	10
Coosa bottom (free flowing)		----	----	----	----	----	----	15	5	1
Swamps		----	----	----	----	----	----	6	1	0
		35	0	0	72	17	10	160	96	30/420

[1]These stands fit the description of the indicated cover type if the description is interpreted broadly, e.g., if the normally dominant species are replaced by common associates and the normally dominant species are represented sufficiently to provide an appropriate portion of the stand basal area.

results will be unsatisfactory. In the description of a similar key for the Piedmont Forest Habitat Region (Johnson and Sellmann, 1974) was a statement regarding the attributes of an ideal user. Perhaps it would be worthwhile to restate that description: "The interpreter should be thoroughly familiar with the key and should have a good understanding of all the terms used in the key; he should be capable of making all measurements or estimates required by the key; he should be sufficiently familiar with local conditions that he would be likely to sense a blunder in the making; and, lastly, he would be imbued with a desire to do his work well. If the person using this key has these attributes, results of his use of the key should be satisfactory."

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APPENDIX I

Forest Cover Photo-Interpretation Key for the Ridge and Valley Forest Habitat Region in Alabama

1. Stand highly uniform with regard to density, tree heights, crown widths, and tone. Photographic tone[1] is dark grey. Rows may or may not be visible. May be on any site. (Figures 36D, 51A, and 52) .... Pine plantation[2]
1. Stand not as above 2
   2. Stand is on an upland site (Figure 21) 3
   2. Stand is on a streambottom site 18
3. Stand showing evidence of rows. Stocking thin or patchy. (figures 52A and B) .... Pine plantation
3. Stand not as above 4
   4. Stand is in Zone I (See maps in Appendix IV) 5
   4. Stand is not in Zone I 7
5. 70 percent or more of the overstory tree crowns are dark grey (figures 34B, 35A, 36A and B, and 37A) .... Fig. 53A
5. Tree crowns are not as above 6
   6. 30 to 70 percent of the overstory tree crowns are dark grey (figures 38 through 43 and 50B) .... Fig. 53B
   6. Less than 30 percent of the overstory tree crowns are dark grey (figures 44 through 49 and 50A) .... Fig. 53C
7. Stand is in Zone II (see maps in Appendix IV) 8
7. Stand is not in Zone II 10
   8. 70 percent or more of the overstory tree crowns are dark grey (figures 34B, 35A, 36A and B, and 37A) .... Fig. 54A
   8. Tree crowns are not as above 9
9. 30 to 70 percent of the overstory tree crowns are dark grey (figures 38 through 43 and 50B) .... Fig. 54B
9. Less than 30 percent of the overstory tree crowns are dark grey (figures 44 through 49 and 50A) .. Fig. 54C
   10. Stand is in Zone III (see maps in Appendix IV) 11
   10. Stand is in Zone IV 13
11. 70 percent or more of the overstory tree crowns are dark grey (figures 34B, 35A, 36A and B, and 37A) .... Fig. 55A
11. Tree crowns are not as above 12
   12. 30 to 70 percent of the overstory tree crowns are dark grey (figures 38 through 43 and 50A) .... Fig. 55B
   12. Less than 30 percent of the overstory tree crowns are dark grey (figures 44 through 49 and 50A) .... Fig. 55C
13. Stand is on a definite hill (Figure 18B) 14
13. Stand is on a flat area without definite slope (Figure 18A) 16
   14. 70 percent or more of the overstory tree crowns are dark grey (figures 34B, 35A, 36A and B, and 37A) .... Fig. 56A
   14. Tree crowns are not as above 15
15. 30 to 70 percent of the overstory tree crowns are dark grey (figures 38 through 43 and 50B) .... Fig. 56B
15. Less than 30 percent of the overstory tree crowns are dark grey (figures 44 through 49 and 50A) .. Fig. 56C
   16. 70 percent or more of the overstory tree crowns are dark grey (figures 34B, 35A, 36A and B, and 37A) .... P(5)
   16. Tree crowns are not as above 17
17. 30 to 70 percent of the overstory tree crowns are dark grey (figures 38 through 43 and 50B) .... PH(7)
17. Less than 30 percent of the overstory tree crowns are dark grey (figures 44 through 49 and 50A) .... H(8)
   18. Stream has a well defined channel (figures 23 and 24) 19
   18. Stream does not have a well defined channel (is a swamp) (figures 25 and 26) 33
19. Stream is the Coosa River 20
19. Stream is not the Coosa River. This includes any part of the stream, from the headwaters down, including coves) 27
   20. Stream is free flowing (Figure 23) 21
   20. Stream is impounded (figures 8, 27 and 51) 24
21. 70 percent or more of the overstory tree crowns are dark grey 22
21. Tree crowns are not as above 23
   22. Stand is on a sandbar or is on the extreme upstream or downstream end of an island larger than a sandbar .... H(13)
   22. Stand is not located on one of the sites described above (figures 34B, 35A, 36A and B, and 37A). (This condition has not been found) .... Probably similar to P(6)
23. 30 to 70 percent of the overstory tree crowns are dark grey (figures 38 through 43 and 50B). (This condition has not been found) .... Probably similar to PH(8)
23. Less than 30 percent of the overstory tree crowns are dark grey (figures 44 through 59 and 50A) .... H(10)
   24. Stand is on recent alluvium subject to overflow from fluctuating water levels. e.g., sandbars, ends of islands, and shoals and flats at the mouths of streams entering the impoundment (Figure 27) 25

[1]References to photographic tone are applicable to photographs taken using panchromatic film and a deep yellow (e.g., Wratten No. 12) filter or with black and white infrared film and a deep yellow (e.g., Wratten No. 12) or deep red (e.g., Wratten No. 89B) filter. The key can also be used with infrared color photography because softwood crowns are shown with darker hues than hardwood crowns. In the case of normal color photography, however, the differences in hues between softwoods and hardwoods are minimal. Consequently, the key should not be used with such photography.

[2]Pine plantations in the Ridge and Valley Forest Habitat Region are mainly loblolly pine, but Virginia pine has been planted sporadically. Because site has not been an appreciable factor in the choice of species to plant, it is difficult or impossible to recognize the species in a plantation.

24. Stand is not located on a site such as those described above (figures 8 and 51) .... Estimate how far the base level is below the lake surface. From the estimated base level determine the slope position and aspect as though the lake were not there. Return to item I in the key and proceed as with upland stands.

25. Tree crowns are dark grey (Figure 27A) .... H(13)

25. Tree crowns light grey 26

26. Stand height 15 feet or less (Figure 27B) .... Probably H(12) but may be H(10)

26. Stand height greater than 15 feet .... H(10)

27. Stream is free flowing 28

27. Stream is impounded 30

28. 70 percent or more of the overstory tree crowns are dark grey (figures 34B, 35A, 36A and B, and 27A.) (This condition has not been found) .... Probably similar to P(6)

28. Tree crowns are not as above 29

29. 30 to 70 percent of the overstory tree crowns are dark grey (figures 38 through 43 and 50B) .... PH(8)

29. Less than 30 percent of the overstory tree crowns are dark grey (figures 44 through 49 and 50A) .... H(9)

30. Stand is on recent alluvium subject to overflow from fluctuating water levels. e.g., shoals at point where stream enters impoundment (Figure 28) 31

30. Stand is not located on recent alluvium .... Estimate how far the base level is below the lake surface. From the estimated base level determine the slope position and aspect as though the lake or pond were not there. Return to item 1 in the key and proceed as with upland stands.

31. Tree crowns are dark grey (Figure 27A) .... H(13)

31. Tree crowns light grey 32

32. Stand height 15 feet or less (Figure 27B) .... Probably H(12) but may be H(9)

32. Stand taller than 15 feet .... H(9)

33. 70 percent or more of the overstory tree crowns are dark grey (figures 34B, 35A, 36A and B, and 37A). (This condition has not been found) .... Probably similar to P(6)

33. Tree crowns are not as above 34

34. 30 to 70 percent of the overstory tree crowns are dark grey (figures 38 through 43 and 50B). (This condition has not been found) .... Probably similar to PH(9)

34. Less than 30 percent of the overstory tree crowns are dark grey (figures 44 through 49 and 50A) .... H(11)

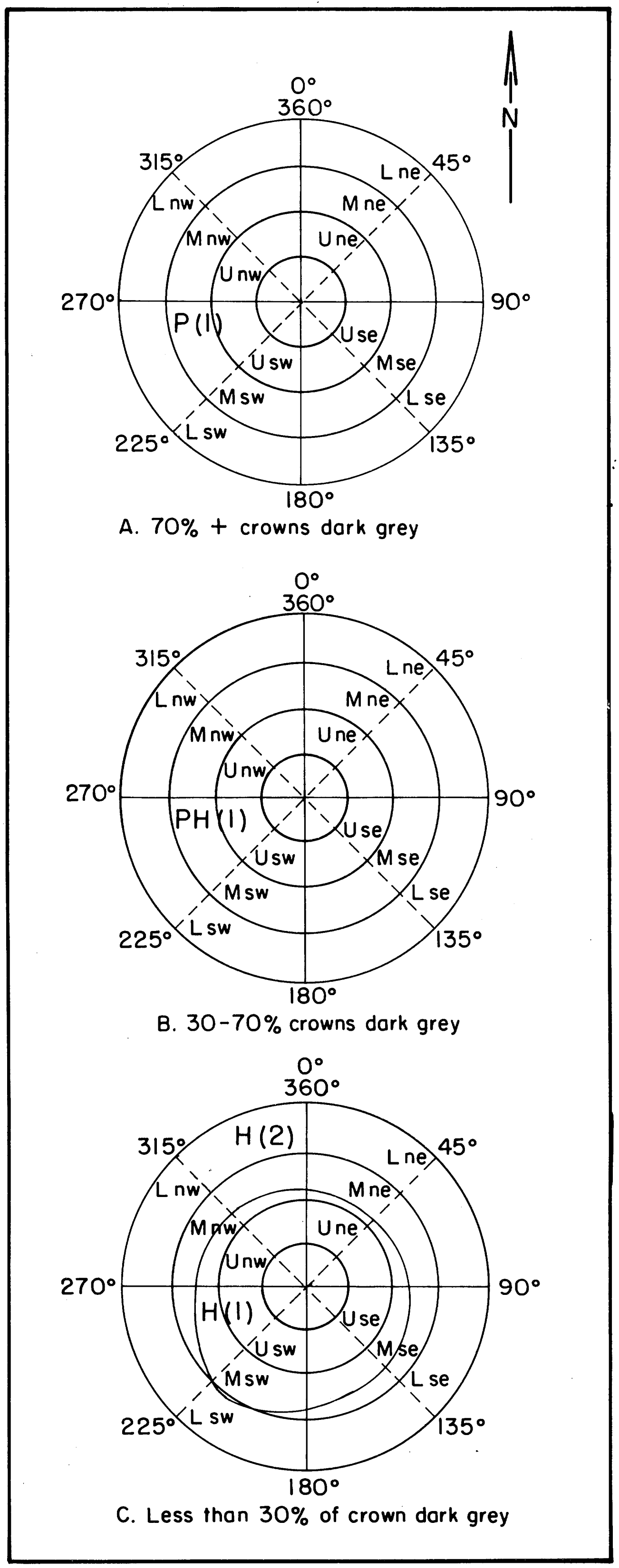

Figure 53. Forest cover type distribution in Zone I. If stand occurs on a saddle, use the cover type occurring on mid-slope when the aspect is N45°W.

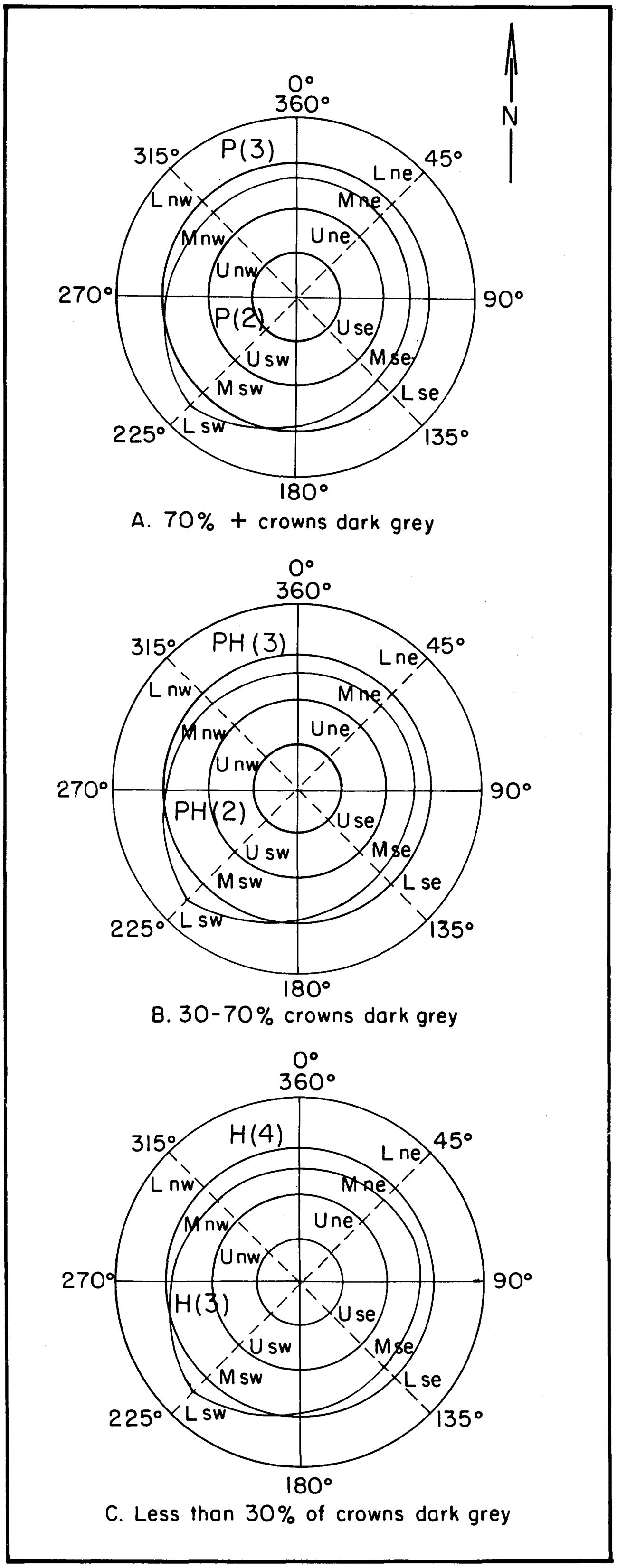

Figure 54. Forest cover type distribution in Zone II. If stand occurs on a saddle, use the cover type occurring on mid-slope when the aspect is N45°W.

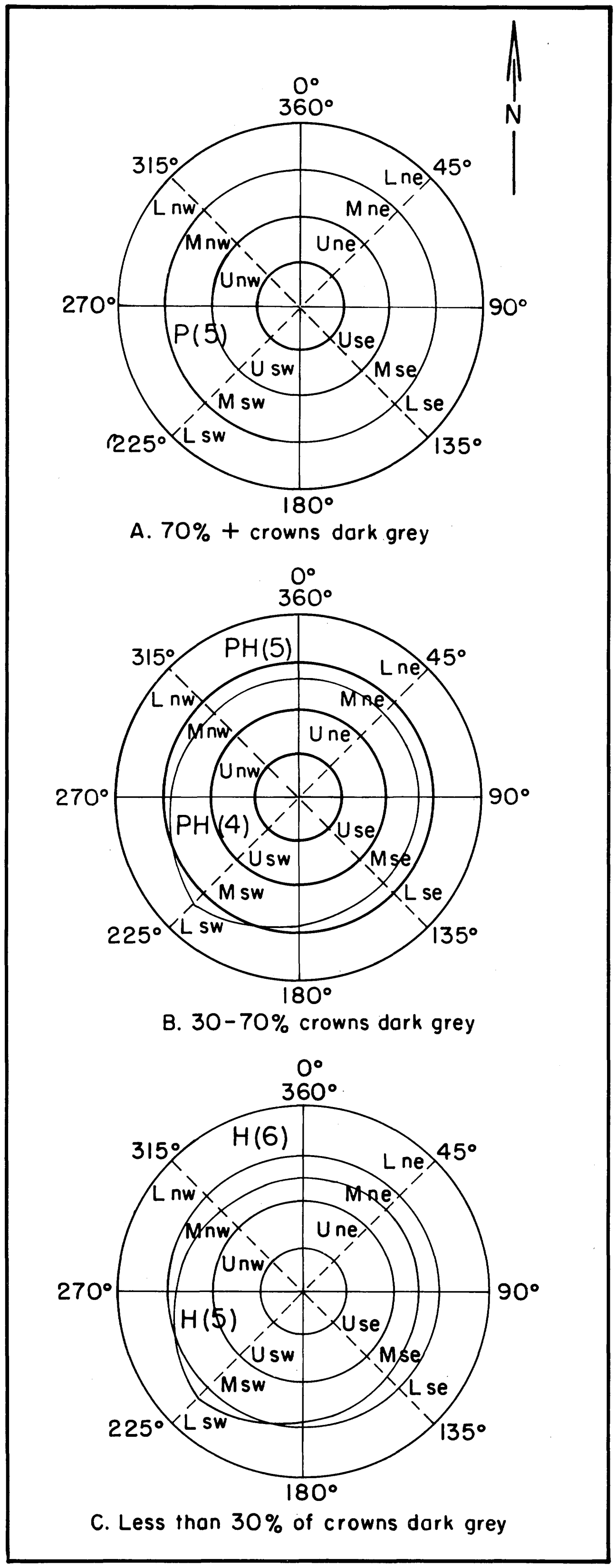

Figure 55. Forest cover type distribution in Zone III. If stand occurs on a saddle, use the cover type occurring on mid-slope when the aspect is N45°W.

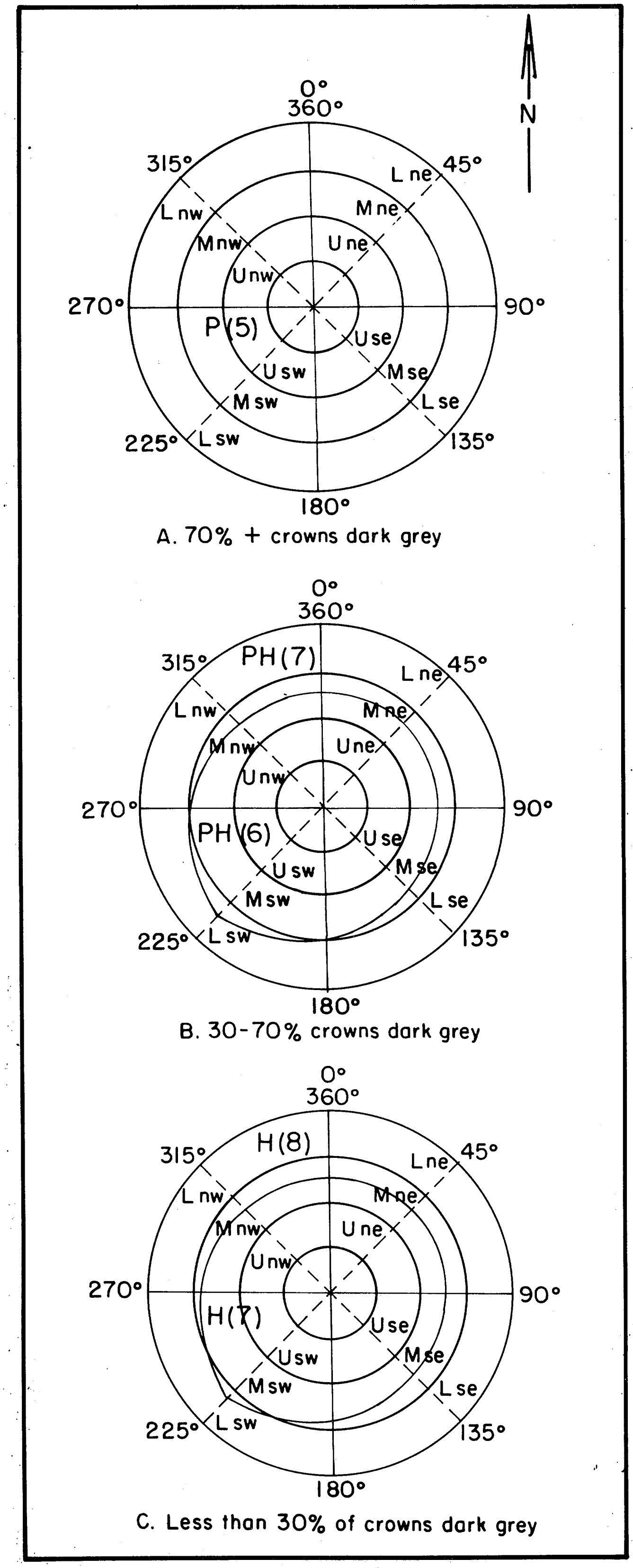

Figure 56. Forest cover type distribution in Zone IV. If stand occurs on a saddle, use the cover type occurring on mid-slope when the aspect is N45°W.

APPENDIX II

Forest Cover Types Occurring in the Ridge and Valley Forest Habitat Region

Cover Type Symbol	*Cover Type*	*S.A.F. Equivalent*
P(1)	**Longleaf pine - shortleaf pine**	70

Type Description

Pine makes up 70 percent or more of the basal area of the overstory. Longleaf pine and shortleaf pine, in any combination, usually make up the bulk of the pine component. Loblolly pine and eastern redcedar occur sporadically. Virginia pine never occurs. The most common hardwood associates are mockernut hickory, blackjack oak, post oak, and scarlet oak. Less common hardwood associates include southern red oak, sassafras, black cherry, red maple, black tupelo, flowering dogwood, and sourwood.

P(2) **Mixed pines** 75, 80

Type Description

Pine makes up 70 percent or more of the basal area of the overstory. Longleaf, shortleaf, and Virginia pine, in any combination, usually make up the bulk of the pine component. Loblolly pine is a common associate. Eastern redcedar occurs sporadically. The most common hardwood associates are mockernut hickory, blackjack oak, and chestnut oak. Less common hardwood associates include pignut hickory, northern red oak, post oak, scarlet oak, southern red oak, white oak, sassafras, sweetgum, black cherry, eastern redbud, red maple, black tupelo, flowering dogwood, and sourwood.

P(3) **Loblolly pine (upland)** 81

Type Description

Pine makes up 70 percent or more of the basal area of the overstory. Loblolly pine usually makes up the bulk of the pine component. Shortleaf pine and Virginia pine are common associates. Longleaf pine and eastern redcedar occur sporadically. The most common hardwood associates are chestnut oak, post oak, and white oak. Less common hardwood associates include mockernut hickory, pignut hickory, American beech, black oak, northern red oak, scarlet oak, southern red oak, yellow-poplar, sweetgum, black cherry, red maple, American basswood, flowering dogwood, and sourwood.

P(4) **Shortleaf pine - loblolly pine** 81

Type Description

Pine makes up 70 percent or more of the basal area of the overstory. Loblolly pine and shortleaf pine, in any combination, usually make up the bulk of the pine component. Virginia pine is a common associate. Eastern redcedar occurs sporadically. Longleaf pine does not occur. The most common hardwood associates are post oak and white oak. Less common hardwood associates include mockernut hickory, pignut hickory, black oak, blackjack oak, chestnut oak, scarlet oak, southern red oak, yellow-poplar, sassafras, sweetgum, black cherry, American holly, red maple, yellow buckeye, flowering dogwood, and sourwood.

P(5) Loblolly pine - shortleaf pine 81

Type Description

Pine makes up 70 percent or more of the basal area of the overstory. Loblolly pine and shortleaf pine, in any combination, usually make up the bulk of the pine component. Longleaf pine, Virginia pine, and eastern redcedar occur sporadically. The most common hardwood associates are blackjack oak, post oak, southern red oak, and white oak. Less common hardwood associates include mockernut hickory, pignut hickory, shagbark hickory, black oak, northern red oak, scarlet oak, water oak, American elm, yellow-poplar, sweetgum, black cherry, eastern redbud, red maple, black tupelo, flowering dogwood, sourwood, and green ash.

P(6) Loblolly pine (drainage) 81

Type Description

Pine makes up 70 percent or more of the basal area of the overstory. Loblolly pine makes up the bulk of the pine component. The other pines and eastern redcedar occur sporadically. The most common hardwood associates are water oak, white oak, yellow-poplar, and sweetgum. Less common hardwood associates include pignut hickory, shagbark hickory, hazel alder, American hornbeam, American beech, chestnut oak, northern red oak, southern red oak, black cherry, red maple, flowering dogwood, and green ash.

PH(1) Longleaf pine - shortleaf pine - upland hardwoods

Type Description

30 to 70 percent of the basal area of the overstory is made up of pine. Longleaf pine and shortleaf pine, in any combination, usually make up the bulk of the pine component. Loblolly pine is a common associate. Eastern redcedar occurs sporadically. Virginia pine never occurs. The most common hardwoods are mockernut hickory, blackjack oak, and post oak. Other common hardwoods are chestnut oak, scarlet oak, and southern red oak. Less common hardwood associates include pignut hickory, American beech, black oak, northern red oak, white oak, American elm, sassafras, sweetgum, black cherry, black tupelo, flowering dogwood, and sourwood. The less common species sometimes become important stand components.

PH(2) Mixed pines - upland hardwoods 76

Type Description

30 to 70 percent of the basal area of the overstory is made up of pine. Longleaf, shortleaf, and Virginia pine, in any combination, usually make up the bulk of the pine component. Loblolly pine is a common associate. Eastern redcedar occurs sporadically. The most common hardwoods are mockernut hickory, blackjack oak, chestnut oak, and post oak. A common hardwood associate is scarlet oak. Less common hardwood associates include pignut hickory, black oak, northern red oak, southern red oak, white oak, yellow-poplar, sassafras, sweetgum, black cherry, red maple, black tupelo, flowering dogwood, and sourwood. The less common species sometimes become important stand components.

PH(3) Loblolly pine - upland hardwoods

Type Description

30 to 70 percent of the basal area of the overstory is made up of pine. Loblolly pine usually makes up the bulk of the pine component. Shortleaf pine and Virginia pine are common associates. Longleaf pine and eastern redcedar occur sporadically. The most common hardwoods are mockernut hickory, chestnut oak, and white oak. Other common hardwoods are pignut hickory, post oak, scarlet oak, yellow-poplar, and sweetgum. Less common hardwood associates include bitternut hickory, shagbark hickory, American beech, black oak, blackjack oak, northern red oak, southern red oak, water oak, sassafras, black cherry, eastern redbud, red maple, black tupelo, flowering dogwood, sourwood and green ash. The less common species sometimes become important stand components.

PH(4) Shortleaf pine - chestnut oak - white oak - hickory 76

Type Description

30 to 70 percent of the basal area of the overstory is made up of pine. Shortleaf pine usually makes up the bulk of the pine component. Loblolly pine and Virginia pine are common associates. Eastern redcedar occurs sporadically. Longleaf pine never occurs. The most important hardwoods are mockernut hickory, chestnut oak, and white oak. Other common hardwoods are northern red oak, post oak, scarlet oak, and southern red oak. Less common hardwood associates include pignut hickory, shagbark hickory, American beech, black oak, blackjack oak, yellow-poplar, sweetgum, black cherry, yellow buckeye, black tupelo, flowering dogwood, sourwood, and common persimmon. The less common species sometimes become important stand components.

PH(5) Loblolly pine - white oak 82

Type Description

30 to 70 percent of the basal area of the overstory is made up of pine. Loblolly pine usually makes up the bulk of the pine component. Shortleaf pine and Virginia pine are common associates. Eastern redcedar occurs sporadically. Longleaf pine never occurs. The most important hardwood is white oak. Other common hardwoods are pignut hickory, post oak, scarlet oak, southern red oak, and yellow-poplar. Less common hardwood associates include mockernut hickory, shagbark hickory, American beech, black oak, chestnut oak, northern red oak, water oak, winged elm, sassafras, sweetgum, American sycamore, black cherry, red maple, yellow buckeye, black tupelo, flowering dogwood, sourwood, and green ash. The less common species sometimes become important stand components.

PH(6) Loblolly pine - shortleaf pine - post oak - southern red oak

Type Description

30 to 70 percent of the basal area of the overstory is made up of pine. Loblolly pine and shortleaf pine, in any combination, make up the bulk of the pine component. Longleaf pine is a common associate. Virginia pine and eastern redcedar occur sporadically. The most important hardwoods are post oak, and southern red oak. Other common hardwoods are blackjack oak, scarlet oak, and white oak. Less common hardwood associates include mockernut hickory, pignut hickory, shagbark hickory, black oak, chestnut oak, chinkapin oak, northern red oak, water oak, American elm, yellow-poplar, sassafras, sweetgum, black cherry, eastern redbud, red maple, black tupelo, flowering dogwood, sourwood, and green ash. The less common species sometimes become important stand components.

PH(7) Loblolly pine - oak - sweetgum 82

Type Description

30 to 70 percent of the basal area of the overstory is made up of pine. Loblolly pine usually makes up the bulk of the pine component, but shortleaf pine often is the dominant pine. Virginia pine and eastern redcedar occur sporadically. Longleaf pine never occurs. The most important hardwoods are scarlet oak, southern red oak, water oak, white oak, and sweetgum. Post oak is a common associate. Less common hardwood associates include black willow, mockernut hickory, pignut hickory, shagbark hickory, hazel alder, American beech, northern red oak, American elm, winged elm, yellow-poplar, sassafras, black cherry, eastern redbud, red maple, yellow buckeye, American basswood, black tupelo, flowering dogwood, sourwood, and green ash. The less common hardwood species sometimes become important stand components.

PH(8) Loblolly pine - branch hardwoods 82

Type Description

30 to 70 percent of the basal area of the overstory is made up of pine. Loblolly pine makes up the bulk of the pine component. The other pines and eastern redcedar occur sporadically. The most important hardwoods are white oak, yellow-poplar, and sweetgum. Other common hardwoods are water oak, red maple, and green ash. Less common hardwoods include black willow, bitternut hickory, mockernut hickory, pignut hickory, shagbark hickory, hazel alder, American hornbeam, American beech, black oak, blackjack oak, chestnut oak, post oak, scarlet oak, southern red oak, winged elm, sugarberry, sweetbay, American sycamore, black cherry, boxelder, American basswood, black tupelo, and flowering dogwood. The less common species sometimes become important stand components.

PH(9) Loblolly pine - swamp hardwoods

Type Description

30 to 70 percent of the basal area of the overstory is made up of pine. Loblolly pine is the only pine found in the swamps. Eastern redcedar occurs sporadically. The most important hardwoods are water oak, white oak, sweetgum, and red maple. Other common hardwoods are bitternut hickory, southern red oak, willow oak, black tupelo, and green ash. Less common hardwood associates include black willow, pignut hickory, hazel alder, American hornbeam, swamp chestnut oak, American elm, sugarberry, sweetbay, yellow-poplar, American sycamore, and boxelder. The less common species sometimes become important stand components.

H(1) Blackjack oak - mockernut hickory

Type Description

Less than 30 percent of the basal area of the overstory is made up of pine. Longleaf pine and shortleaf pine make up the bulk of the pine component. Loblolly pine and eastern redcedar occur sporadically. Virginia pine does not occur. The most common hardwoods are mockernut hickory and blackjack oak. Other common hardwoods are chestnut oak, post oak, scarlet oak, and southern red oak. Less common hardwood associates include pignut hickory, black oak, northern red oak, white oak, sassafras, sweetgum, black cherry, black tupelo, flowering dogwood, and sourwood. The less common species sometimes become important stand components.

H(2) Mockernut hickory - white oak - blackjack oak

Type Description

Less than 30 percent of the basal area of the overstory is made up of pine. Longleaf pine is the most common pine. Loblolly pine, shortleaf pine, and eastern redcedar occur sporadically. Virginia pine does not occur. The most important hardwoods are mockernut hickory and post oak. Other common hardwoods are blackjack oak, chestnut oak, scarlet oak, southern red oak, white oak, yellow-poplar, and sweetgum. Less common hardwood associates include pignut hickory, black oak, northern red oak, sassafras, black cherry, red maple, black tupelo, flowering dogwood, and sourwood. The less common species sometimes become important stand components.

H(3) Chestnut oak - mockernut hickory

Type Description

Less than 30 percent of the basal area of the overstory is made up of pine. The pine component may be made up of any of the pines, in any combination, but shortleaf pine often is the most important pine. Eastern redcedar occurs sporadically. The most important hardwoods are mockernut hickory, blackjack oak, chestnut oak, and post oak. Other common hardwoods are pignut hickory, scarlet oak, and white oak. Less common hardwood associates include shagbark hickory, black oak, northern red oak, southern red oak, winged elm, sugarberry, yellow-poplar, sassafras, sweetgum, black cherry, eastern redbud, black locust, red maple, black tupelo, flowering dogwood, sourwood, and green ash. The less common species sometimes become important stand components.

H(4) Oak - hickory

Type Description

Less than 30 percent of the basal area of the overstory is made up of pine. The pine component may be made up of any of the pines, except longleaf pine, in any combination. Eastern redcedar occurs sporadically. The most important hardwoods are pignut hickory, chestnut oak, northern red oak, and white oak. Other common hardwoods are mockernut hickory, shagbark hickory, scarlet oak, yellow-poplar, and green ash. Less common hardwood associates include American beech, black oak, post oak, southern red oak, American elm, winged elm, common hackberry, sassafras, sweetgum, American sycamore, black cherry, eastern redbud, black locust, red maple, American basswood, black tupelo, flowering dogwood, sourwood, and common persimmon. The less common species sometimes become important stand components.

H(5) Hickory - oak

Type Description

Less than 30 percent of the basal area of the overstory is made up of pine. Loblolly pine and shortleaf pine, in any combination, usually make up the bulk of the pine component. Virginia pine and eastern redcedar occur sporadically. Longleaf pine does not occur. The most important hardwoods are mockernut hickory, chestnut oak, northern red oak, post oak, and white oak. Other common hardwoods are pignut hickory, shagbark hickory, black oak, and scarlet oak. Less common hardwood associates include American beech, blackjack oak, southern red oak, winged elm, yellow-poplar, sassafras, sweetgum, black cherry, eastern redbud, red maple, black tupelo, flowering dogwood, sourwood, and green ash. The less common species sometimes become important stand components.

H(6) Beech - oak

Type Description

Less than 30 percent of the basal area of the overstory is made up of pine. The pine component usually is made up of loblolly pine, shortleaf pine and/or Virginia pine in any combination. Eastern redcedar occurs sporadically. The most important hardwoods are American beech, northern red oak, and white oak. Other common hardwoods are mockernut hickory, shagbark hickory, chestnut oak, scarlet oak, yellow-poplar, sweetgum, and green ash. Less common hardwood associates include pignut hickory, black oak, post oak, southern red oak, winged elm, sugarberry, sassafras, black cherry, red maple, black tupelo, flowering dogwood, and sourwood. The less common species sometimes become important stand components.

H(7) Oak

Type Description

Less than 30 percent of the basal area of the overstory is made up of pine. Loblolly pine usually makes up the bulk of the pine component but any of the other pines may be present. Eastern redcedar occurs sporadically. The most important hardwoods are post oak, scarlet oak, southern red oak, and white oak. Other common hardwoods are mockernut hickory, shagbark hickory, yellow-poplar, and sweetgum. Less common hardwood associates include pignut hickory, American beech, blackjack oak, chestnut oak, chinkapin oak, northern red oak, water oak, American elm, sassafras, black cherry, eastern redbud, red maple, American basswood, black tupelo, flowering dogwood, sourwood, and green ash. The less common species sometimes become important stand components.

H(8) Oak - sweetgum

Type Description

Less than 30 percent of the basal area of the overstory is made up of pine. Loblolly pine usually makes up the bulk of the pine component. Shortleaf pine and eastern redcedar occur sporadically. The most important hardwoods are water oak, white oak, and sweetgum. Other common hardwoods are pignut hickory, shagbark hickory, American beech, northern red oak, post oak, scarlet oak, southern red oak, and green ash. Less common hardwood associates include black willow, bitternut hickory, mockernut hickory, hazel alder, black oak, swamp chestnut oak, American elm, sugarberry, yellow-poplar, black cherry, eastern redbud, honeylocust, red maple, American basswood, black tupelo, flowering dogwood, sourwood and common persimmon. The less common species sometimes become important stand components.

H(9) Branch hardwoods 59

Type Description

Less than 30 percent of the basal area of the overstory is made up of pine. Loblolly pine makes up the bulk of the pine component but any of the pines may be present. Eastern redcedar occurs sporadically. The most important hardwoods are water oak, white oak, yellow-poplar, and sweetgum. Other common hardwoods are American beech, red maple, and green ash. Less common hardwood associates include black willow, eastern cottonwood, bitternut hickory, mockernut hickory, pignut hickory, shagbark hickory, river birch, hazel alder, American hornbeam, black oak, chestnut oak, northern red oak, post oak, scarlet oak, southern red oak, swamp chestnut oak, willow oak, American elm, winged elm, common hackberry, sugarberry, sweetbay, sassafras, American sycamore, black cherry, eastern redbud, honeylocust, black locust, boxelder, yellow buckeye, American basswood, black tupelo, flowering dogwood, sourwood, and common persimmon. The less common species sometimes become important stand components.

H(10) Coosa river hardwoods

Type Description

Less than 30 percent of the basal area of the overstory is made up of pine. Loblolly pine makes up the bulk of the pine component. Longleaf pine, shortleaf pine, and eastern redcedar occur sporadically. The most important hardwoods are water oak, white oak, and green ash. Other common hardwoods are shagbark hickory, northern red oak, sugarberry, yellow-poplar, sweetgum, American sycamore, and red maple. Less common hardwood associates include black willow, eastern cottonwood, bitternut hickory, mockernut hickory, pignut hickory, river birch, hazel alder, American hornbeam, American beech, scarlet oak, southern red oak, swamp chestnut oak, American elm, black cherry, honeylocust, boxelder, silver maple, American basswood, black tupelo, flowering dogwood, and sourwood. The less common species sometimes become important stand components.

H(11) Swamp hardwoods

Type Description

Less than 30 percent of the basal area of the overstory is made up of pine. Loblolly pine is the only pine found in the swamps. Eastern redcedar occurs sporadically. The most important hardwoods are water oak, white oak, sweetgum, and red maple. Other common hardwoods are bitternut hickory, southern red oak, willow oak, black tupelo, and green ash. Less common hardwood associates include black willow, pignut hickory, hazel alder, American hornbeam, American beech, swamp chestnut oak, American elm, winged elm, sugarberry, sweetbay, yellow-poplar, American sycamore, boxelder, American basswood, flowering dogwood and common persimmon. Water tupelo occurs as small patches in the wettest portions of the swamps adjacent to the streams and in areas of standing water. The less common species sometimes become important stand components.

H(12) **Hazel alder**

Type Description

Hazel alder forms the bulk of the vegetative cover with scattered black willows, yellow-poplar, sweetgum and other wet site species forming an overstory.

H(13) **Black willow**

Type Description

Black willow forms the bulk of the overstory. Eastern cottonwood and river birch are common associates. Hazel alder also is often present.

APPENDIX III

Scientific Names of the Tree Species[1]

Conifers

Pine Family — *Pinaceae*
- Loblolly pine .... *Pinus taeda* L.
- Longleaf pine .... *Pinus palustris* Mill.
- Shortleaf pine .... *Pinus echinata* Mill.
- Virginia pine .... *Pinus virginiana* Mill.

Cypress or Cedar Family — *Cuppressaceae*
- Eastern redcedar .... *Juniperus virginiana* L.

Broad-leaved Trees

Willow or Poplar Family — *Salicaceae*
- Black willow .... *Salix nigra* Marsh
- Eastern cottonwood .... *Populus deltoides* Bartr.

Walnut Family — *Juglandaceae*
- Bitternut hickory *Carya cordiformis* (Wangenh.) K. Koch
- Mockernut hickory .... *Carya tomentosa* Nutt.
- Pignut hickory .... *Carya glabra* (Mill.) Sweet
- Shagbark hickory .... *Carya ovata* (Mill.) K. Koch

Birch Family — *Betulaceae*
- River birch .... *Betula nigra* L.
- Hazel alder .... *Alnus serrulata* (Aiton) Willd.[2]
- American hornbeam .... *Carpinus caroliniana* Walt.

Beech Family — *Fagaceae*
- American beech .... *Fagus grandifolia* Ehrh.
- Black oak .... *Quercus velutina* Lam.
- Blackjack oak .... *Quercus marilandica* Muenchh.
- Chestnut oak .... *Quercus montana* L.
- Chinkapin oak .... *Quercus muehlenbergi* Engelm.
- Northern red oak .... *Quercus rubra* L.
- Post oak .... *Quercus stellata* Wangenh.
- Scarlet oak .... *Quercus coccinea* Muenchh.
- Southern red oak .... *Quercus falcata* Michx.
- Swamp chestnut oak .... *Quercus prinus* L.
- Water oak .... *Quercus nigra* L.
- White oak .... *Quercus alba* L.
- Willow oak .... *Quercus phellos* L.

Elm Family — *Ulmaceae*
- American elm .... *Ulmus americana* L.
- Winged elm .... *Ulmus alata* Michx.
- Common hackberry .... *Celtis occidentalis* L.
- Sugarberry .... *Celtis laevigato* Willd.

Magnolia Family — *Magnoliaceae*
- Sweetbay .... *Magnolia virginiana* L.
- Yellow-poplar .... *Liriodendron tulipifera* L.

Laurel Family — *Lauraceae*
- Sassafras .... *Sassafras albidum* (Nutt.) Nees

Witchhazel Family — *Hamamelidaceae*
- Sweetgum .... *Liquidambar styraciflua* L.

Sycamore Family — *Plantanaceae*
- American sycamore .... *Platanus occidentalis* L.

Rose Family — *Rosaceae*
- Black cherry .... *Prunus serotina* Ehrh.

Pulse or Pea Family — *Leguminosae*
- Honeylocust .... *Gleditsia triacanthos* L.
- Black locust .... *Robinia pseudoacacia* L.
- Eastern redbud .... *Cercis canadensis* L.

Holly Family — *Aquifoliaceae*
- American holly .... *Ilex opaca* Ait.

Maple Family — *Aceraceae*
- Boxelder .... *Acer negundo* L.
- Red maple .... *Acer rubrum* L.
- Silver maple .... *Acer saccharinum* L.

Buckeye Family — *Hippocastanaceae*
- Yellow buckeye .... *Aesculus octandra* Marsh

Linden Family — *Tiliaceae*
- American basswood .... *Tilia americana* L.

Tupelo Family — *Nyssaceae*
- Black tupelo .... *Nyssa sylvatica* Marsh
- Water tupelo .... *Nyssa aquatica* L.

Dogwood Family — *Cornaceae*
- Flowering dogwood .... *Cornus florida* L.

Heath Family — *Ericaceae*
- Sourwood .... *Oxydendrum arboreum* DC.

Ebony Family — *Ebenaceae*
- Common persimmon .... *Diospyros virginiana* L.

Olive Family — *Oleaceae*
- Green ash .... *Fraxinus pennsylvanica* Marsh.

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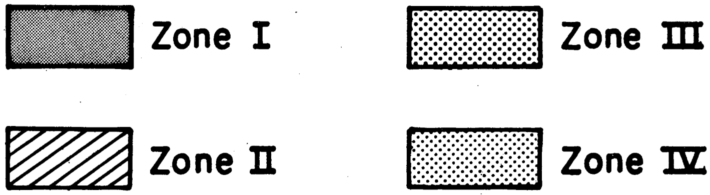
[1]Harlow and Harrar, 1968
[2]Clark, 1972.

APPENDIX IV

County Maps Showing Location of the Vegetative Zones of the Ridge and Valley Forest Habitat Region

Key



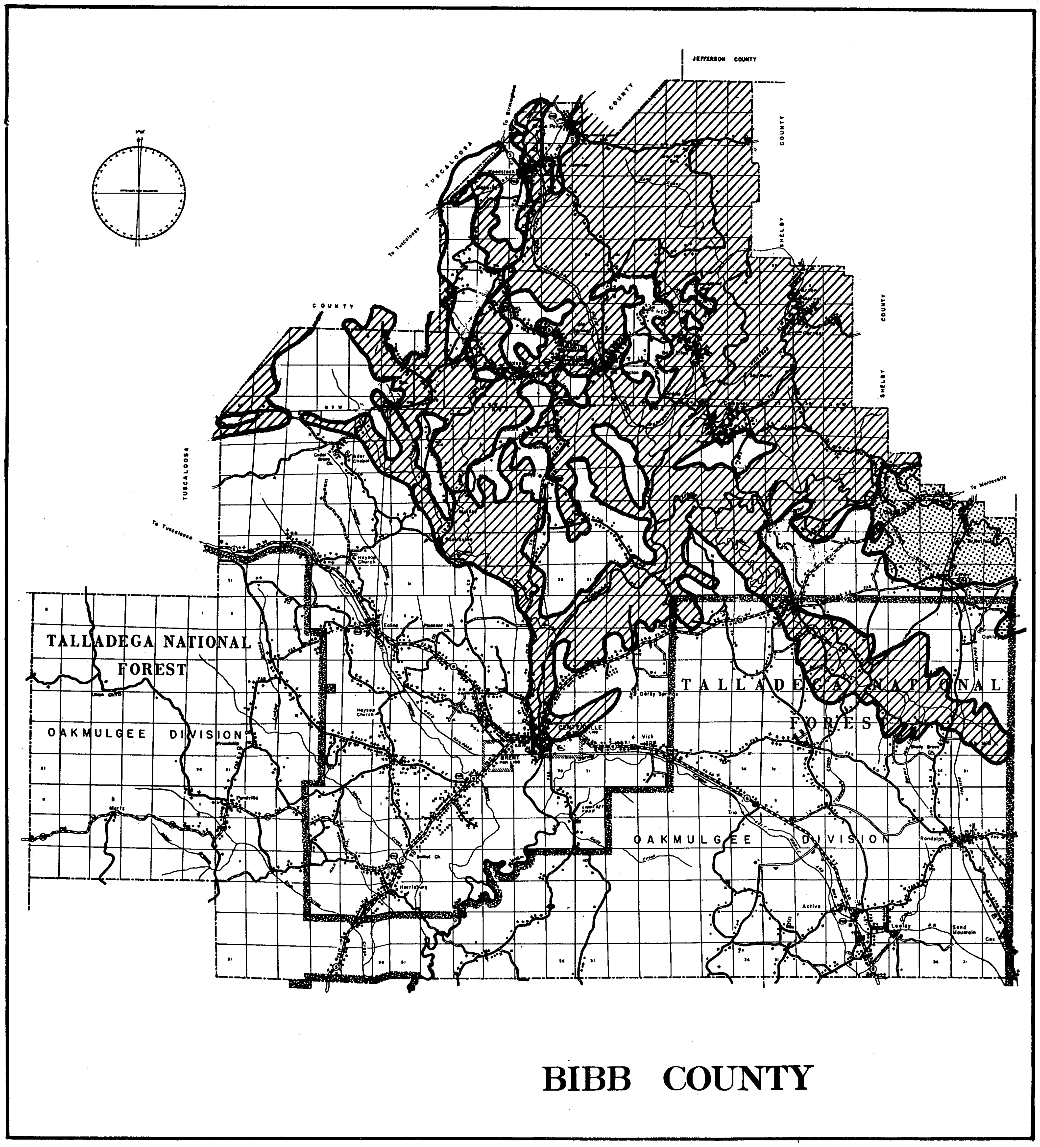


Figure 57. Bibb County

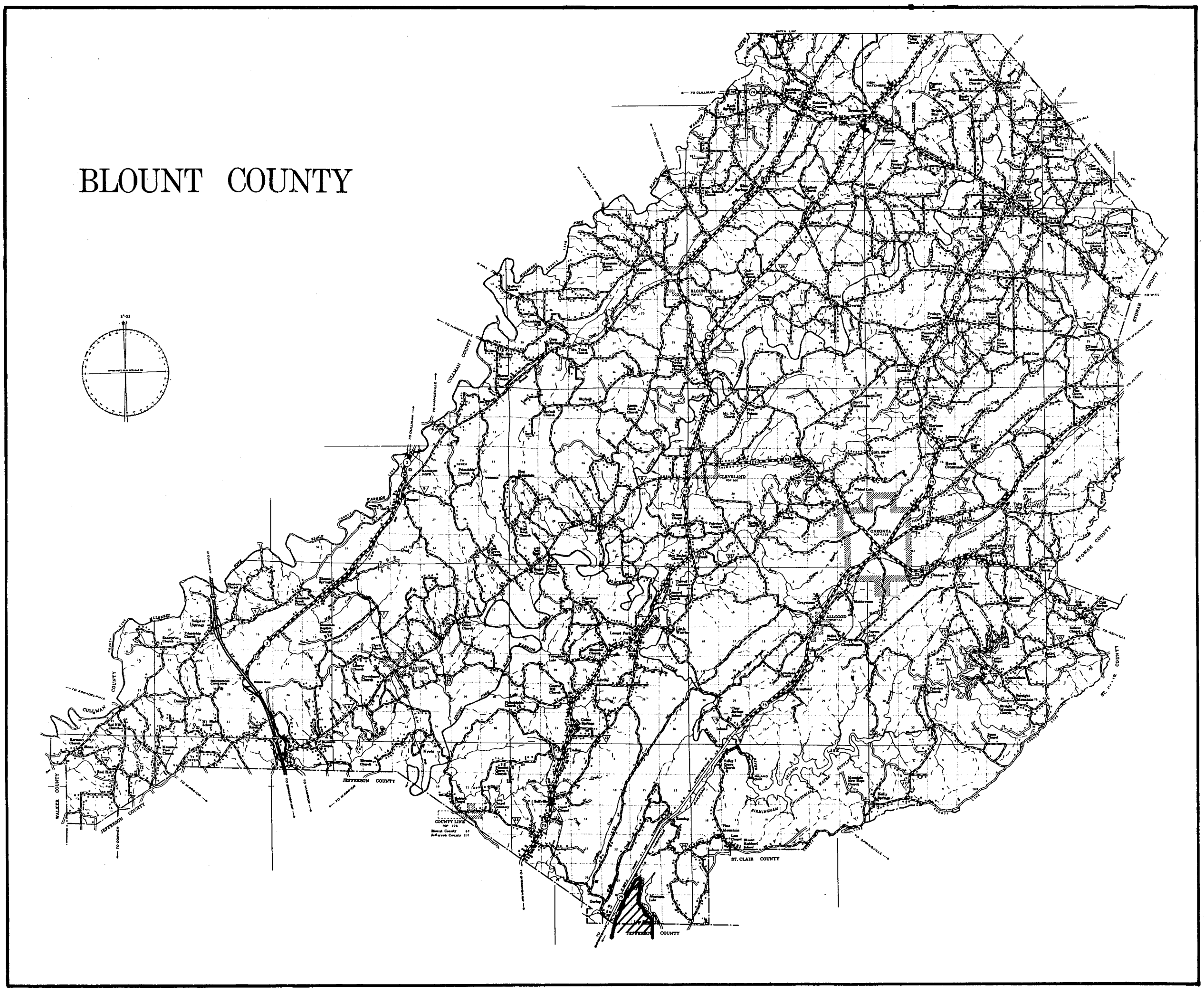


Figure 58. Blount County

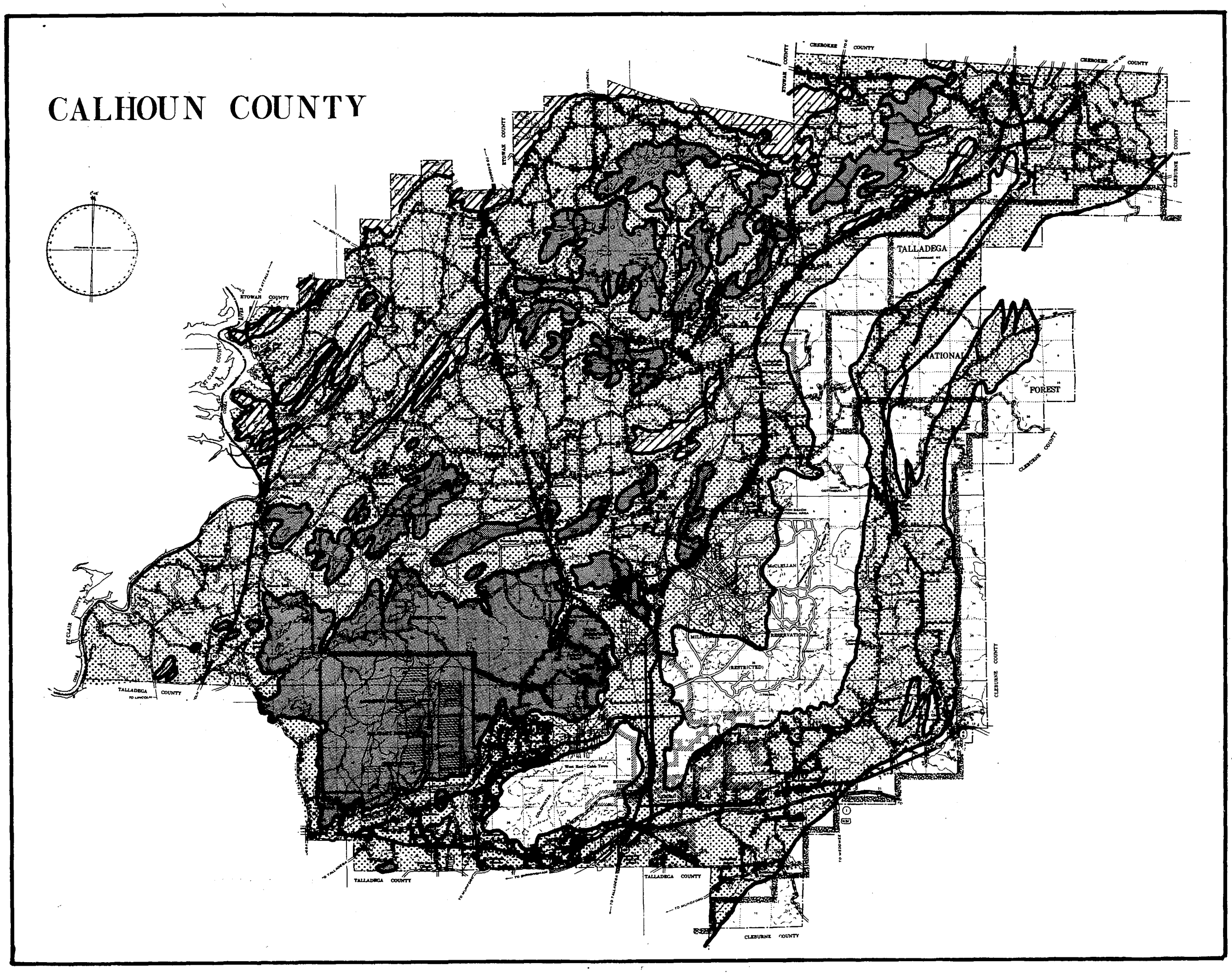


Figure 59. Calhoun County

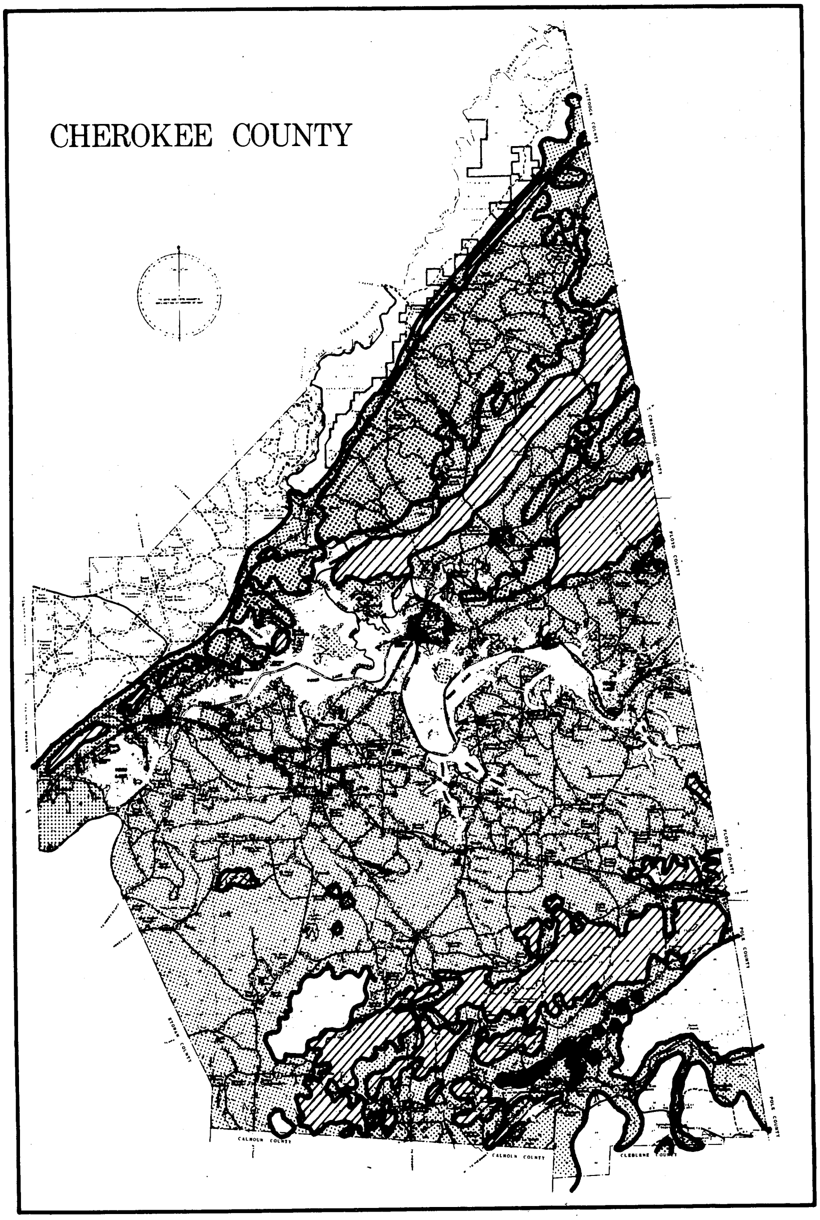


Figure 60. Cherokee County

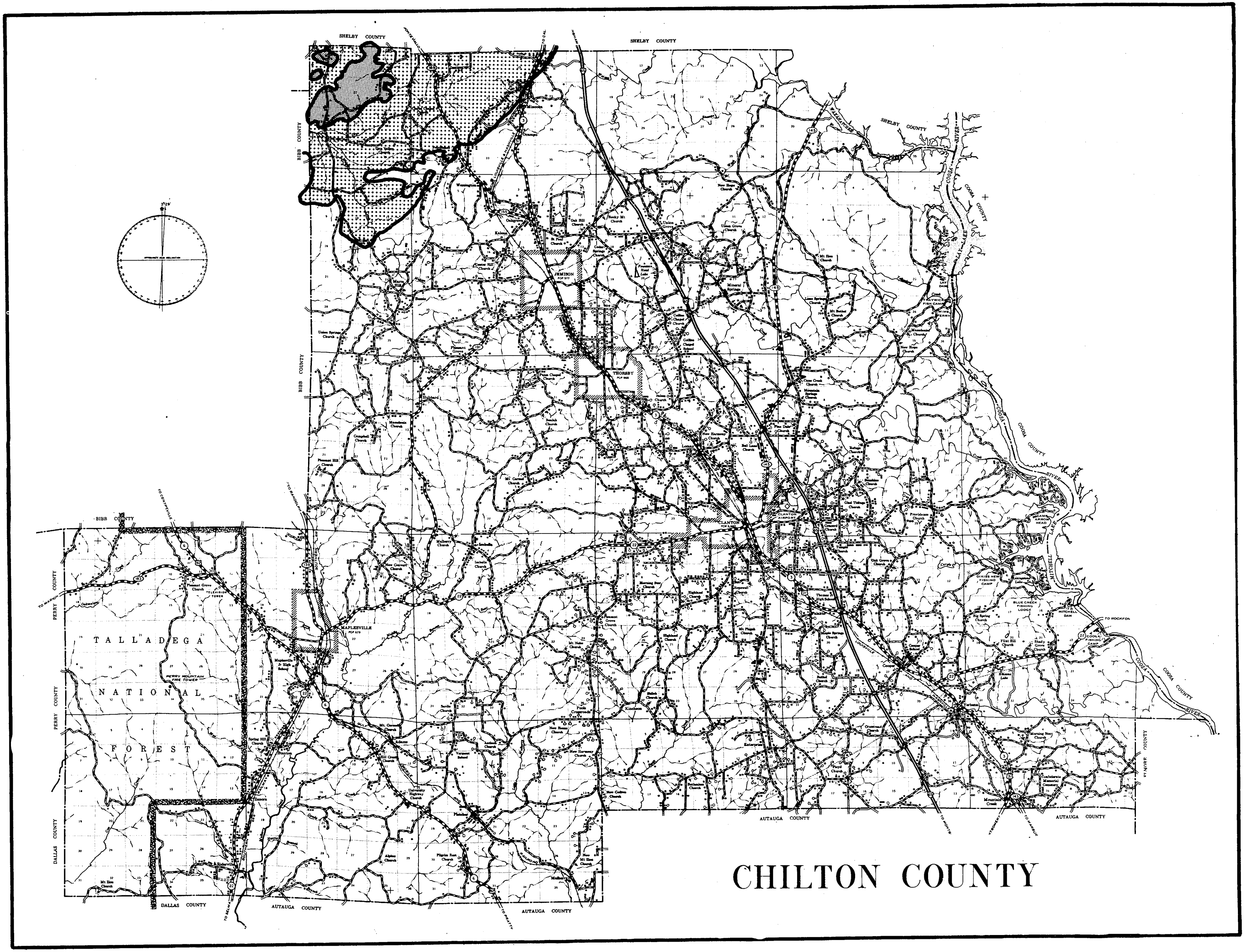


Figure 61. Chilton County

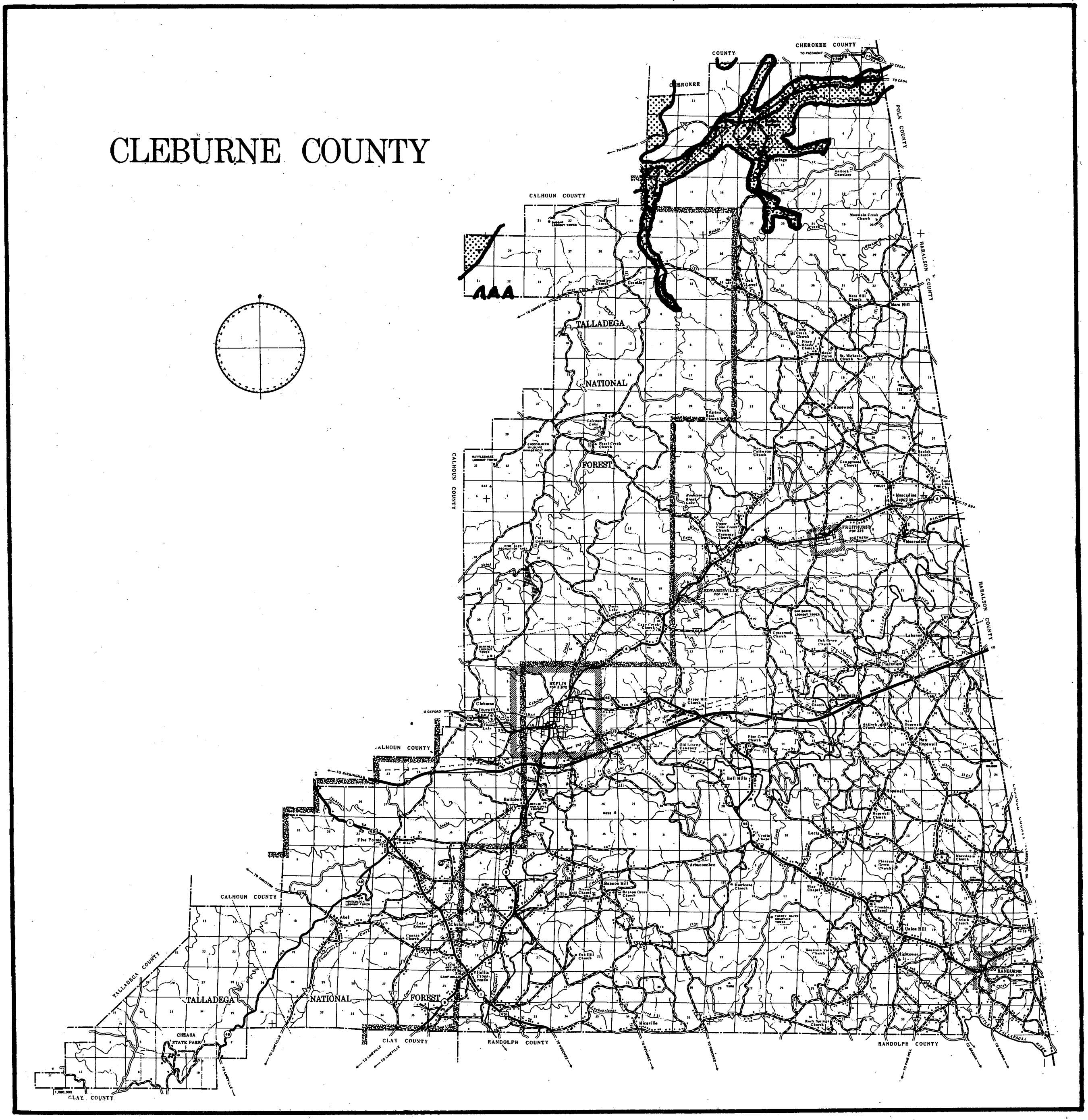


Figure 62. Cleburne County

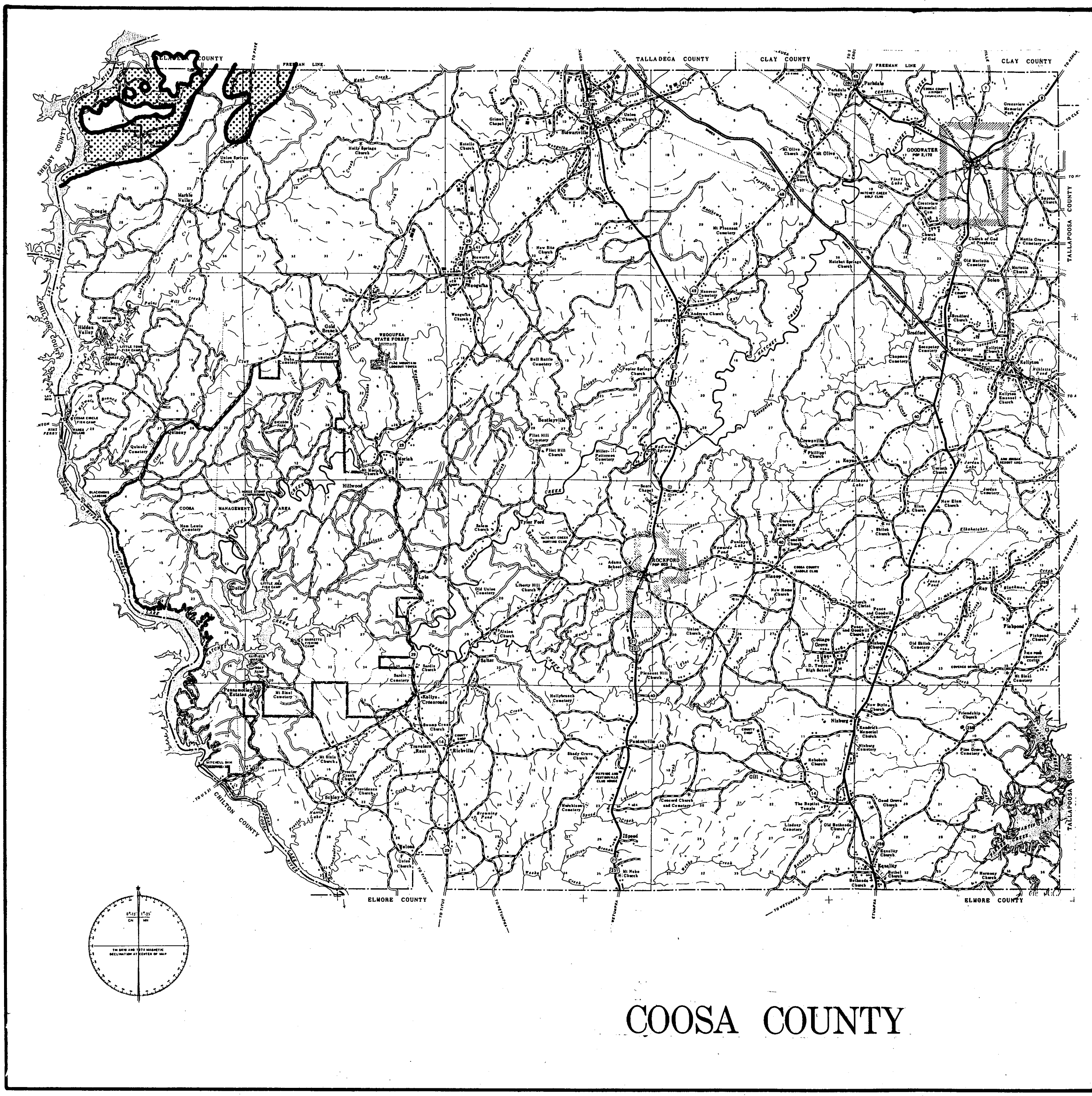


Figure 63. Coosa County

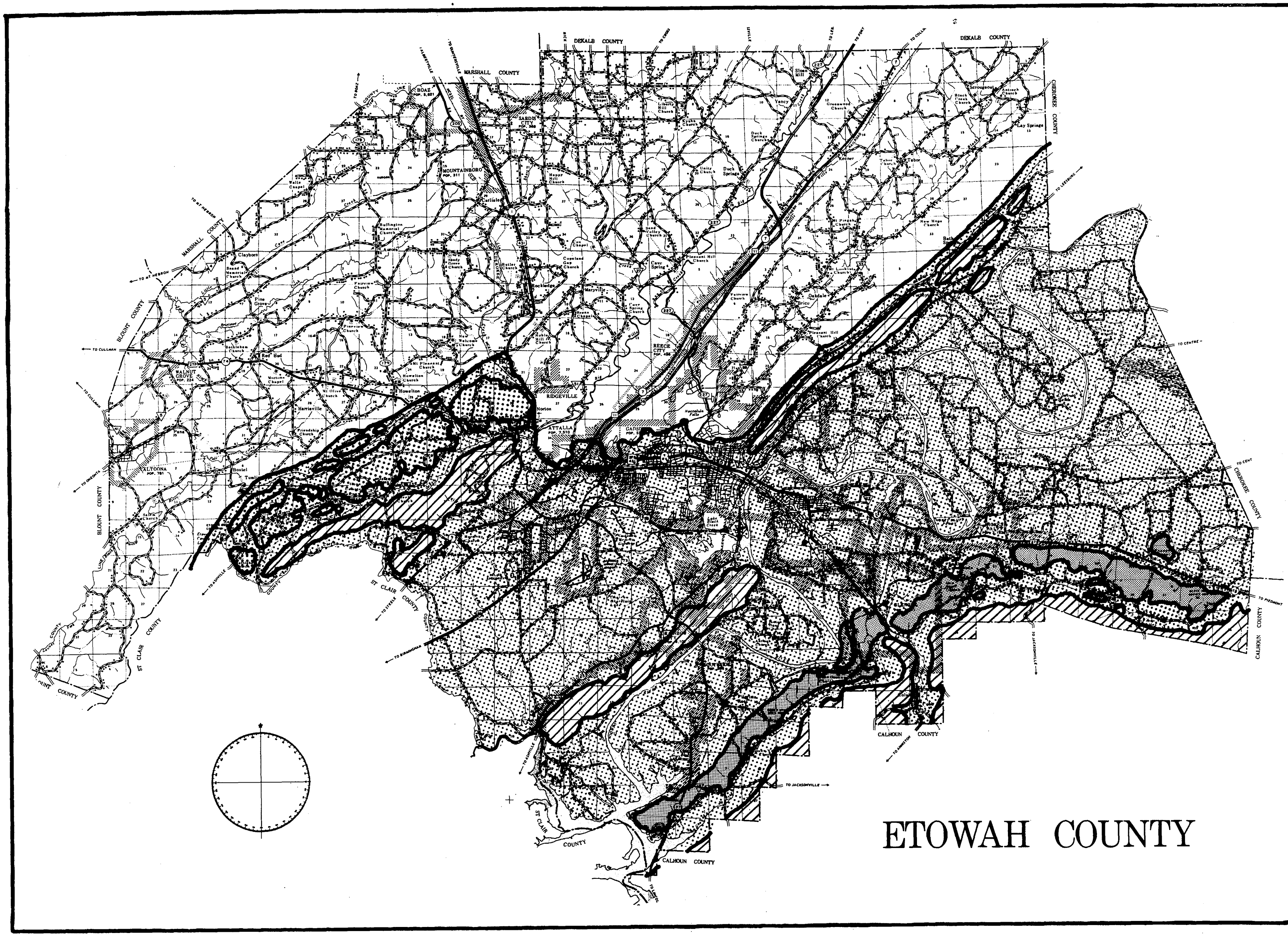


Figure 64. Etowah County

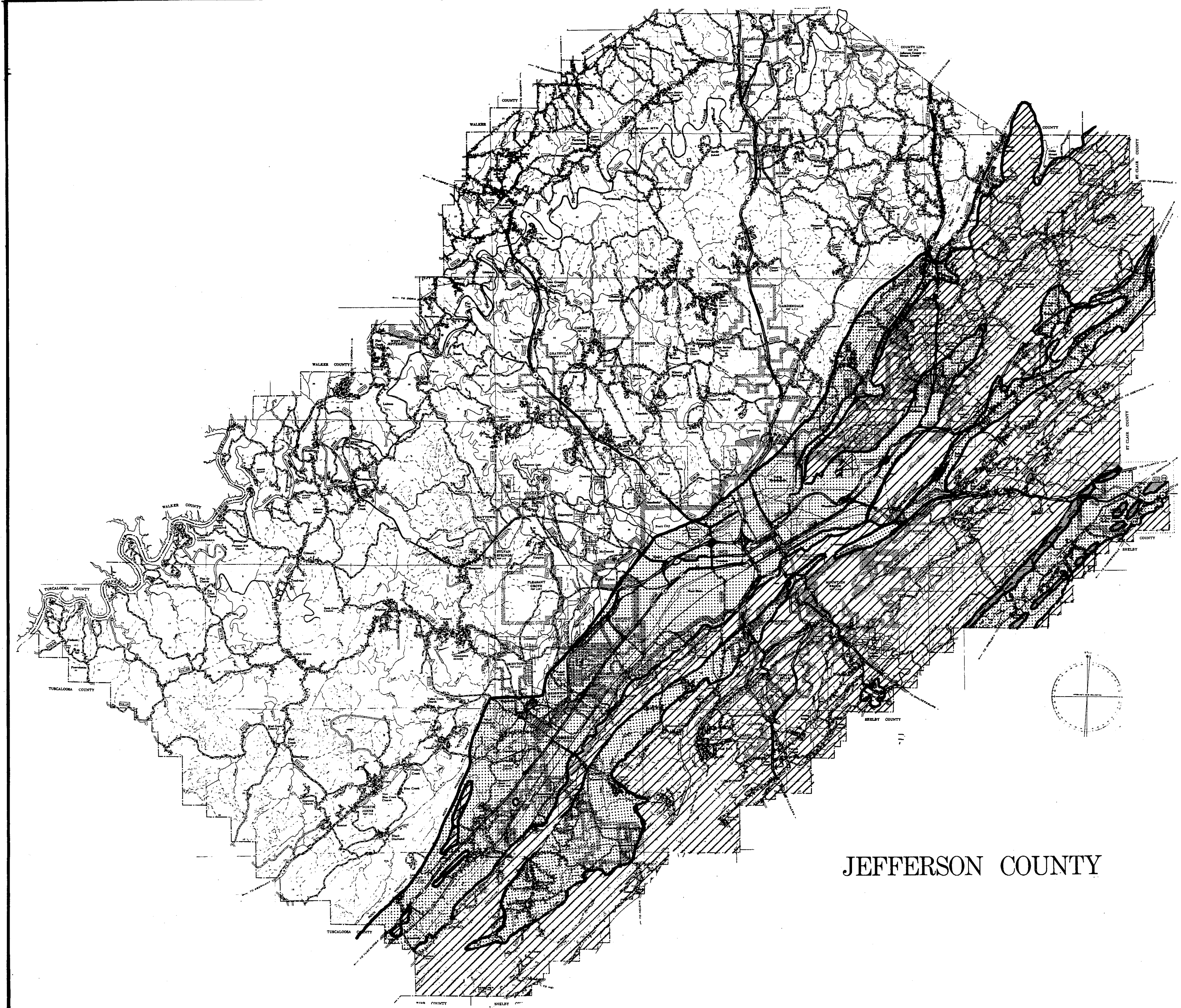


Figure 65. Jefferson County

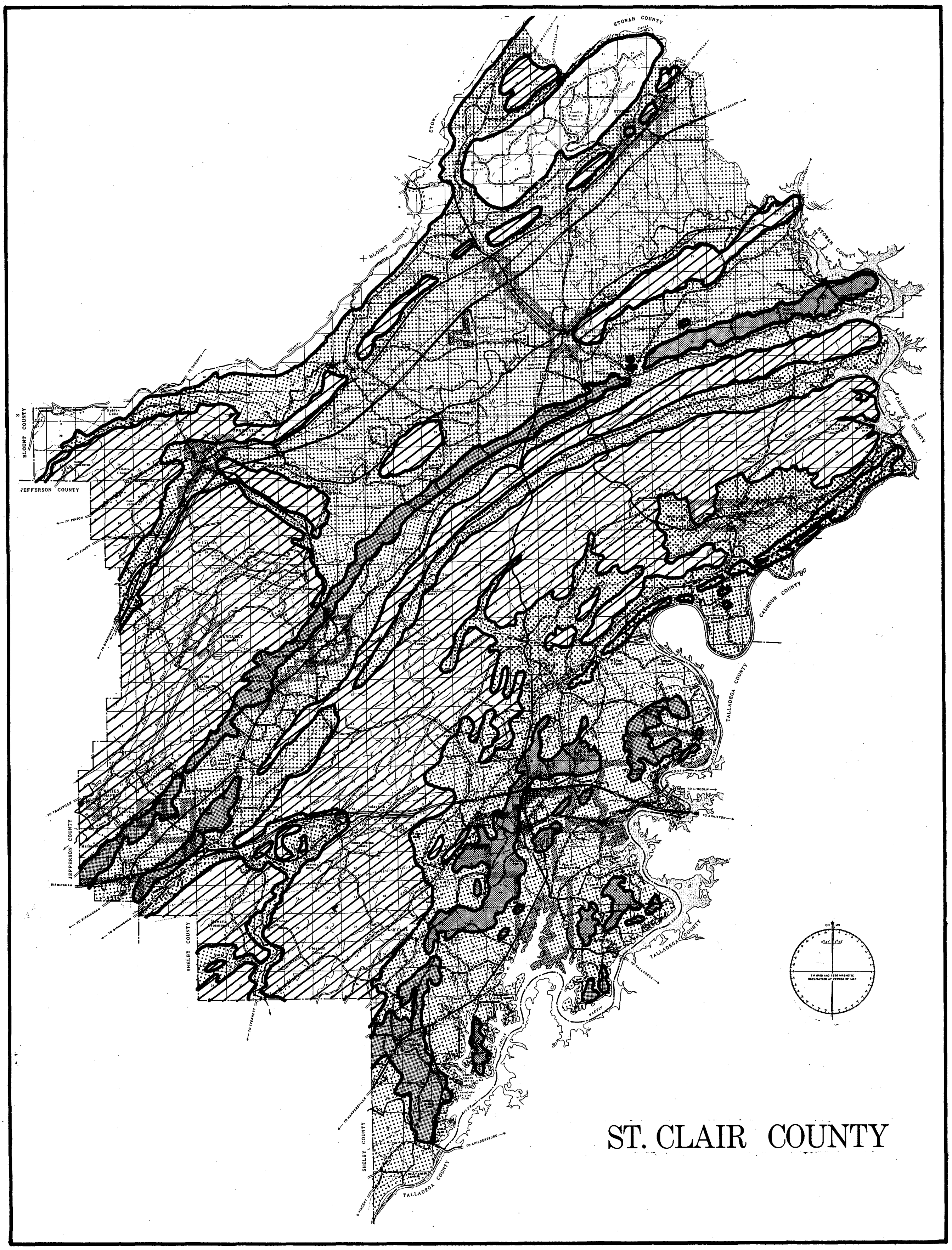


Figure 66. St. Clair County

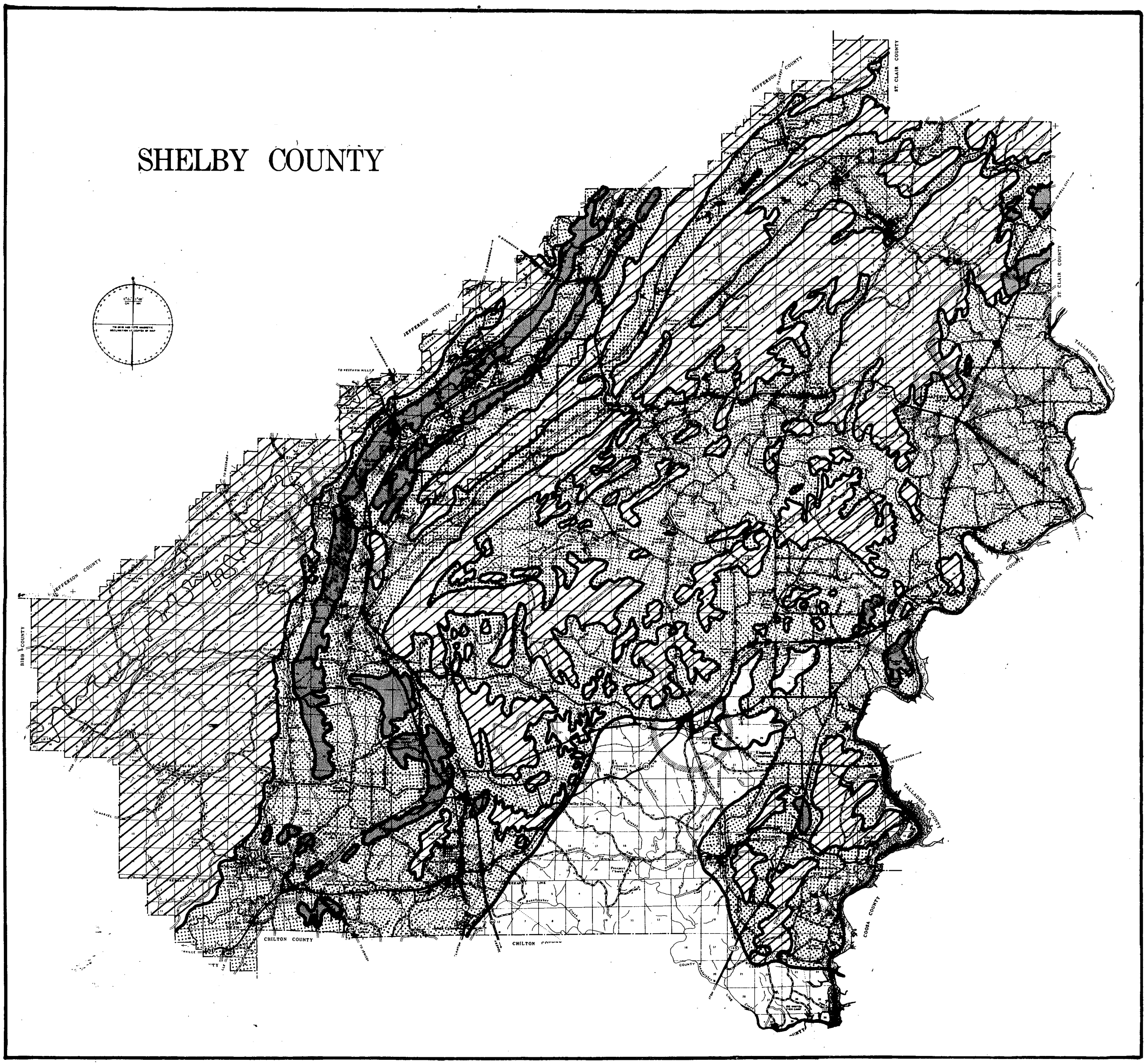


Figure 67. Shelby County

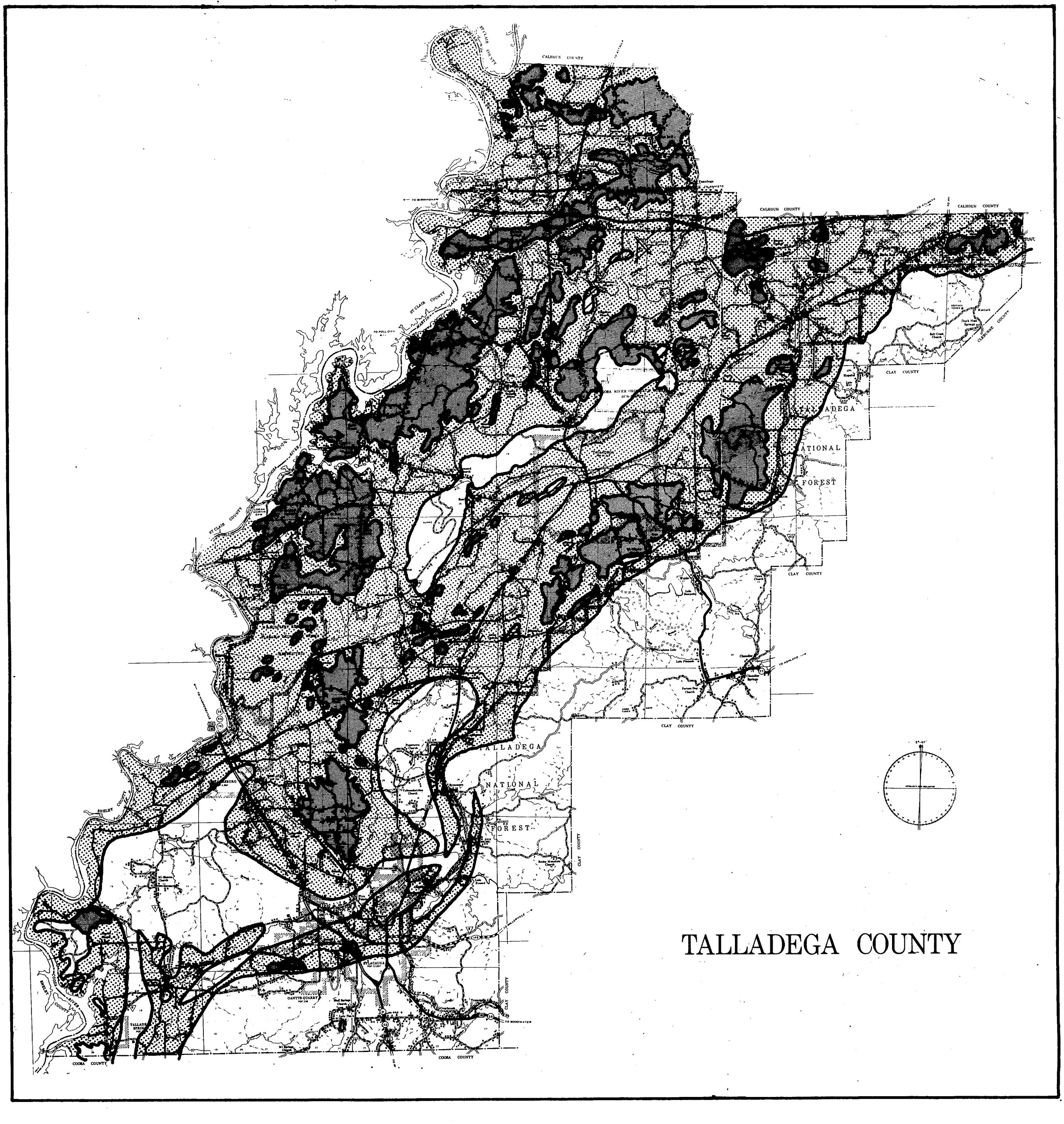


Figure 68. Talladega County

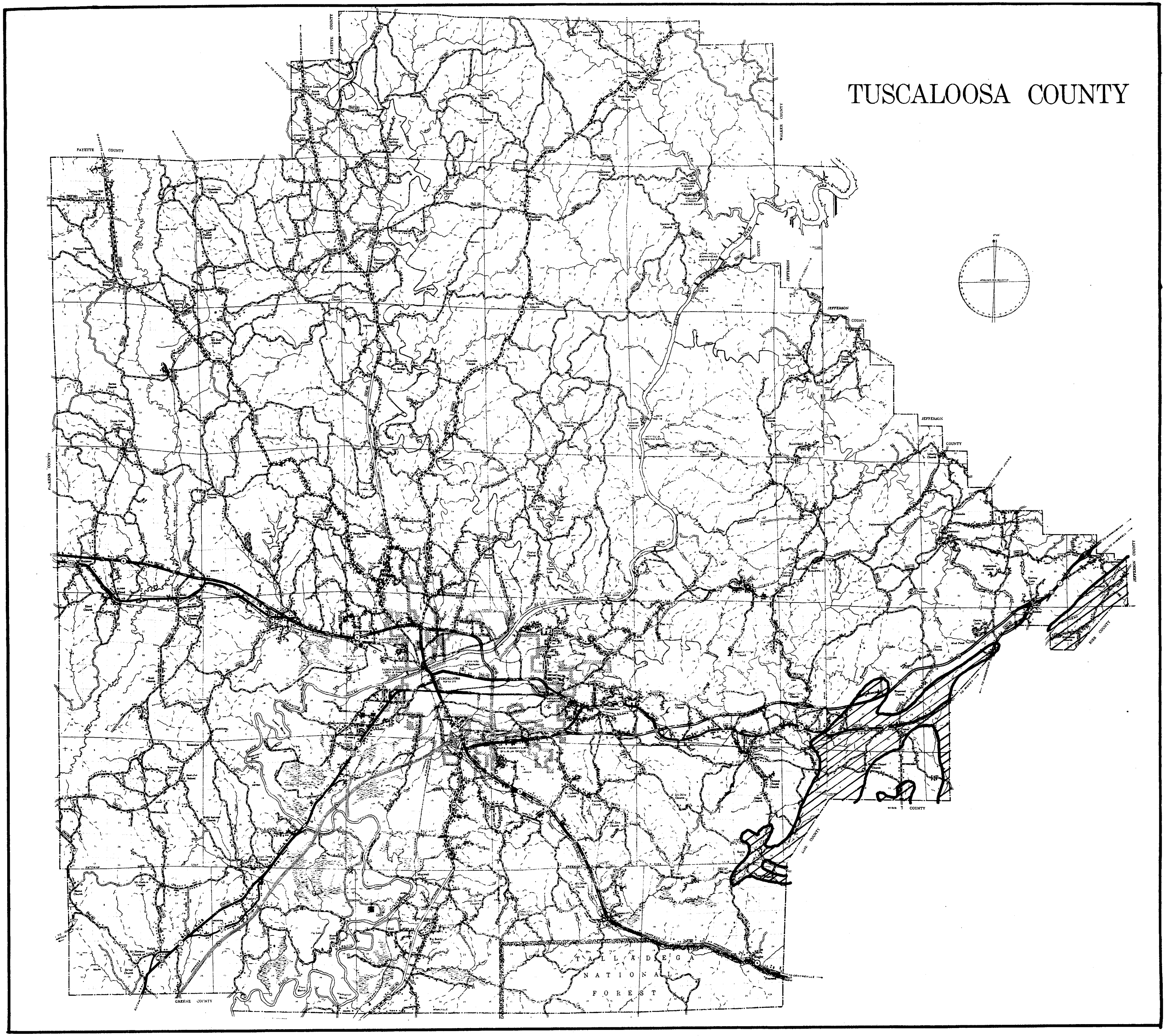
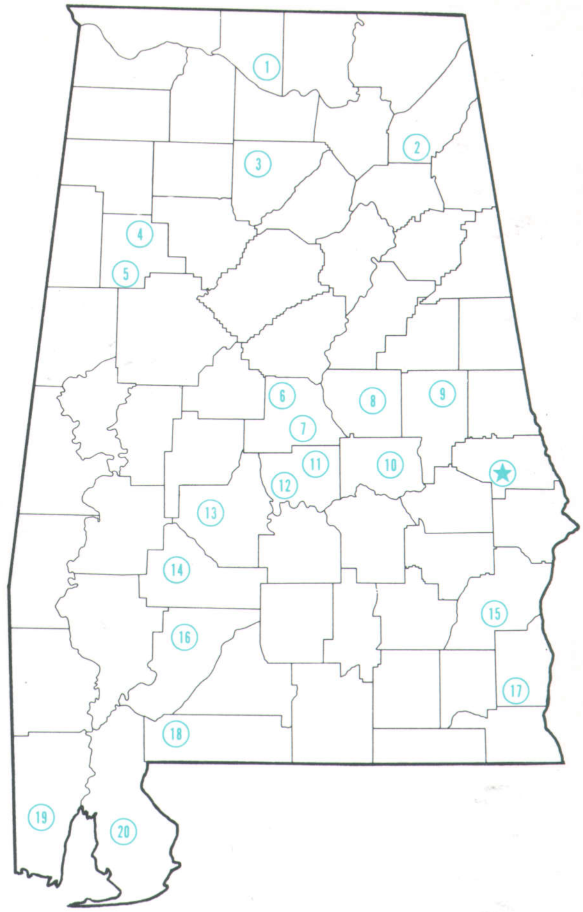


Figure 69. Tuscaloosa County

Alabama's Agricultural Experiment Station System
AUBURN UNIVERSITY

With an agricultural research unit in every major soil area, Auburn University serves the needs of field crop, livestock, forestry, and horticultural producers in each region in Alabama. Every citizen of the State has a stake in this research program, since any advantage from new and more economical ways of producing and handling farm products directly benefits the consuming public.



Research Unit Identification

★ **Main Agricultural Experiment Station, Auburn.**

1. Tennessee Valley Substation, Belle Mina.
2. Sand Mountain Substation, Crossville.
3. North Alabama Horticulture Substation, Cullman.
4. Upper Coastal Plain Substation, Winfield.
5. Forestry Unit, Fayette County.
6. Thorsby Foundation Seed Stocks Farm, Thorsby.
7. Chilton Area Horticulture Substation, Clanton.
8. Forestry Unit, Coosa County.
9. Piedmont Substation, Camp Hill.
10. Plant Breeding Unit, Tallassee.
11. Forestry Unit, Autauga County.
12. Prattville Experiment Field, Prattville.
13. Black Belt Substation, Marion Junction.
14. Tuskegee Experiment Field, Tuskegee.
15. Lower Coastal Plain Substation, Camden.
16. Forestry Unit, Barbour County.
17. Monroeville Experiment Field, Monroeville.
18. Wiregrass Substation, Headland.
19. Brewton Experiment Field, Brewton.
20. Ornamental Horticulture Field Station, Spring Hill.
21. Gulf Coast Substation, Fairhope.