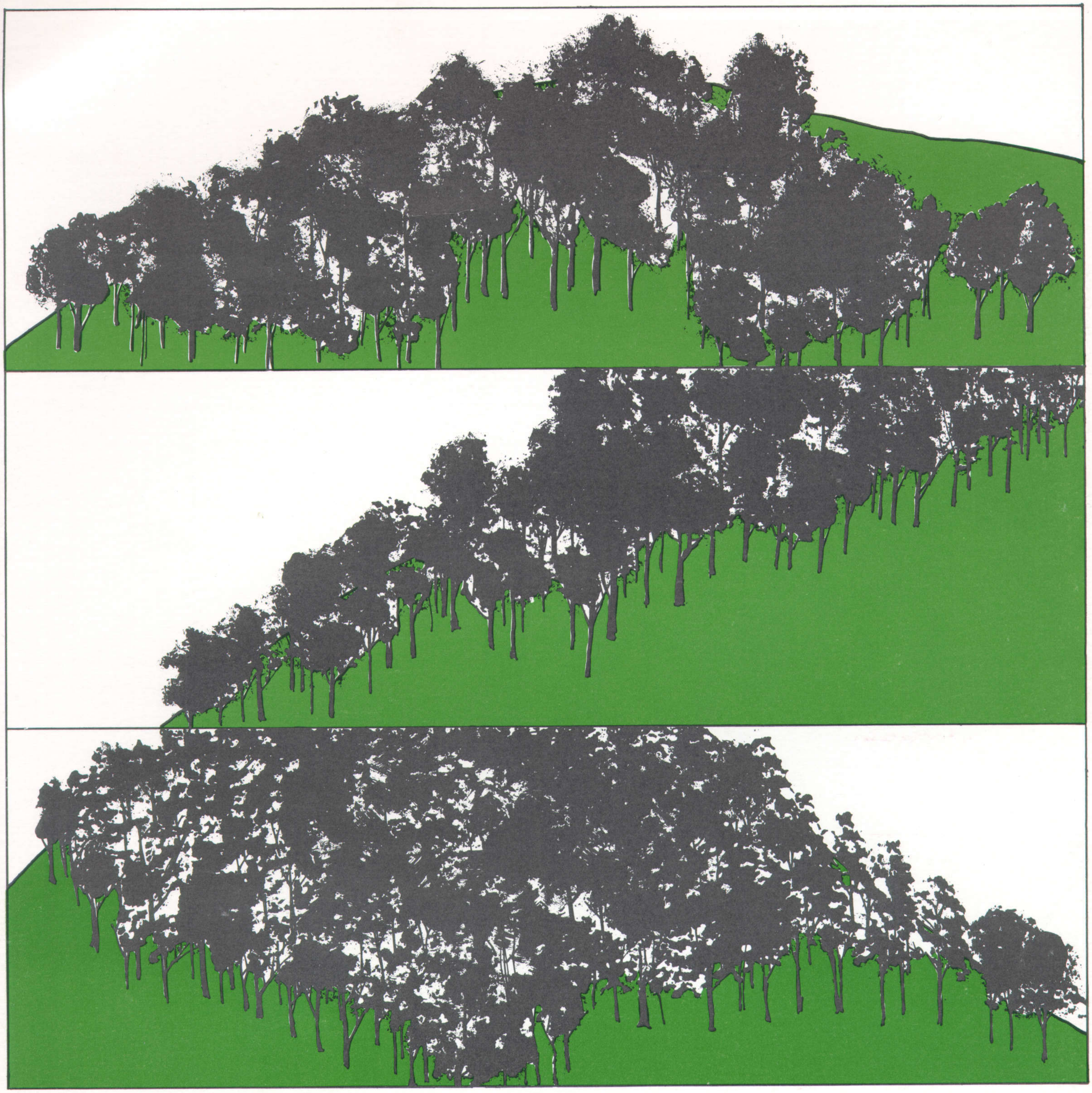

Forest Cover Photo-Interpretation Key for the Mountain Forest Habitat Region in Alabama

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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 generally 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 a set of forest habitat regions into which the State will be divided. This is the second of these keys. The first was developed for the Piedmont Forest Habitat Region (Johnson and Sellman, 1974).[2]

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 deliberately because it was felt that the keys should be of use to *all* land managers 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 nineteen-thirties with the advent of federal crop control programs. Until recently these photographs have been made using panchromatic 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 the format size, except for the very earliest photographs, has been 9 x 9 inches. Recently the photographic specifications have been changed, for reasons of economy, so that the scale is 1:40,000 and the focal length of the camera lens is 6 inches. This key has been developed using the 1:20,000 photographs. However, the design of the key is such that it can be used with little or no modification with photographs taken at other scales. The scales probably should be no larger than 1:10,000 because an insufficient area of ground surface would be visible on a single stereopair to permit an accurate evaluation of the topographic positions of the stands in question. 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 photographs 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 the branch-bottom conditions where the evaluation is 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). With some modification they probably could also be used with normal color or color infrared photography.

It is well that the keys have been designed in this way because it means that they can be used by organizations electing to obtain their own photography. It is probable that there will be an increase in the use of such photography since the USDA-ASCS has changed the scale of its photographs, which has the effect of reducing costs to the agency but increasing costs and inconvenience to its customers. Another factor operating to reduce utilization of USDA-ASCS photography by the forest industry is the lack of customer control of photographic contrast and season of photography.

The keys have been designed to indicate the probable species composition of the stands being examined. It provides no information on the condition of the stands (i.e., the sizes of the trees making up the stands or their density). Stand conditions can be evaluated using a number of procedures which have been described elsewhere (Avery,

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[2]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.

1966 and 1968; Moessner, 1960; Spurr, 1960; Wilson *et al*, 1960). It must be kept in mind that aerial photographs record the situation as of a given point in time. The longer the time between film exposure and photo-interpretation, the greater is the probability of errors in photo-interpretation. 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, burning, may be even more extensive and profound. For example, the practice of introducing species into areas in which they are not native or planting species off their normal sites will completely invalidate a photo-interpretation key based on normal species occurrence-site relationships. For these reasons, one must not expect these keys to yield accurate results when the photographs are old or when land use has tended to destroy the usual species occurrence-site relationships.

DESCRIPTION OF THE REGION

The location of the Mountain Forest Habitat Region is shown in generalized form in Figure 1 and in detail on the county maps in Appendix IV. The Region is synonymous with the Mountain Forest Habitat Region defined by Hodgkins (1965). From a geological point of view the use of the term "Mountain" is questionable, since the general view among geologists appears to be that the Blue Ridge does not extend into Alabama. However, there are geologists that hold the opposing view. Indeed, the area included in the Mountain Forest Habitat Region is one whose geology is still being resolved and, consequently, many interpretations of the geologic structure can be found. The resolution of these geologic problems is beyond the scope of this study. For convenience, the maps and terminology of Adams *et al* (1926) and Johnston (1930) have been accepted and the regional bounds will be described within this context. The Mountain Forest Habitat Region has been formed from the Talladega Slate portion of the Piedmont physiographic province and the Weisner quartzite portions of the Ridge and Valley physiographic province. Together, these components include the portions of the State with the greatest relief. The vegetative distribution patterns within this Region are sufficiently different from either the Piedmont or the Ridge and Valley provinces to justify the recognition of the Region as a distinct entity.

The Mountain Forest Habitat Region has been defined in terms of two geological formations, the Talladega slate and Weisner quartzite. However, as can be seen in Figure 1, other formations exist as narrow strips or patches within the boundaries of the Region. Because of their limited extent and apparently negligible effect on the vegetation distribution pattern, all of these included formations will be ignored in the following discussion.

The Talladega slate area is characterized by metamorphic rocks that have been intensely deformed and stressed. Included in the formation are slates, shales, schists, phyllites, and conglomerates. In some places sandstones, quartzites, limestones, or dolomites may be found. The topography is varied but is rough almost everywhere (figures 2, 3, and 4).

The relief varies from less than 200 feet in some areas to well over 1,000 feet in others. The ridges generally tend to run in a northeast-southwest direction but may assume other orientations in some places. The main ridge lies near the eastern boundary of the formation and forms the Rebecca-Talladega-Horseblock Mountain massif. The highest point along this ridge occurs at Cheaha Mountain, a part of Talladega Mountain, where the altitude is 2,407 feet. This is the highest point in Alabama. The crest of this massif has a sandstone cap (Figure 3) which probably explains its resistance to weathering. Over much of the Talladega slate area the stream pattern is controlled by ridges of resistant material; but in some places, notably in southern Cleburne County, the stream pattern is dendritic (Figure 4). The Rebecca-Talladega-Horseblock Mountain ridge forms the watershed divide between the Coosa River on the west and the Tallapoosa River on the east. Within the Mountain Forest Habitat Region stream gradients are relatively steep, and poorly drained or swampy areas are rare except where natural flowage has been slowed by beaver dams or man-made structures such as road embankments.

The Weisner quartzite manifests itself in the form of monoclinal ridges with steep western faces and somewhat less steep eastern faces (Figure 5). These ridges lie to the west of the Talladega slate, except for Kehatchee Mountain and a couple of associated ridges which intrude through the Talladega slate near Childersburg. They have a general southwest-northeast trend but are more broken and less continuous than the ridges of the Talladega slate. Usually, the Weisner quartzite ridges occur as islands more or less completely surrounded by the limestones, dolomites, and shales of the Coosa River valley, which is in the Ridge and Valley Forest Habitat Region. The cores of the ridges are strata of highly erosion resistant quartzite which often surface in the form of naked outcrops and cliffs (Figure 5). Interbedded with the quartzite are sandstones and, in some cases, limestones and dolomites. Some of these Weisner quartzite ridges are almost as high as the highest parts of the Talladega slate. The elevation of Duggar Mountain is 2,130 feet, while that of Indian Mountain is more than 1,900 feet. The slopes are steep and the soils are rocky. In general, the sites on the Weisner quartzite ridges are considerably poorer than comparable sites in the Talladega slate area.

As was previously mentioned, the Weisner quartzite ridges occur as islands rising above the limestones, dolomites, and shales of the Coosa River Valley (Figure 6). This means that flat valley floors occurring in and around the Weisner quartzite ridge areas should not be considered to be part of the Mountain Forest Habitat Region. They belong to the Ridge and Valley Forest Habitat Region and their forest cover should not be interpreted using the Mountain Forest Habitat Region key. The detailed county maps in Appendix IV show the extent of most of these valleys. It should be noted that some streams, such as Terrapin Creek in Cleburne County, originate in and run for considerable distances through Weisner quartzite areas before entering the Ridge and Valley Forest Habitat Region. The county maps show the breaking points with reasonable accuracy.

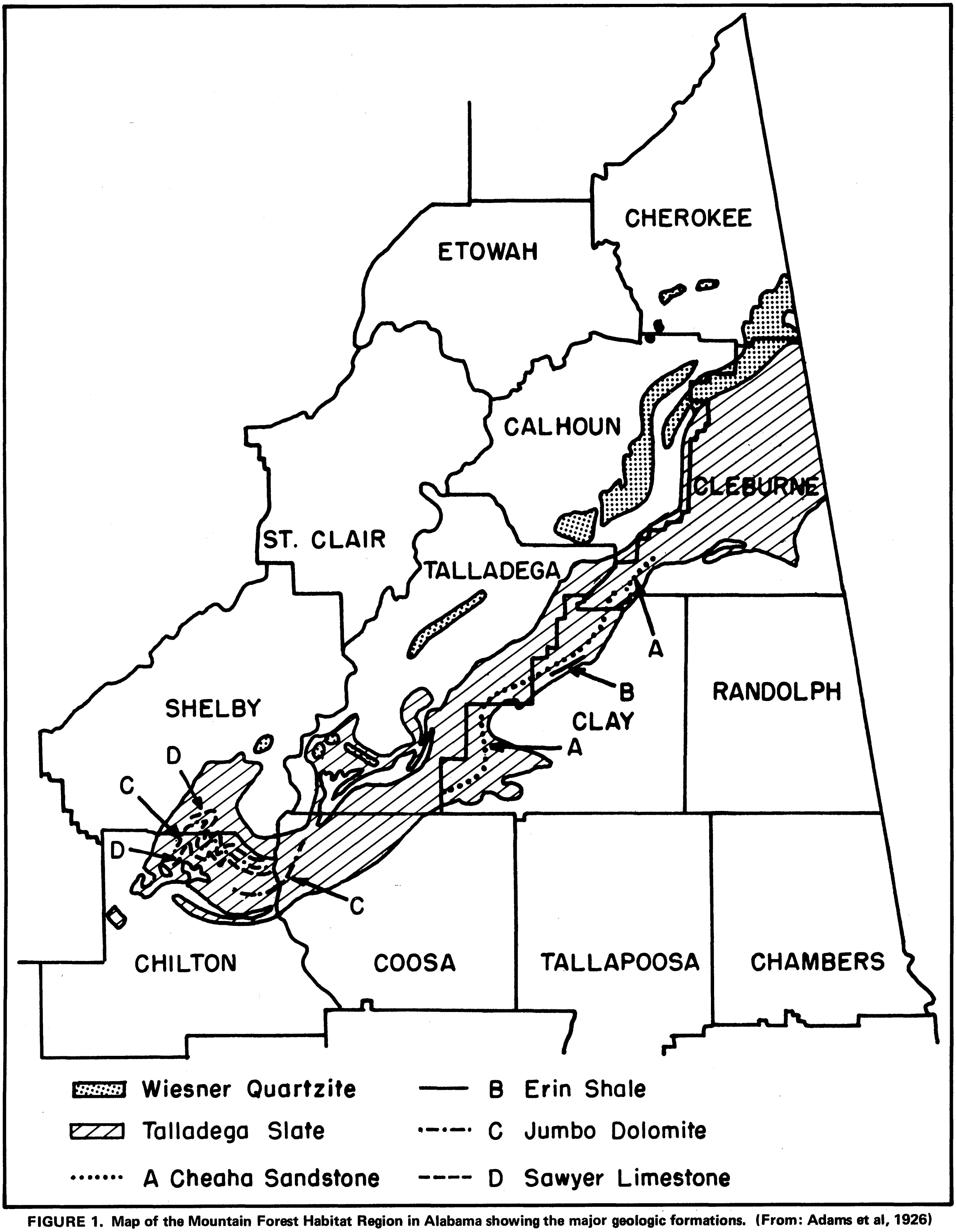

FIGURE 1. Map of the Mountain Forest Habitat Region in Alabama showing the major geologic formations. (From: Adams et al, 1926)

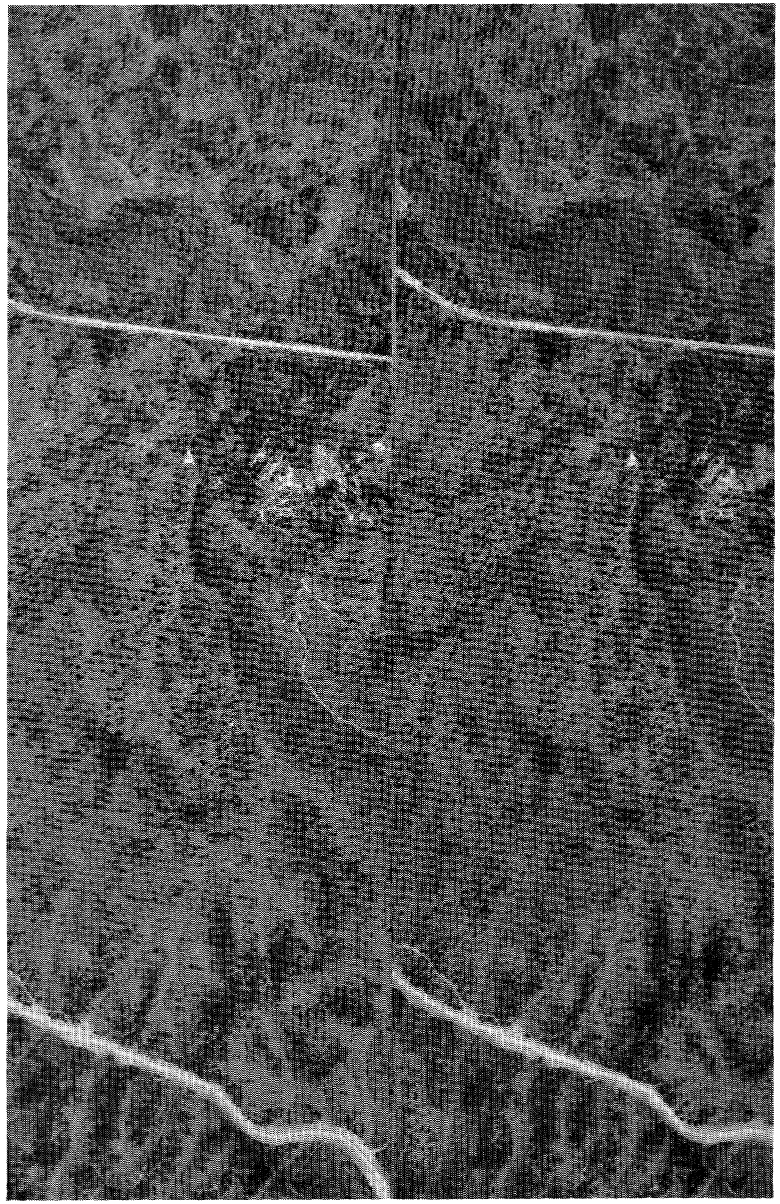

FIGURE 2. Stereogram of typical terrain in the Talladega Slate area. Horseblock Mountain area of Cleburne County. (A20-01029-472-9,10)

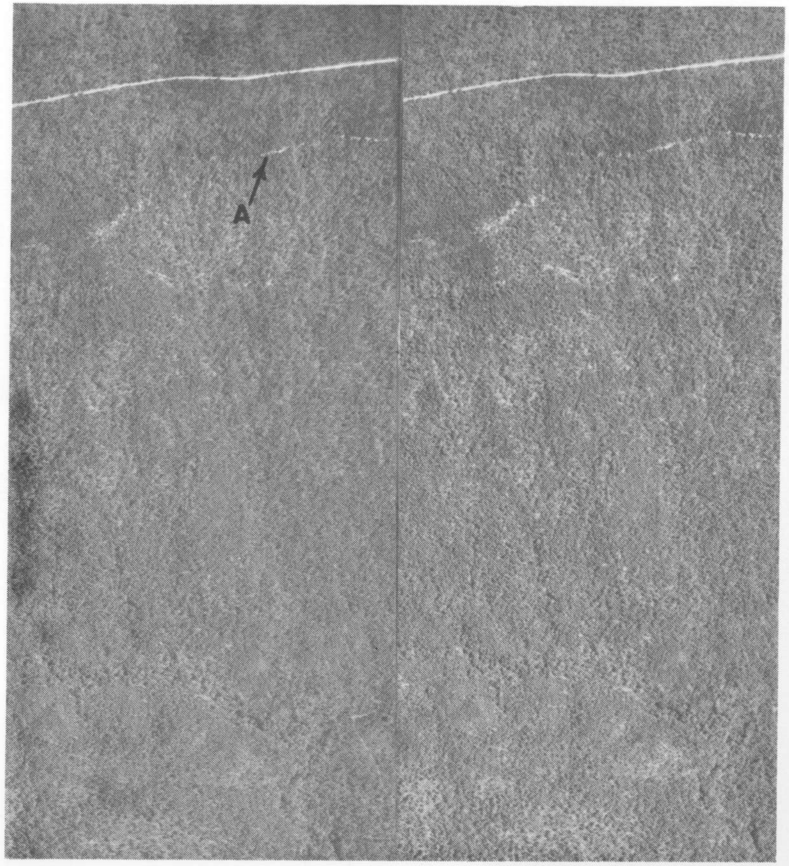

FIGURE 3. Stereogram of a portion of the Rebecca-Talladega-Horseblock Mountain massif, near Horn Mountain showing cliffs of resistant sandstone (A). This is in the Talladega Slate area in Clay County. (GV-2JJ-157, 158)

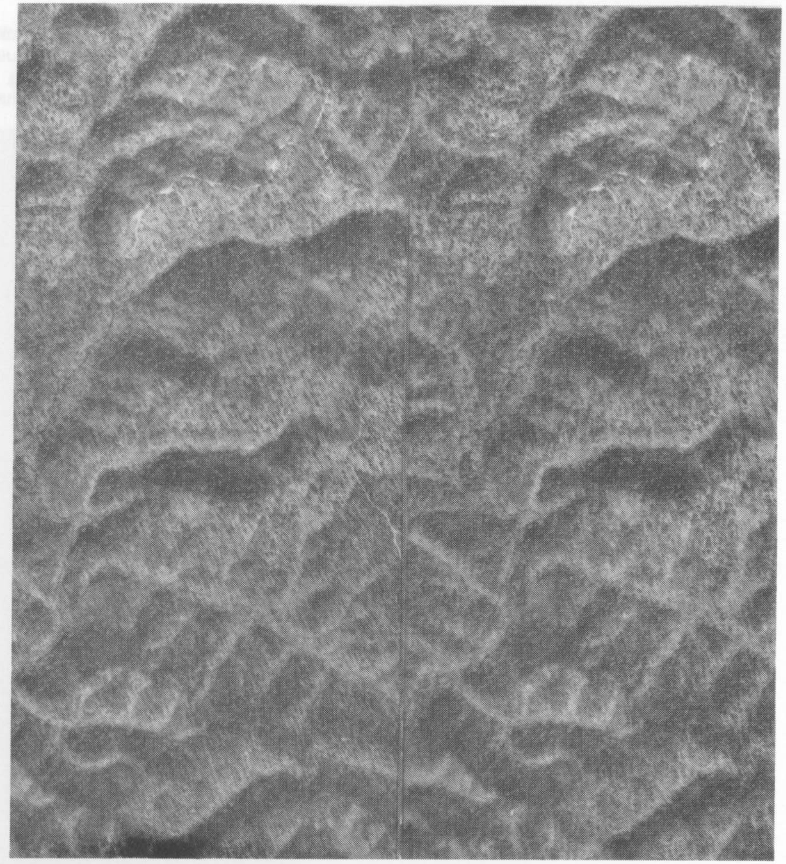

FIGURE 4. Stereogram of a portion of the Talladega Slate area where the terrain is less mountainous than is the case elsewhere in the Mountain Forest Habitat Region. Note the dendritic stream pattern. Cleburne County. (A20-01029-472-234, 235)

FIGURE 5. Stereogram of a portion of the Weisner Quartzite area. The hills are monoclinal ridges with generally steep western faces and somewhat less steep eastern faces. Note the characteristic exposed quartzite strata at A. Note also the very rugged character of this terrain. This is Duggar Mountain in Cleburne County. (A20-01029-272-246, 247)

FIGURE 6. Stereogram of an area with Weisner Quartzite uplands (U) and Shady Limestone bottomlands (L). The latter belong in the Ridge and Valley Forest Habitat Region and the forest cover in these areas should not be interpreted with the Mountain Forest Habitat Region key. This is in the Indian Mountain area of Cherokee County. (GT-1LL-39, 40)

ECOLOGICAL FOUNDATION OF THE KEY

All persons concerned with plant ecology are aware of the correlations that exist between species occurrence and site characteristics. The site characteristics that can be used in a photo-interpretation key for forest cover types are essentially topographic in nature. Topography is important because it affects the plant moisture regime. On the photographs, upland sites can be distinguished from bottomland sites without much difficulty. In the uplands, the moisture regime is affected by 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. Rocks that resist weathering usually are associated with poorer sites and rougher topography. Rocks that are less resistant to weathering are associated with better sites and more gentle topography. This relationship was found to be of consequence in the mountains. It was incorporated into the key through the medium of geographic zones, which are described in Section 7.1. Some of these zones are associated with Weisner quartzite, which is highly resistant to weathering and produces very dry sites, while the remaining zones are associated with Talladega slate which, in general, produces somewhat better sites. Since these zones cannot be distinguished on aerial photographs, their locations have been made available to the interpreter through the medium of maps.

Species distribution is not controlled solely by the amount of available water. Because species become adapted to a certain set of conditions through evolutionary development, they occupy reasonably well defined geographic ranges. These ranges were used, along with the bedrock geology, in the definition of the zones and have been made available to the interpreter through zone maps.

Plant communities tend to change with time, becoming more and more stable as far as species composition is concerned. 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 the forest cover has been removed by one means or another. There are, of course, light-seeded intolerant hardwood species that may invade a denuded area along with the pines, creating a mixed forest cover. As time goes on, 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 the site is left in an appropriate condition, the new stand probably will be pine. If there is no site preparation, it is likely that, because of their sprouting capability, the new stand will be almost pure hardwoods. 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 way the photo-interpreter can judge stage of succession.

The combination of topographic, geological, and broad species range information apparently 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 key for the Piedmont Forest Habitat Region (Johnson and Sellmann, 1974).

Initially a reconnaissance was made of the Region for the purpose of obtaining a working knowledge of its geography and species complexes. No quantitative information was gathered during this stage of the operation. Instead, the 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. Certain of these zones had affinities with bedrock geology while others did not. In addition, topographic position and aspect had considerable influence on the occurrence of the species complexes. Steepness of 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 in an attempt to cover as many conditions as was feasible. Initially these transects were laid out on aerial photographs. They were 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

[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.

evaluated by means of point sampling with a 10-factor prism so as to obtain estimates of basal areas per acre, by species, in the overstory. The sampling points were arbitrarily selected to represent typical parts of the stands. No attempts were made to use any form of formal probability sampling.

The data obtained 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 7, 8, and 9, constitute descriptions of species complexes which occurred repeatedly. These were tentatively described at an early stage, and the descriptions were crystallized after further field work provided a stronger base.

As previously mentioned, slope position and aspect had powerful effects on the species occurrence patterns, but crest width and degree of steepness did not influence the distribution of species in the Mountain Forest Habitat Region as they did in the Piedmont. In the mountains almost all, if not all, crests were relatively narrow, and the slopes were steep. Therefore, crest width and slope steepness were not used as variables in the key. As the reconnaissance transect phase of the study progressed, it confirmed impressions obtained in the reconnaissance that conditions in the Weisner quartzite areas were sufficiently different from those in the Talladega slate areas that the two formations would have to be differentiated 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 proportion 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. A number of hills in both the Weisner quartzite and the Talladega slate areas 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. The 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.

DESCRIPTION OF THE KEY

The Key consists of two parts (see Appendix I). The first is a typical dichotomous elmination 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 45A and the stand in question was on the lower slope facing northeast, the forest cover type would be P(7), which is usually a mixture of loblolly and shortleaf pines.[4]

FOREST COVER TYPES

The forest cover types recognized by the key are shown in diagram form in figures 7, 8, and 9, and, in addition, are formally described in Appendix II.

The development of these type descriptions was a complex operation which was carried out simultaneously with the 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 the work progressed the zone pattern became firmer and as this occurred the 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 these points were located along transects but later, when supplemental information was needed, such points were located without reference to transects. At each of these points a sweep was made with a prism having a basal area factor of 10. The overstory 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. However, studies involving formal sampling can be built on this work since the key forms the basis for the development of sampling frames.

The results of this 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 calculation made use of 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. The utilization of the supplemental data in the rate of occurrence computations results in some apparent anomalies where occurrence rates are high but dominance rates are low. Black tupelo is an excellent example of such a species. It occurs widely but only rarely are concentrations of black tupelo trees found.

The second source of information used in the development of the cover type descriptions was the accumulated experience of the persons doing the field work. These people were professionally trained foresters who were well prepared to accumulate mental impressions of cover type - site relationships as well as species associations. Heavy use was made of this accumulation of knowledge. It was used to confirm the evidence of prism data, to bolster prism data when the latter were scarce, and, in some cases, total dependence had to be placed on it when prism data were totally lacking.

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

The scarcity or absence of prism data for some cover types is the result of two factors. First, access to many parts of the Region is difficult. The terrain is very rough, the roads are confined essentially to valley floors and ridgetops, and footpaths are virtually non-existent. In addition, with the exception of the areas under the jurisdiction of the U.S. Forest Service, it is difficult in many cases to obtain permission to enter or cross property. This is a particular problem in the Weisner quartzite areas where the forested areas of interest lie behind farms. The second reason for the shortage of prism data is the small total area covered by the types in question. As a consequence representative stands in these types are difficult to find and to read. An effort was made to fill the gaps but eventually it was decided that the cost of the effort would be excessive and that the work should be terminated.

The diagrams in figures 7, 8, and 9 are pictorial representations of 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 have little significance as far as contributing to stand basal area is concerned. The diagrams

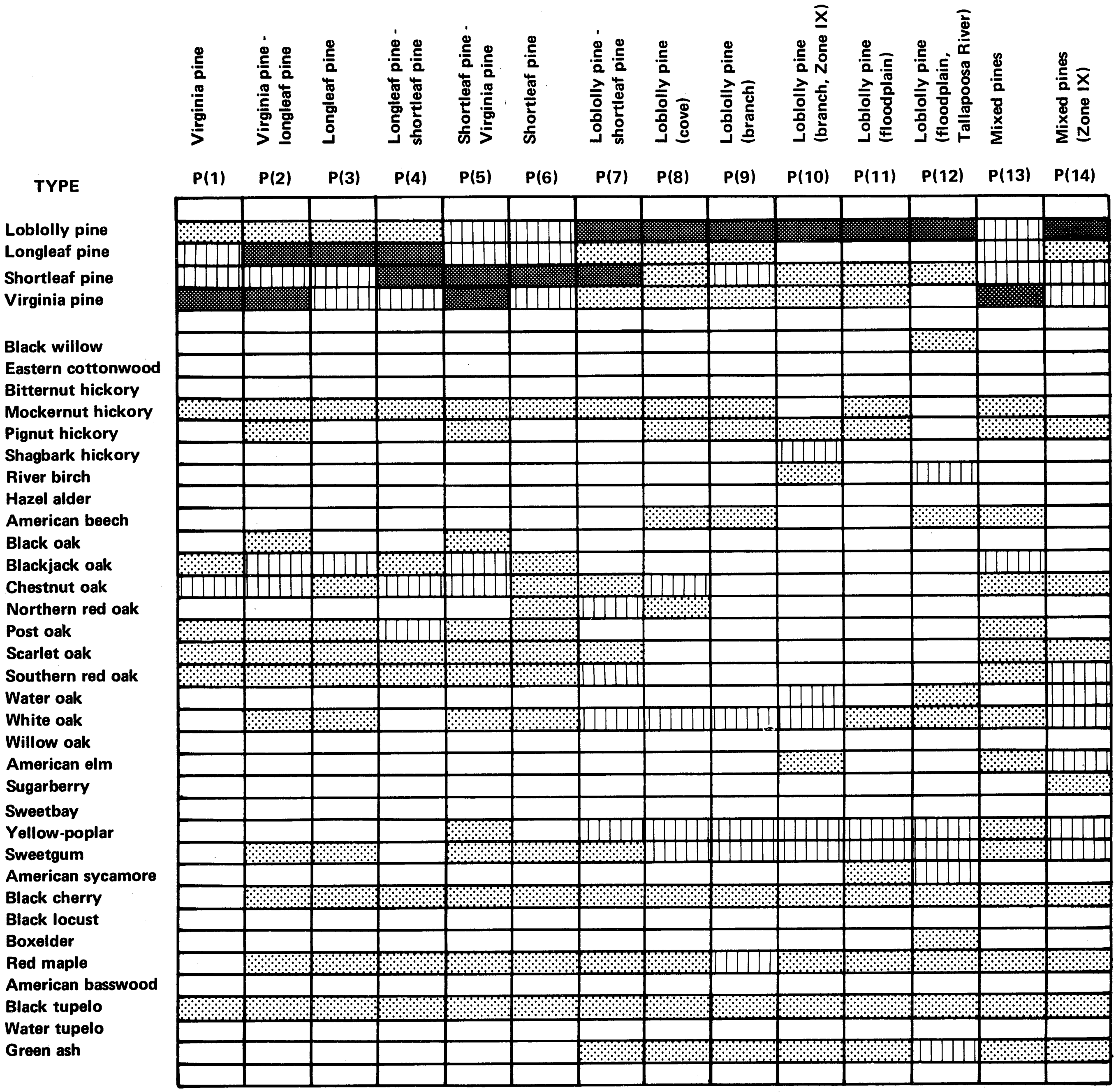


FIGURE 7. Diagram showing relative importance of species within the pine cover types.[5]

[5] 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.

are arranged, with some exceptions, with the cover types associated with the driest sites on the left and the cover types associated with the wettest sites on the right. This provides a visualization of the shifts in species importance as the quality of the sites change.

A total of 36 cover types have been defined, with pine types totalling 14, pine-hardwood types totalling 14, and hardwood types totalling 8. It is recognized that this detail is not needed by many persons involved with land management. However, when it became evident that this detail could be achieved the decision was made to proceed in the direction of detail rather than that of generality. The reasoning behind this decision was that users could always lump types but the reverse could not be done.

The reason for the detail can best be seen on figures 7, 8, and 9, which show the relative importance of the species within the types. For example, in Figure 9, H(1) is distinguished from H(2) by the fact that blackjack oak is more important in H(1) and white oak in H(2). On the basis of occurrence alone the two types are practically indistinguishable. The third upland type, which is associated with the highly mixed conditions of Zone IX, is quite different from either of the others. The occurrence pattern is different and, in addition, no species are dominant. Figure 7 reveals why there are so many pine types. It can be seen, in the upland situations, that the relative proportions of the four pine species change from type to type. In the lowland types loblolly pine is always

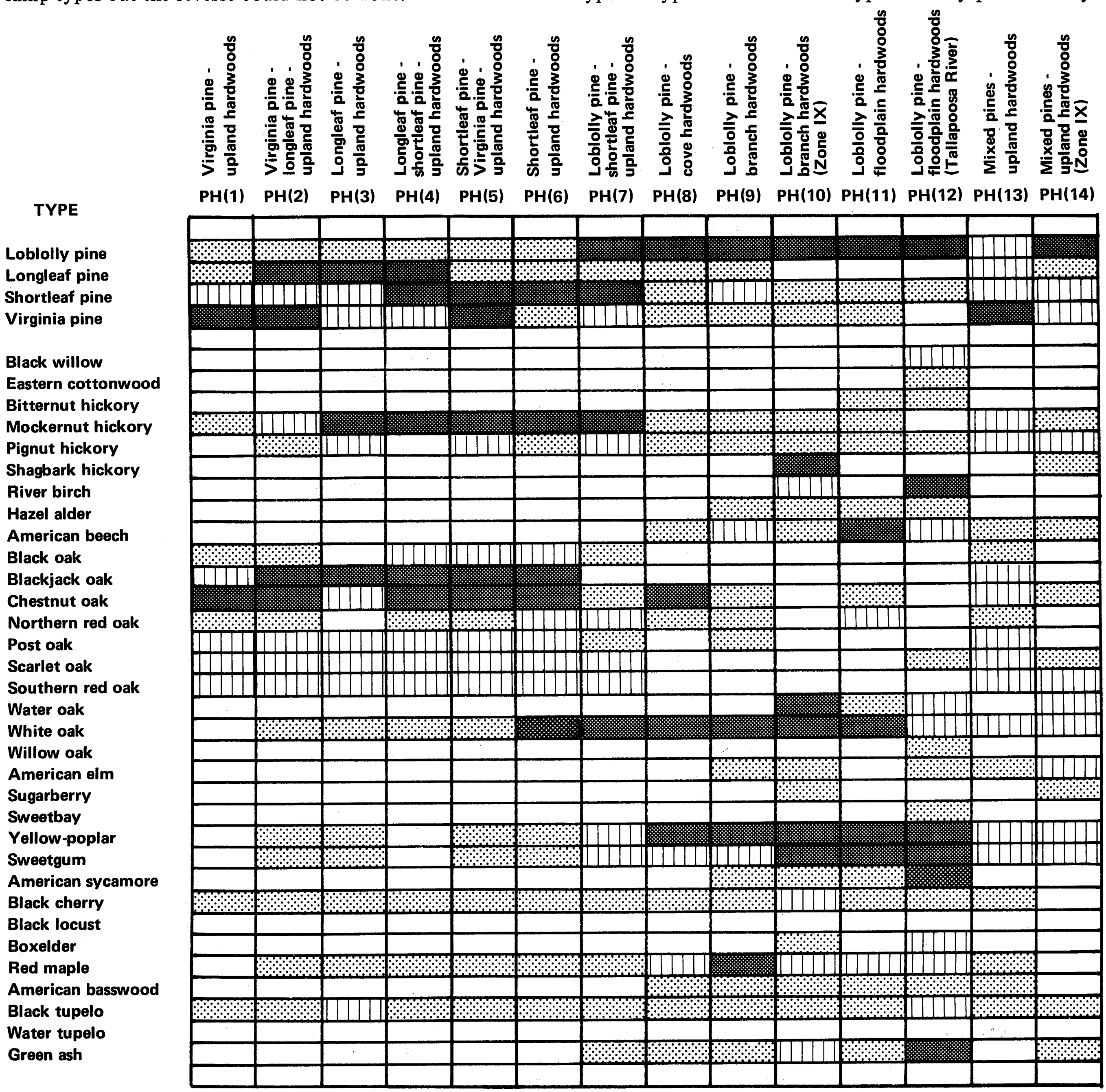


FIGURE 8. Diagram showing relative importance of species within the pine-hardwood cover types.

dominant but the relative importance of other pines change. In some of these lowland types the cover type differences are based on the mix of associated hardwoods rather than pines. The importance of this is probably negligible as far as the pine types are concerned but it becomes significant in the pine-hardwood types, as can be seen in Figure 8.

Since the cover types are based on topographic positions and percentage of dark-toned crowns and not on the actual species groupings themselves, their stability with regard to species components is dependent on the number of species involved. Some of the cover types, such as the pure pine types, are relatively simple and involve only one, two, or three critical species. The 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.

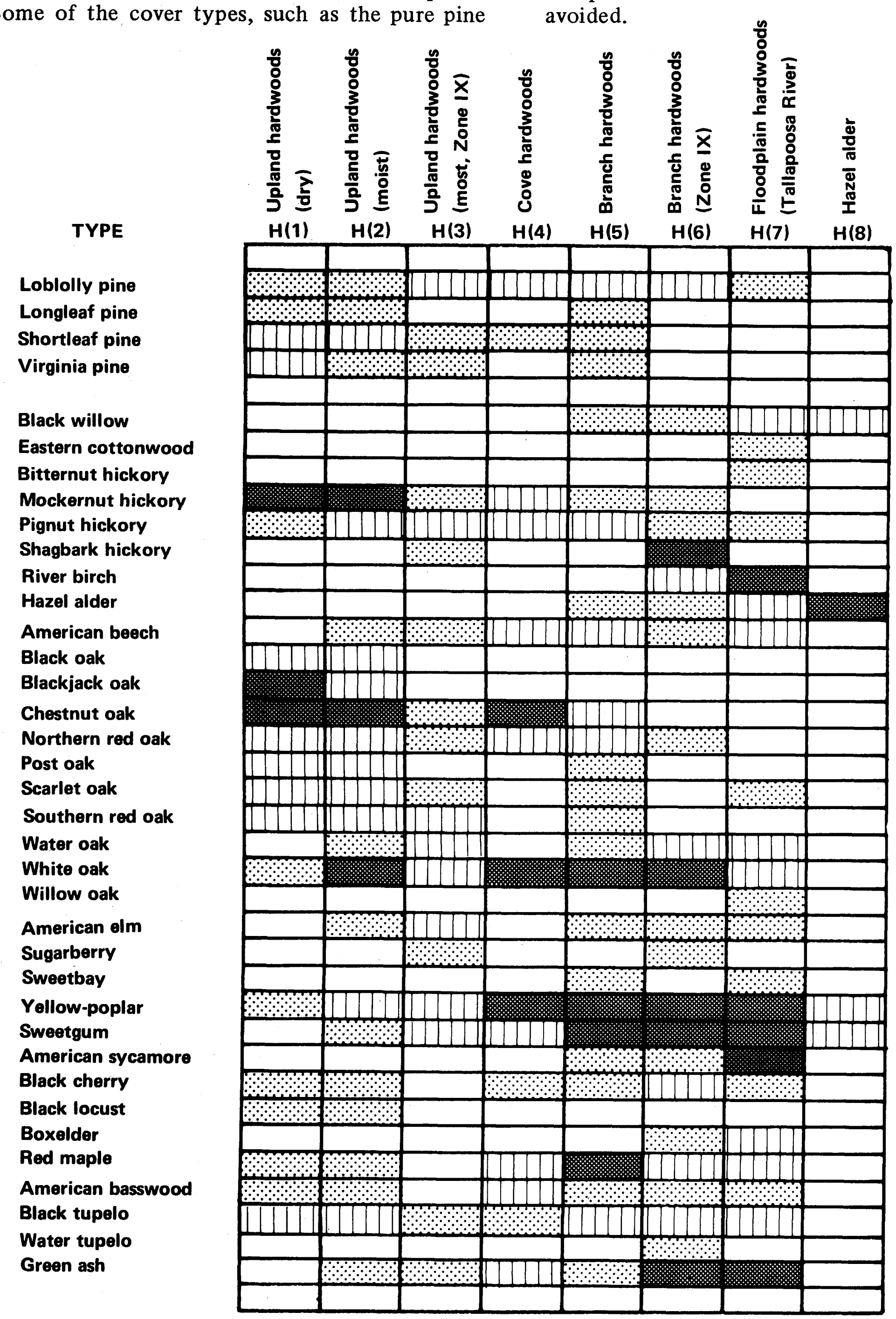


FIGURE 9. Diagram showing relative importance of species within the hardwood cover types.

	Virginia pine		Virginia pine - longleaf pine		Longleaf pine		Longleaf pine-shortleaf pine		Shortleaf pine - Virginia pine		Shortleaf pine		Loblolly pine - shortleaf pine		Loblolly pine (cove)		Loblolly pine (branch)		Loblolly pine (branch, Zone IX)		Loblolly pine (floodplain)		Loblolly pine (floodplain, Tallapoosa River)		Mixed pines		Mixed pines (Zone IX)	
TYPE	P(1)		P(2)		P(3)		P(4)		P(5)		P(6)		P(7)		P(8)		P(9)		P(10)		P(11)		P(12)		P(13)		P(14)	
Sample size	18		43		8		13		48		46		7		0		7		0		6		0		50		3	
	P	D	P	D	P	D	P	D	P	D	P	D	P	D	P	D	P	D	P	D	P	D	P	D	P	D	P	D
Loblolly pine			12	2					27	5	17	4	86	38			71	56			100	97			58	15	67	22
Longleaf pine	22	14	67	39	100	90	77	34	15	7	30	10					29	2							42	13		
Shortleaf pine	17	6	19	3			69	37	73	33	96	78	86	48			29	16							50	18		
Virginia pine	94	73	95	50	50	<1	15	10	87	44	7	2	14	<1			14	5							96	43	100	78
Black willow																												
Eastern cottonwood																												
Bitternut hickory																												
Mockernut hickory	11	<1	42	<1	75	<1	69	2	58	1	28	<1	57	<1			43	4			50	<1			42	<1	33	<1
Pignut hickory			5	<1					17	<1															10	1	67	<1
Shagbark hickory																												
River birch																												
Hazel alder																												
American beech																	14	<1							2	<1		
Black oak			5	<1					6	<1																		
Blackjack oak	6	<1	79	2	100	10	69	1	37	2	37	1													40	3		
Chestnut oak	33	5	28	2	25	<1	69	7	42	2	22	<1	29	<1											18	<1	33	<1
Northern red oak	6	<1									7	<1	29	2														
Post oak	11	1	16	<1			38	3	50	1	26	<1													30	1		
Scarlet oak			12	<1	13	<1	23	1	46	1	24	1	14	<1											14	<1		
Southern red oak	11	1	5	<1			15	<1	13	1	13	<1	14	2											16	1		
Water oak																												
White oak			2	<1					13	<1	4	<1	57	6			43	2			33	<1			20	<1	67	<1
Willow oak																												
American elm																									4	<1	33	<1
Sugarberry																												
Sweetbay																												
Yellow-poplar									10	<1			57	4			71	8			67	<1			12	<1		
Sweetgum			2	<1					6	<1	7	<1	43	<1			57	2			50	2			32	<1	67	<1
American sycamore																					17	<1						
Black cherry			9	<1			8	<1	6	<1	7	<1	29	<1											6	<1		
Black locust																												
Boxelder																												
Red maple			16	<1			15	<1	8	<1	2	<1	29	<1			71	4			50	<1			30	<1	67	<1
American basswood																												
Black tupelo	6	<1	79	<1	75	<1	38	<1	54	<1	26	<1	14	<1											76	1	33	<1
Water tupelo																												
Green ash													14	<1											4	<1		

Table 1. Occurrence and dominance values for species within the pine cover types.[6]

[6]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".

TYPE	PH(1) Virginia pine - upland hardwoods		PH(2) Virginia pine - longleaf pine - upland hardwoods		PH(3) Longleaf pine - upland hardwoods		PH(4) Longleaf pine - shortleaf pine - upland hardwoods		PH(5) Shortleaf pine - Virginia pine - upland hardwoods		PH(6) Shortleaf pine - upland hardwoods		PH(7) Loblolly pine- shortleaf pine upland hardwoods		PH(8) Loblolly pine cove hardwoods		PH(9) Loblolly pine - branch hardwoods		PH(10) Loblolly pine - branch hardwoods Zone (IX)		PH(11) Loblolly pine - floodplain hardwoods		PH(12) Loblolly pine - floodplain hardwood (Tallapoosa River)		PH(13) Mixed pines - upland hardwoods		PH(14) Mixed pines - upland hardwoods (Zone IX)	
Sample size	13		17		12		19		52		35		5		0		9		0		3		0		31		2	
	P	D	P	D	P	D	P	D	P	D	P	D	P	D	P	D	P	D	P	D	P	D	P	D	P	D	P	D
Loblolly pine									6	2	11	2	60	27			78	32			100	42			55	9	50	17
Longleaf pine			59	23	100	41	74	29	8	1	14	1													19	5		
Shortleaf pine			41	8	50	7	58	16	77	32	97	41	60	21			22	11							61	16		
Virginia pine	100	45	76	20					78	17	9	2					11	1							77	23	50	30
Black willow																												
Eastern cottonwood																												
Bitternut hickory																					33	1						
Mockernut hickory	46	1	53	3	92	8	95	6	62	8	80	14	60	13			33	6							42	3		
Pignut hickory	8	1	6	1	8	3			27	2	3	1	60	7											45	4	50	1
Shagbark hickory																												
River birch																												
Hazel alder																	22	1										
American beech																	11	4			67	13			3	1		
Black oak	15	1	18	1			21	4	25	3	14	2	20	1											13	1		
Blackjack oak	31	4	76	24	92	26	63	16	52	9	49	6					11	1							23	3		
Chestnut oak	77	38	59	8	50	2	79	18	65	10	29	8	20	1											35	8		
Northern red oak	8	1	6	1			5	1	10	1	23	4	40	3			11	1							3	1		
Post oak	23	3	24	5	33	3	26	2	44	5	34	3	20	1			11	1							39	6		
Scarlet oak	15	2	35	3	50	4	26	3	42	5	29	3	20	5											26	3		
Southern red oak	31	3	18	4	25	3	5	2	6	1	26	4	40	4											23	5		
Water oak																											100	27
White oak			6	1			16	3	13	3	31	7	60	10			56	13			67	8			42	9	50	1
Willow oak																												
American elm																	11	2							10	1	50	1
Sugarberry																											50	9
Sweetbay																												
Yellow-poplar			6	1					2	1	14	1	60	6			78	17			100	19			19	4	50	1
Sweetgum											11	1	20	3			67	5			100	17			29	2	100	10
American sycamore																	11	1										
Black cherry	23	1	6	1					16	1	6	1	20	1			56	1			33	1			23	1		
Black locust																												
Boxelder																												
Red maple			6	1			5	1	16	1	14	1	20	1			67	8			67	1			23	1		
American basswood																	11	1			33	1			10	1		
Black tupelo	54	1	71	1	75	2	32	1	54	1	29	2	20	1			11	2			33	1			48	1	50	9
Water Tupelo																												
Green Ash																	11	1										

Table 2. Occurrence and dominance values for species within the pine-hardwood cover types.

	Upland hardwoods (dry)		Upland hardwoods (moist)		Upland hardwoods (moist, Zone IX)		Cove hardwoods		Branch hardwoods		Branch hardwoods (Zone IX)		Floodplain hardwoods (Tallapoosa River)		Hazel alder	
TYPE	**H(1)**		**H(2)**		**H(3)**		**H(4)**		**H(5)**		**H(6)**		**H(7)**		**H(8)**	
Sample	**55**		**133**		**4**		**5**		**58**		**17**		**2**		**0**	
	P	**D**	**P**	**D**	**P**	**D**	**P**	**D**	**P**	**D**	**P**	**D**	**P**	**D**	**P**	**D**
Loblolly pine	4	<1	15	1	75	10			47	5	59	4	50	<1		
Longleaf pine	11	1	14	<1					7	<1						
Shortleaf pine	35	4	29	3			40	4	7	1	6	<1				
Virginia pine	24	3	13	1					7	<1						
Black willow									2	<1	6	<1				
Eastern cottonwood																
Bitternut hickory																
Mockernut hickory	76	20	74	17					5	<1	6	<1				
Pignut hickory	16	<1	22	5			20	7	41	5	18	<1				
Shagbark hickory			2	<1							35	5				
River birch											12	3	100	31		
Hazel alder									24	<1	24	<1				
American beech			1	<1			20	4	41	4	6	<1	50	5		
Black oak	16	1	21	3												
Blackjack oak	56	9	20	5												
Chestnut oak	84	46	78	29			60	12	24	4						
Northern red oak	13	3	20	3			20	3	21	3	6	<1				
Post oak	22	3	30	5					3	<1						
Scarlet oak	24	4	30	7					3	<1			50	5		
Southern red oak	15	1	15	3	100	17			9	1						
Water oak			1	<1	100	37					18	<1	50	<1		
White oak	2	<1	41	9	50	5	80	20	84	22	88	26				
Willow oak																
American elm			2	<1	100	5			2	<1	35	1				
Sugarberry											6	1				
Sweetbay									5	<1						
Yellow-poplar	2	<1	28	3			100	34	97	22	100	21	100	39		
Sweetgum			6	<1	75	20			72	18	71	13	100	<1		
American sycamore									2	<1	12	1	100	5		
Black cherry	22	<1	27	<1			20	<1	16	<1	53	2				
Black locust	7	<1	2	<1												
Boxelder											6	<1	100	<1		
Red maple	9	<1	23	<1			40	4	81	9	82	4	50	<1		
American basswood	7	<1	11	<1			20	8	16	<1	24	1				
Black tupelo	44	2	47	2			40	<1	31	2	59	6	50	<1		
Water tupelo											12	4				
Green ash			2	<1	25	5	20	3	7	<1	47	8	100	13		

Table 3. Occurrence and dominance value for species within the hardwood cover types.

DESCRIPTIONS OF THE VARIABLES

Zones

Early in the reconnaissance phase of the study it became evident that the distribution of pine species occupying the crests and upper slopes was not random. In certain areas within the Region certain pines, or combinations of pines, were dominant while in other areas other combinations would be dominant. The reasons for this occurrence pattern are obscure. It is not known if the pattern is a more or less permanent phenomenon or if it is transitory. All that can be said at this point is that it exists.

In a similar manner the distribution of the hardwood species also follows a pattern. However, in this case the evidence indicates that the pattern is correlated with bedrock geology. In general, the sites in the Talladega slate area are better than their topographic equivalents in the Weisner quartzite area. As a result the hardwood species distributions on the two formations are somewhat different.

In order to take these patterns into account the Mountain Forest Habitat Region has been divided into nine zones. The locations of these zones are shown in generalized form on Figure 10 and in detail on the county map in Appendix IV. This relatively large number of zones was necessitated by the interlocking of the pine and hardwood distribution patterns. As a result, the pine distribution may be the same in two zones but the hardwood distributions different. In other cases the reverse is true.

The zones have been numbered generally from north to south. Zone I includes the northernmost extension of the Weisner quartzite area in Alabama. To the north it is dominated by the Indian Mountain massif and to the southwest by Duggar Mountain and its associated ridges. Virginia pine is the dominant pine species along the crests and upper slopes, but some shortleaf and longleaf pine are also found on these sites. In the northern half of Zone I, past forest practices have resulted in dominance of the area by hardwoods. Few pure pine stands exist. The pine that is present is in mixed pine-hardwood stands. In the southern half of the zone, forest disturbance has been less and pure pine stands are numerous. The hardwood species distribution over Zone I is typical of Weisner quartzite areas.

Zone I includes flat valleys that do not belong in the Mountain Forest Habitat Region (Figure 6), as was discussed in Section 2, "Description of the Region". No attempt should be made to use this key to interpret the forest cover in these valleys.

Zone II is in the Talladega slate area and the hardwood species distribution is typical of that geologic formation. The pine distribution is very similar to that in Zone I, with Virginia pine dominating the crests and upper slopes.

Zone III is in the Talladega slate area. The occurrence pattern for the pines in this Zone is complex but there is no doubt that shortleaf is the dominant pine. However, longleaf and Virginia pines are common and in localized areas may outnumber the shortleaf pine.

Zone IV is an area of subdued relief within the Talladega slate area which is very similar to the Ashland Plateau portion of the Piedmont Forest Habitat Region. Shortleaf pine is dominant but, unlike the situation in Zone III, loblolly is the most common associate pine.

Zone V includes the Weisner quartzite ridges existing as islands in the Coosa Valley. These include Weisner, Choccollocco, Coldwater, Alpine, and Kehatchee Mountains and their associated ridges. Longleaf pine dominates the crests and upper slopes, but patches of Virginia pine also occur. Shortleaf pine is present everywhere but in relatively small numbers.

Zone VI, the largest of the zones, includes much of the main mountain ridge in the Talladega slate area. The pine occurrence pattern is similar to that in Zone V, but the hardwood pattern is typical of the Talladega slate area.

Zone VII includes the summit ridge and upper slopes of Cheaha Mountain and its immediate subordinate ridges down to approximately the 1,200-foot contour. Within this zone Virginia pine is dominant but longleaf and shortleaf pines also are common, particularly below the middle of the upper slopes. The Virginia pine forms extensive pure stands while the longleaf and shortleaf pines occur mainly as secondary components in Virginia pine stands.

Zone VIII is that portion of the Talladega Slate area which lies southwest of U.S. Highway 431, northeast of approximately Patterson Gap, and outside of Zone VII. To the east of Zone VII, Zone VIII is very narrow, while to the west it is quite wide. The terrain is extremely varied, ranging from portions of the main mountain ridge to low rolling foothills. Because of this great range in topography and because of extensive cultural activities on the part of the U.S. Forest Service, the pattern of occurrence of the pines is confused. Any of the four pines can be found occupying the crests of the low foothills, while on the higher ridges shortleaf and longleaf pine are common and patches of Virginia pine are not uncommon.

Zone IX essentially includes the portion of the Talladega slate area which lies west of the Coosa River. This is an area of relatively low relief where the Mountain Forest Habitat Region merges into the Ridge and Valley Region to the north and west, the Coastal Plain to the south, and the Piedmont to the south and east. As a transition area it exhibits the characteristics of such areas. Interspersed through the area are outliers of the adjacent areas. Since existing geologic maps of the area are highly inadequate, all that can be said for figures 53 and 57 are that they are approximate. The hills usually are associated with the Talladega slate while the low ground belongs with adjacent regions, primarily the Ridge and Valley. Since it was not feasible to map out these non-Talladega slate areas they could not be excluded from the Mountain Forest Habitat Region as was done with the limestone valleys in Zone I. Instead of exclusion it was necessary to modify the key so as to recognize these non-Talladega slate areas and then to develop forest cover types to meet the conditions on these areas. To this end, reference was made to data accumulated in the Ridge and Valley Region but not yet assembled into final form for that Region. It is anticipated that the types developed for the lowlands in Zone IX will not be significantly different from those developed for the equivalent portions of the Ridge and Valley Region. Because of the complexity of the bedrock geology in this Zone and inadequate knowledge regarding the map positions of the various bedrock types, the rate of error for the photo-interpretation of forest cover types is apt to be much higher than in the other zones.

Forest disturbance in Zone IX has been profound. A natural stand of pine, on any site in the uplands, may be made up of any one or more of the four pines. Single species pine stands are rare. Virginia pine is almost always

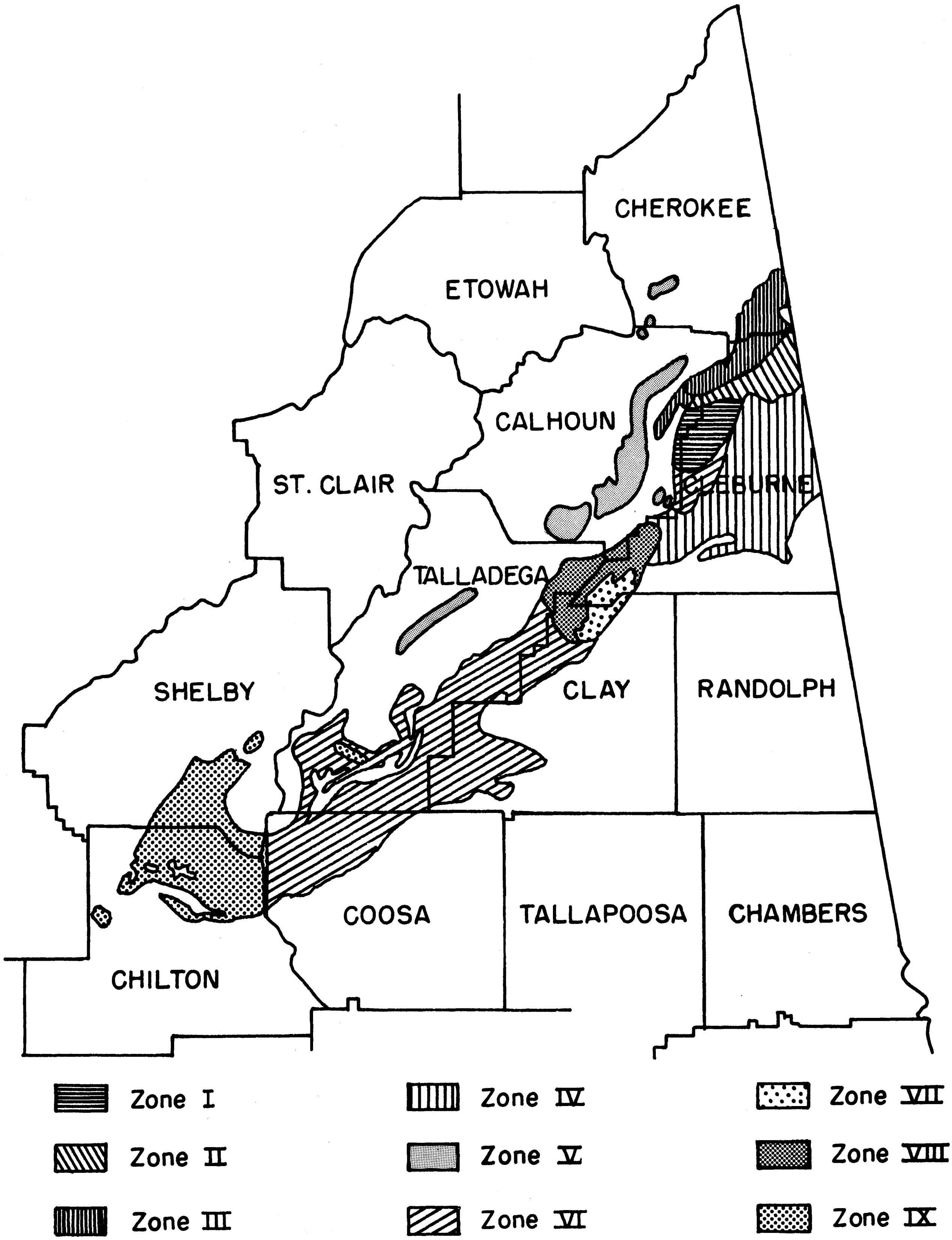


FIGURE 10. Map of the Mountain Forest Habitat Region in Alabama showing the ten vegetative zones.

present and very often is the dominant species. However, the mix of pines is so variable that it is impossible to estimate the situation in any given case with reasonable accuracy. As a result it has been necessary to devise a "catch-all" pine cover type which indicates the presence of pine but does not indicate the probable mix of pine species.

On the county maps (figures 51 through 58) the zone boundaries are shown as lines. In actuality, however, the boundaries are rarely sharp but rather form transition belts (ecotones) whose widths may vary from almost zero to several miles. As a result, one must expect that interpretations of stands made adjacent to the zone boundaries would be subject to more error than interpretations made near the centers of the zones.

Topographic Positions On Hills

The upland sites have been divided into four classes: *crest, upper slope, middle slope,* and *lower slope;* as shown in Figure 11. The lower bound of the upland zone is the *base level,* which is 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 top of the hill and down to a point where the main downward slope of the hill begins.[6] 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 12 shows a portion of the Talladega Slate area where the stream patterns and the slope classes have been delineated for illustrative purposes only. The interpreter should delineate mentally to determine the topographic position at which the unknown stand occurs. One must recognize that forest stands usually extend over more than one topographic situation and that a certain amount of averaging must be done. Although the key probably would be more accurate in classifying the cover at points or on plots, with good judgement the interpreter can achieve reasonable accuracy with stands.

[6]Another definition of the crest is the convex portion of the hilltop.

Aspect

The key recognizes that the moisture regime and, therefore, the vegetation distribution patterns are influenced by the aspect of a slope. Theory and empirical evidence indicates that the coolest and dampest sites occur on the northeast facing slopes while the hottest and driest conditions are found on the southwest facing slopes. The axis of maximum effect is therefore located along the N45°E-S45°W line. The distribution of species is essentially symmetrical on either side of this line, as is shown in the hill patterns in figures 42 to 50.

Bottomland Sites

The sites adjacent to streams and subject to overflow from time to time, i.e., those sites below the base level previously described (Figure II), have been divided into four categories: those in the headwaters areas, as in Figure 13, that are essentially intermittant and are the primary collectors of overland water flow; those in the headwaters area or immediately below it where the land configuration is that of a cup (often referred to as a *cove*) and the stream is small but usually not intermittant (Figure 14); those below the headwaters area with stream widths that are less than 25 feet (Figure 13); and those below the headwaters area where the stream is 25 feet or more in width (Figure 15). The headwaters streams have very narrow overflow areas and the vegetation associated with them occurs along the streambanks or only a short distance from them. On the photographs this often appears as a single line of crowns along the water course. Conditions in a cove depend on its size. Below the headwaters, the overflow zone widens to some extent but still may remain very narrow because of the steep sides of the valleys. When the stream reaches a width of about 25 feet, the associated overflow zone usually becomes wet enough to support a vegetative complex different from the one found higher up the stream. This has been recognized in the key.

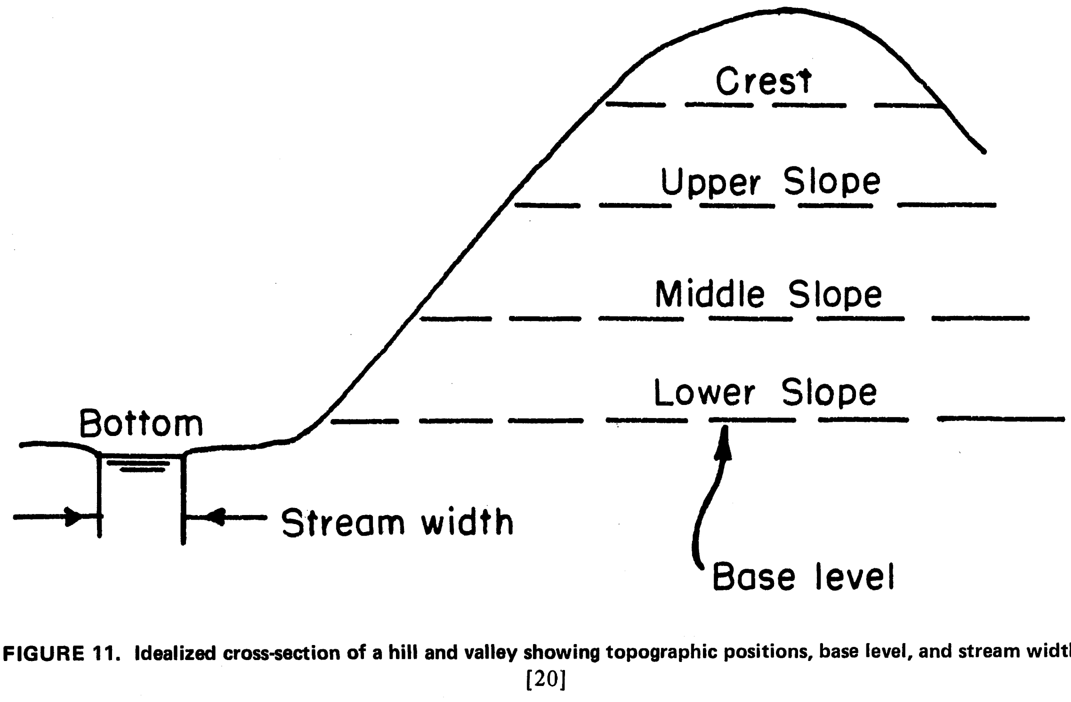


FIGURE 11. Idealized cross-section of a hill and valley showing topographic positions, base level, and stream width.

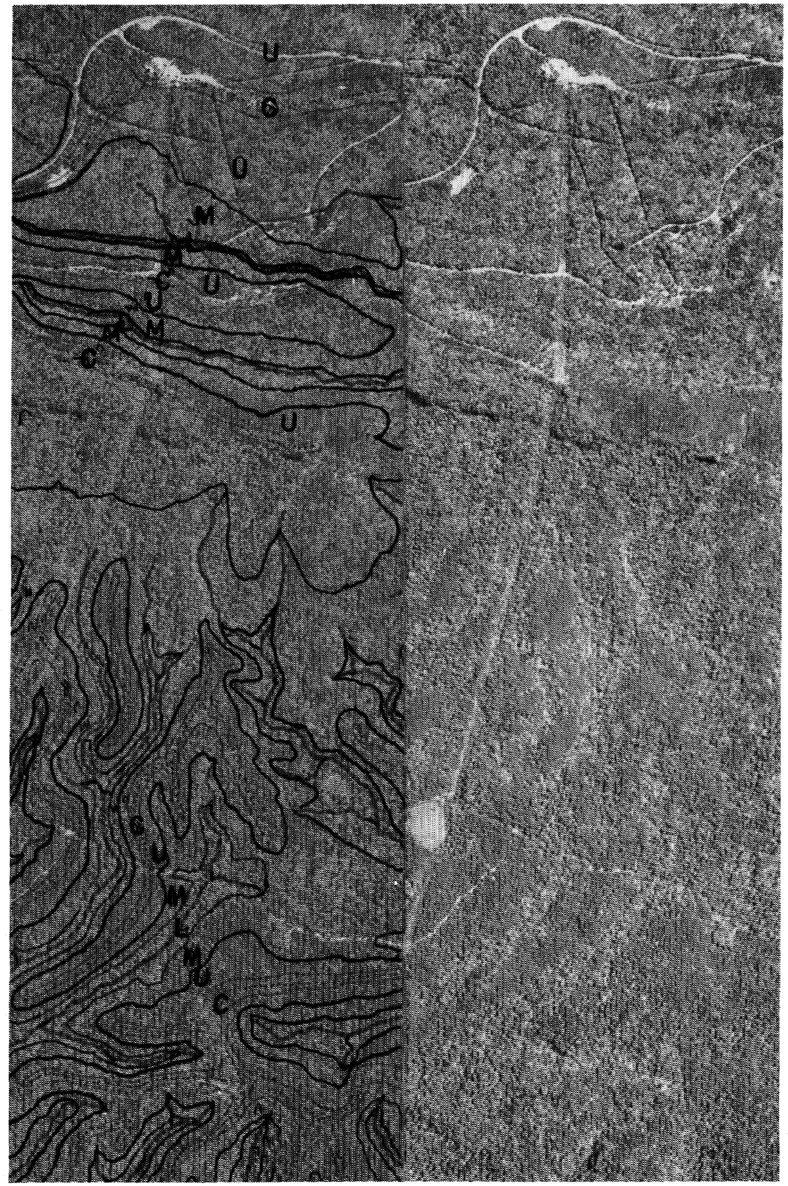


FIGURE 12. Stereogram of a portion of the Cheaha Mountain State Park in Cleburne County. This is in the Talladega Slate area. The stream pattern and the topographic positions have been delineated. The dotted lines are on the crests and the slope positions are labelled C for crest (or ridgeline), U for upper slope, M for mid-slope, and L for lower slope. Note that each spur ridge is treated as a separate entity. In most cases the transition zone between the main and spur ridges falls into the mid-slope category. (GV-1JJ-160, 161)

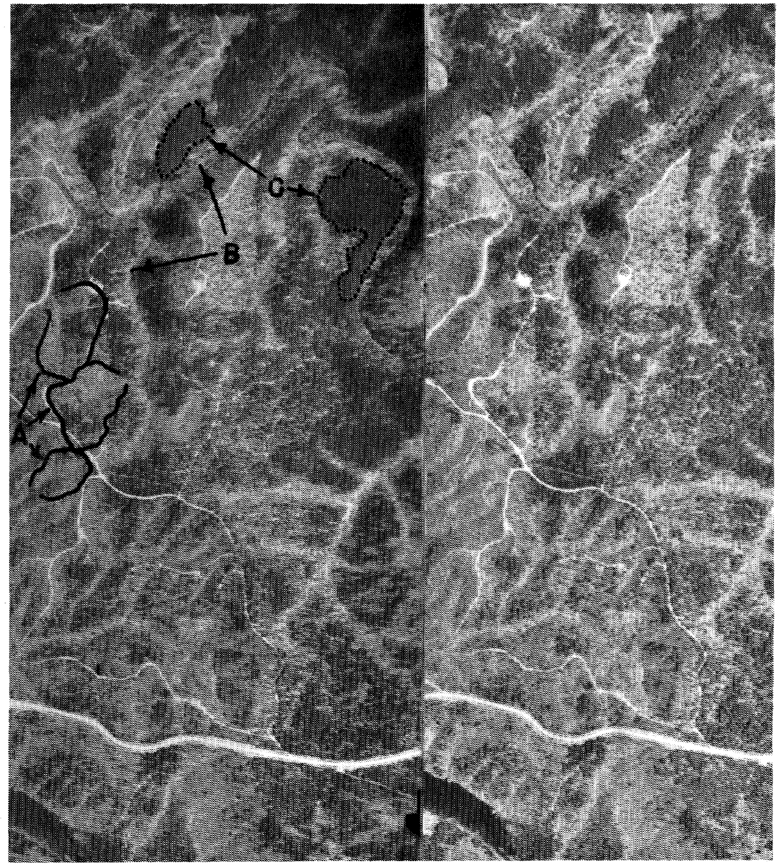


FIGURE 13. Stereogram of a portion of the Weisner Quartzite area showing stream classes recognized in this key. Headwater areas not cup-shaped, are shown at A. Streams, below the headwaters area, with widths of less than 25 feet (or 0.015 inches at a photographic scale of 1:20,000), are shown at B. Dense stands of Virginia pine are shown at C. The large stream at the top of the stereogram is part of the upper reaches of Terrapin Creek in Cleburne County. (A20-01029-472-137, 138)

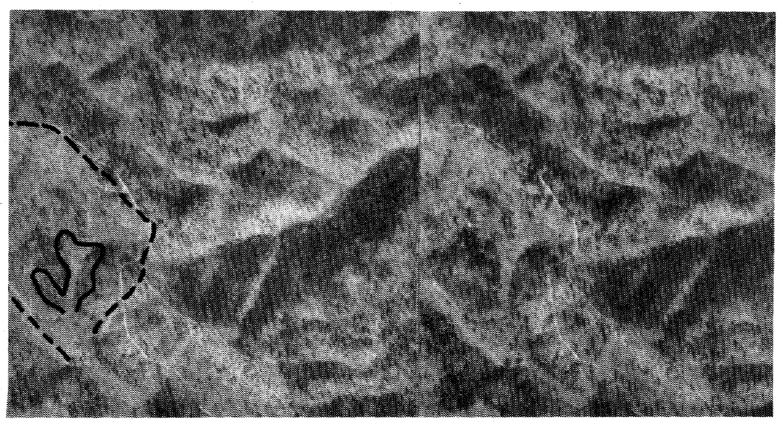


FIGURE 14. Stereogram of a portion of the Rattlesnake Mountain area in Cleburne County showing a cove. This is in the Talladega Slate area. Coves are cup shaped water collection areas at or immediately below the headwaters of a stream. In this case the cove proper is delineated with a solid line while the stream catchment basin is shown with a dashed line. Note that the cove proper lies below the upper slopes and forms a cup. (A20-01029-472-236, 237)

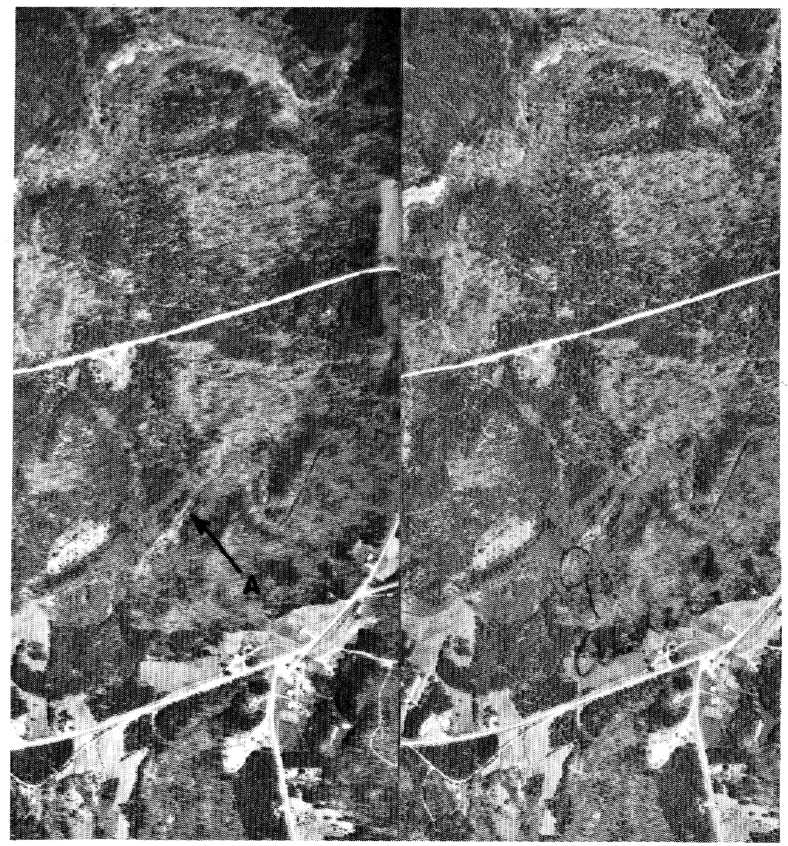


FIGURE 15. Stereogram of a portion of the Weisner Quartzite area showing a stream that, at A, is between 25 and 30 feet wide. Terrapin Creek in Cleburne County. (A20-01029--472-135, 136)

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 do 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 ASCS fail to produce photographs that are ideal for forest cover identification. While the film and filter combination is acceptable, the season of the year may or may not be suitable because the agency only requires photography that will distinguish field from forest. Since the only seasonal condition that interferes seriously with its requirement is snow cover, most of the photographs made for the ASCS are taken in the summer in the North and in the late fall, winter, or early spring in the South. This latter period is the worst possible for taking aerial photographs that are to be used for forest cover evaluation because the hardwood leaves are dying, have fallen, or are just developing. Consequently, photographic tones associated with hardwood cover are subject to wide variations and have been given minimal weight in the key. Nevertheless, tone cannot be ignored completely since 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 the lightest to darkest, appearing on the print. When this range is short, i.e., the lightest tone is not much different from the darkest tone, the print is said to have low contrast and is termed a "soft" print (Figure 16). When the lightest tones are nearly pure white and the darkest tones are nearly black, the print is said to have high contrast and is termed contrasty, or "hard", print (Figure 17). Contrast is controlled in the printing process, and the usual objective is to choose a contrast level that will reveal the maximum detail. If the contrast is not optimum, detail, i.e., information, is lost. In ordering photographs from the ASCS, one is given no opportunity to specify the contrast level, and the ASCS makes little or no effort to provide an optimal contrast. Only rarely does the contrast meet the desires of a forest photo-interpreter. Tonal differences between hardwoods and softwoods are often minimal, making the photo-interpretation problem more difficult than it otherwise would be. 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) 70 percent or more of the crowns 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 an 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 18).

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 the hardwood trees themselves. The only evidence that trees are present are shadows. When the shadows of bare trees fall clear on a smooth surface, they may provide good

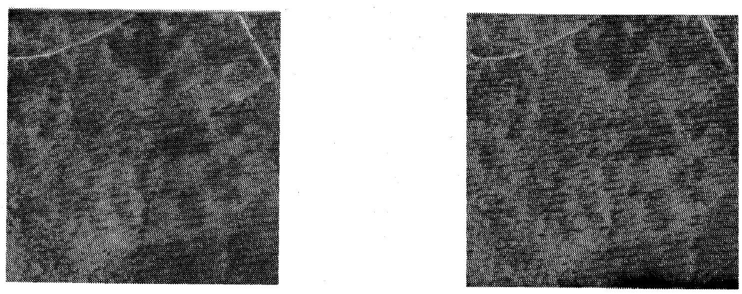


FIGURE 16. Stereogram with low contrast.

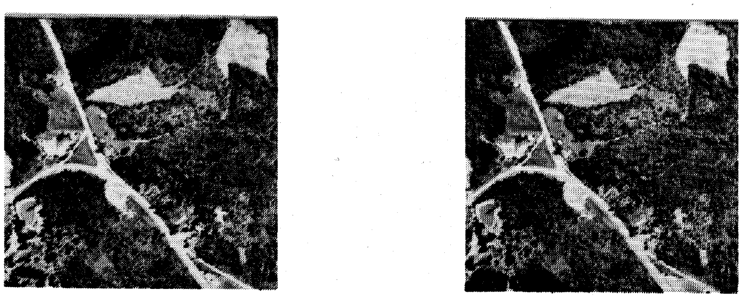


FIGURE 17. Stereograms with high contrast.

evidence for evaluation of the forest cover (Figure 19). Though shadows are seldom as clear as shown in Figure 19 they usually can be used to estimate the relative density of the hardwood component. Figure 20 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 the new leaves appear in the spring. This causes no problem so long as the photographs were taken on panchromatic film, because both live and dead hardwood leaves usually appear lighter on such photographs than do the softwood crowns. However, black and white infrared film 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 tone classes on photographs made then. Unfortunately, ASCS photography in the South rarely is taken this late in the spring and dependence must be placed on the combination of tone and shadows (Figure 21).

Different stands having the same ratio of dark to light crowns may differ considerably in appearance because of difference in stand density. Figures 22 to 37 are stereograms that show examples of the three different tone classes with different stand density levels. Examples are also shown where the hardwood component must be evaluated from shadows.

Texture

To the experienced forest photo-interpreter the arrangement and character of the fine detail of the forest cover often yields valuable clues to the species composition and condition of forest stands. Unfortunately there are no standard textures which can be used as the basis of communication between interpreters. Each interpreter describes texture in terms of things with which he is familiar. Communication is prevented if the person given the description is not familiar with the simile. For this reason little use has been made of texture as a diagnostic tool in these keys. There is, however, one condition in the Mountain Forest Habitat Region where texture is of sufficient importance to justify its inclusion in the key. Dense stands of Virginia pine have a distinct texture that is illustrated in Figure 13 and in Figure 38. The stands are made up of small crowned trees that are packed together in a way that is rarely encountered with the other pine species. As a consequence, reference is made to this texture in the key. In no other case is texture used as a diagnostic factor.

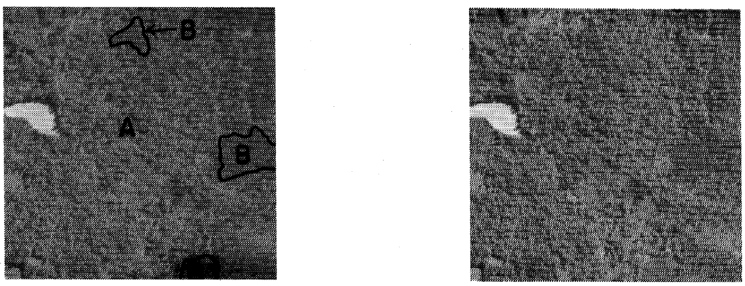


FIGURE 18. Stereogram showing hardwoods (A) and pine (B) during the fall color season.

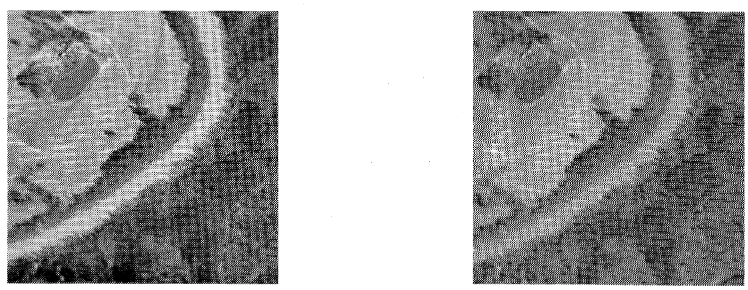


FIGURE 19. Stereogram showing shadows of hardwoods falling clear on the surface of a stream. Crown characteristics are quite clear.

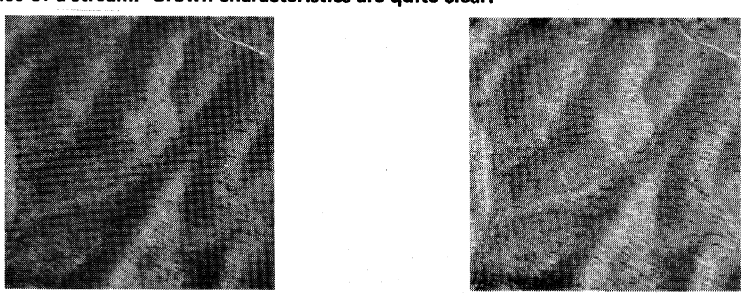


FIGURE 20. Stereogram showing shadows of hardwoods in a relatively dense stand. Note the striated appearance of the shadows. Density of the striations is correlated with stand density.

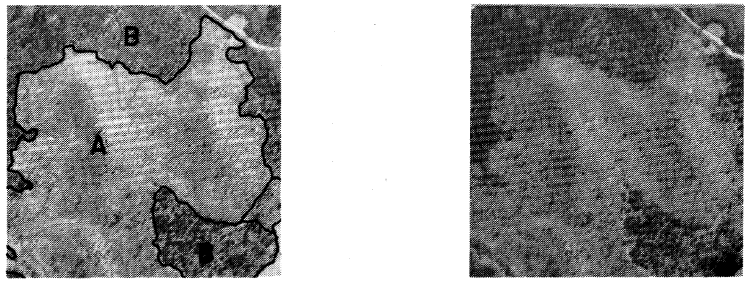


FIGURE 21. Stereogram showing the contrast between hardwoods (A) and pines (B) in early spring when the leaves are beginning to open.

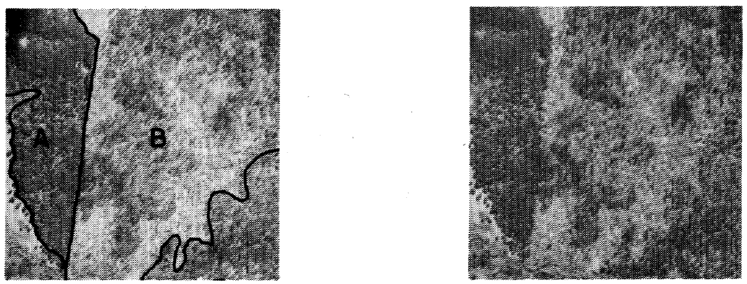


FIGURE 22. Stereogram of a dense stand of pine (A) adjacent to a stand of mixed pine and hardwoods (B).

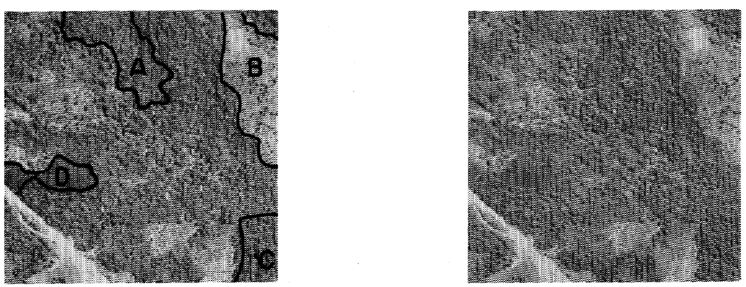


FIGURE 23. Stereogram of a medium dense stand of pine (A), a field restocking to pine (B), a dense stand of mixed pine and hardwoods (C), and a small, dense pine plantation (D).

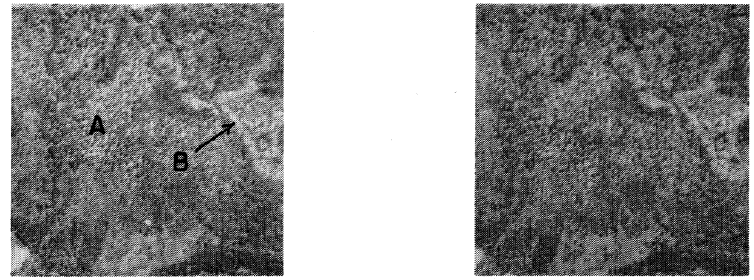


FIGURE 24. Stereogram of an open stand of pine (A), with light toned brush along the stream (B).

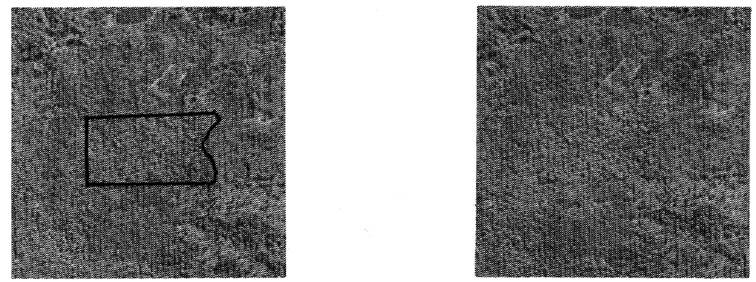


FIGURE 25. Stereogram of a dense mixed pine-hardwood stand. The photographs were taken during the fall color season. Discrimination between the pines and hardwoods would be on the basis of tones of grey.

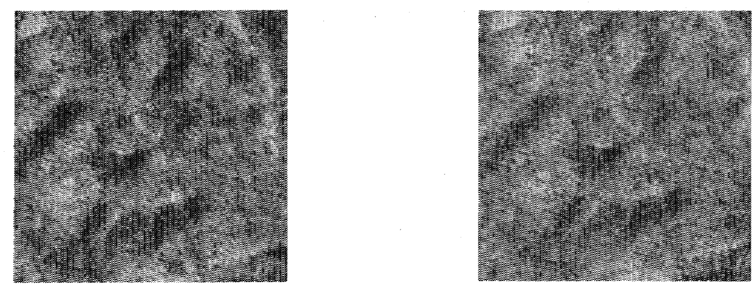


FIGURE 26. Stereogram of a dense mixed pine-hardwood stand. The photographs were taken during winter when leaves were off most of the hardwoods. The pine crowns are still full. The only evidence of hardwoods is the shadow pattern and a few light-toned crowns still holding leaves.

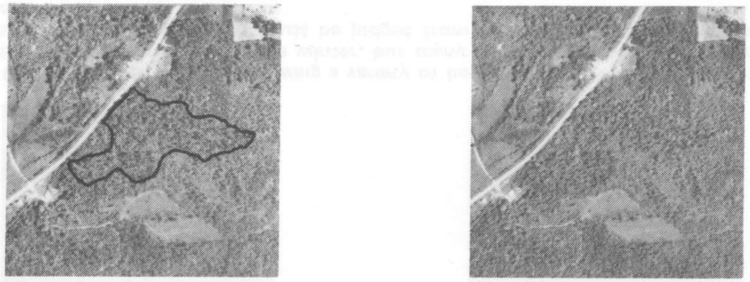


FIGURE 27. Stereogram of a two-storied, mixed pine-hardwood stand. The overstory is medium stocked. The photographs were taken during the fall color season. Discrimination between pines and hardwoods is on the basis of tones of grey.

FIGURE 28. 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.

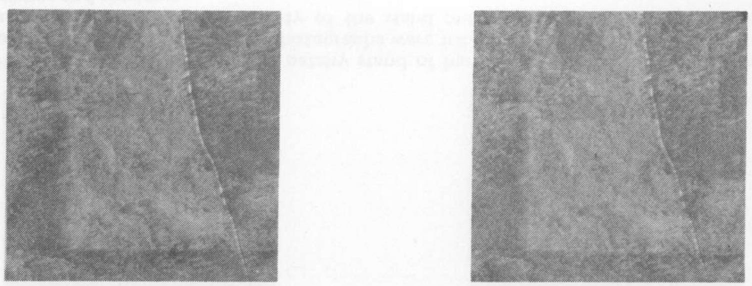


FIGURE 29. Stereogram of a cut-over area with a thin residual stand of mixed pines and hardwoods. The hardwood crowns are light toned while the pine crowns are dark toned.

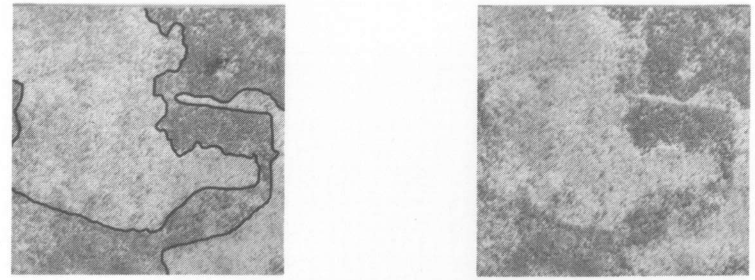


FIGURE 30. Stereogram of a thin stand of mixed pines and hardwoods. The hardwood component can be evaluated only by shadows. Though photographed in the spring when the leaves were developing, the hardwood crowns are not distinct because the understory is also light-toned.

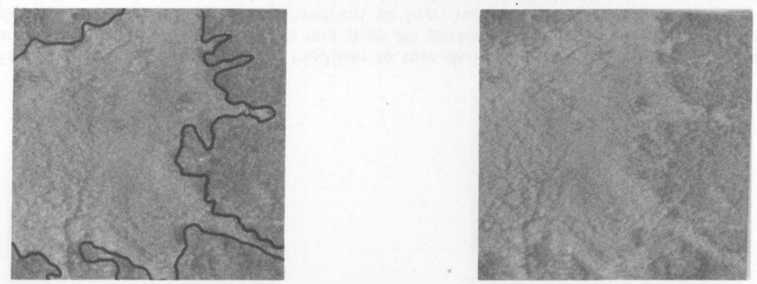


FIGURE 31. Stereogram of a dense stand of hardwoods. The photographs were taken in winter and nearly all of the hardwood leaves have fallen. Although the contrast level is low, the few remaining leaves cause the hardwood crowns to be distinctly lighter in tone than the pine crowns.

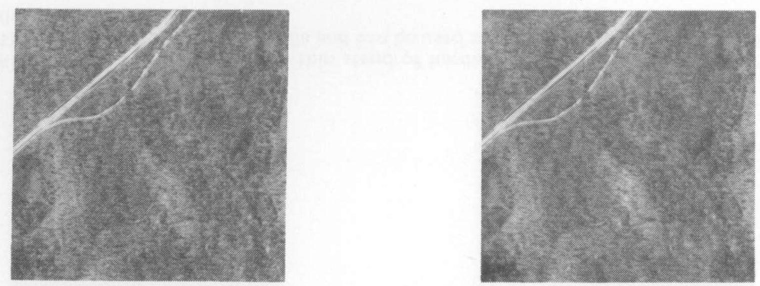


FIGURE 32. Stereogram of a dense stand of hardwoods. The photographs were taken in the winter when few of the hardwood crowns still bore leaves. Density of the stand must be judged from the shadows.

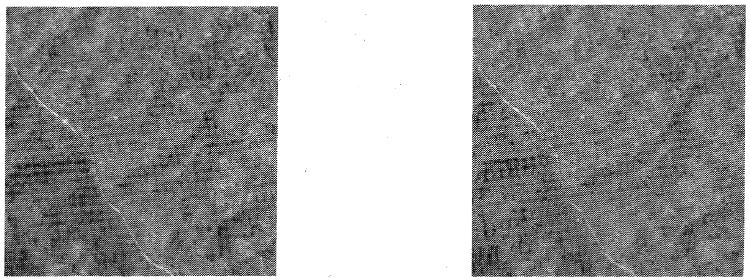


FIGURE 33. Stereogram of a patchy stand of hardwoods ranging from medium to high density. Though the photographs were taken in winter many of the hardwoods still bear leaves. Density of the stand must be judged jointly from the crowns and shadows.

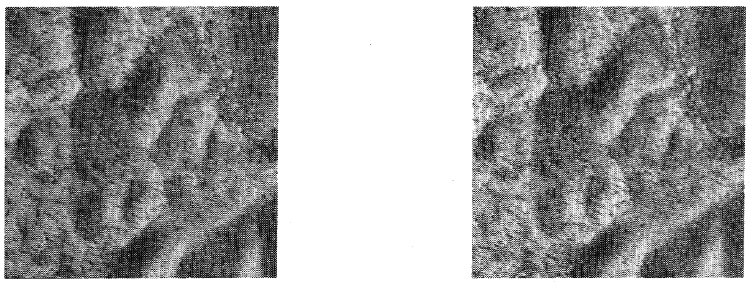


FIGURE 34. Stereogram of a medium dense hardwood stand. The density must be judged primarily from shadows.

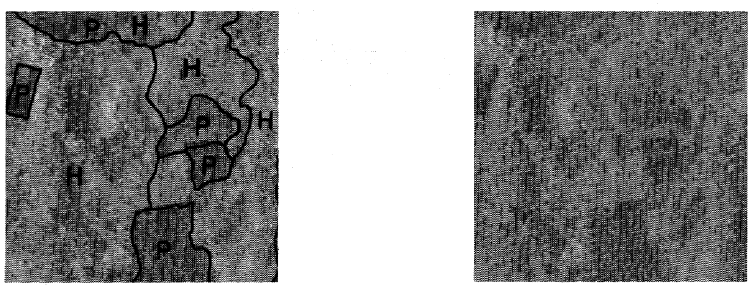


FIGURE 35. Stereogram showing a variety of hardwood and pine stands. The photographs were taken in the winter, but many of the hardwoods still retain their leaves. Stand density must be judged from tones of crowns and shadow patterns.

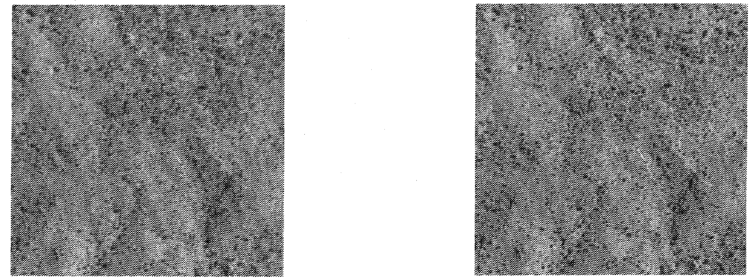


FIGURE 36. Stereogram of a thin stand of hardwoods in the fall color season. The hardwood crowns are visible and can be used to determine relative density of the hardwood component.

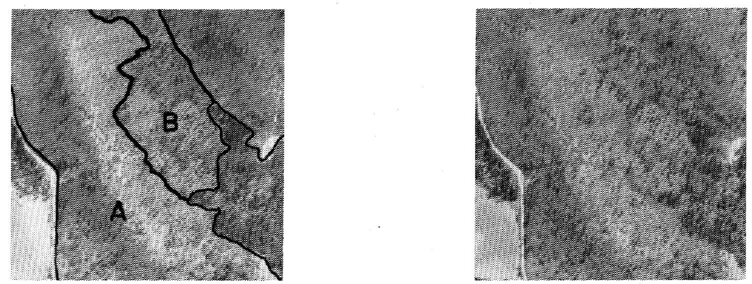


FIGURE 37. Stereogram of a medium to low density hardwood stand (A). The pine component of this stand is less than 30 percent of the stand basal area. In stand B, the density remains medium to low, but the pine component is sufficiently large for the stand to be classed as pine-hardwood. Relative density of the hardwood component can be determined from the shadow pattern.

Plantations

Pine plantations are found in many places in the Mountain Forest Habitat Region. Though most are composed of loblolly pine, several species have been planted. Trees are often planted on sites where they would be unlikely to occur naturally. For this reason, the key does not distinguish between species of planted pines because it is based on natural occurrence patterns. When these are violated the key is invalidated.

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 39). As the plantations grow older, they maintain uniformity of density and tree, but the rows become less and less distinct (Figures 40 and 41). Nevertheless, a plantation is seldom hard to identify.

FIGURE 38. Stereogram of a portion of the Cheaha Mountain area in Clay County showing dense stands of Virginia pine (A). The texture of these stands is sufficiently distinctive that it is of diagnostic value. (GV-1JJ-162, 163)

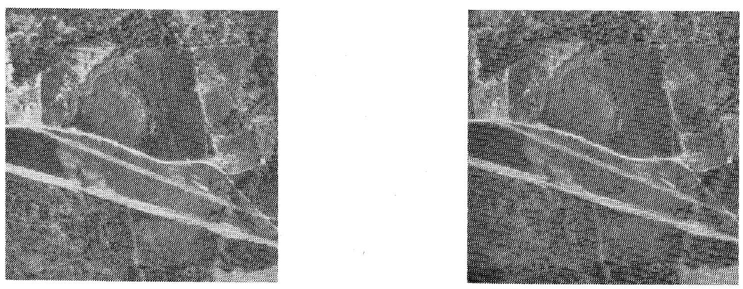


FIGURE 39. Stereogram showing several young pine plantation. The rows of trees are readily visible.

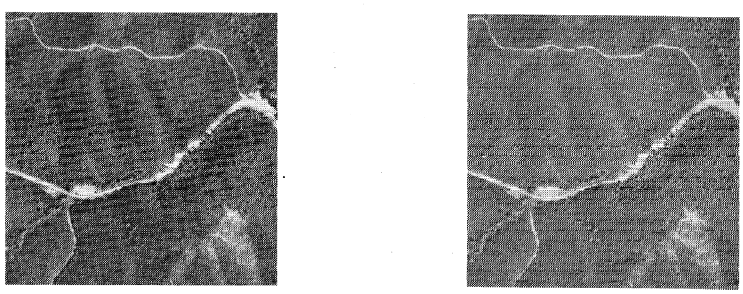


FIGURE 40. Stereogram of an extensive pine plantation that is older than the plantations shown in Figure 35. Rows can be detected but they are not obvious. The extreme uniformity of the stand indicates its non-natural origin.

FIGURE 41. Stereogram of a pine plantation that is older than the one in Figure 36. The rows become less evident as the plantation grows older.

TESTING THE KEY

Objectives of the Testing Program

The primary objective of any test of a key should be to determine its validity. In other words, the test should indicate how well the key would perform if no errors were made in any decision based on the key.

A secondary objective of the testing program should be to determine whether or not the key is easy to use and, if not, where the decision points that present difficulty occur.

Test Program Rationale

The basic validity of an aerial photographic forest cover key can be evaluated only by sampling a portion of the forest stands in the region under study. Each of these stands would have to be visited to determine its species composition and to evaluate or measure on the ground the parameters used at the several decision points in the key. The parameter information then would be used to follow decision paths through the key. The key provides, at the end of each decision path, an estimate of the species composition as determined in the field. Since there are many paths which might be used in a key and all should be evaluated for validity, the sample must include stands that are geographically widely dispersed, that represent a wide variety of species groupings, and a wide spectrum of topographic sites. In order to keep the cost of the testing program within reasonable limits, the stands in the sample must be reasonably accessible, both physically and legally. Because of these constraints, it would be difficult to use probability sampling or any formal statistical design in the testing program. However, if the sampling is too selective, it will fail to represent the intended population. To avoid bias, the sample must be selected in advance of the field work. This probably can best be accomplished by means of index mosaics and aerial photographs. The mosaics would be used to lay out logical routes of travel while the photographs would be used to locate the sample stands.

The results of a testing program such as this would indicate error rates by conditions or by groupings of conditions. 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. Nevertheless, the estimates should be of value because they indicate approximately where the basic strengths and weaknesses of the key occur. It was intended that the key for the Mountain Forest Habitat Region would be subjected to a test based on this reasoning. However, as is reported in the following section, circumstances were such that it was felt that it would not be feasible.

In order to obtain information regarding the ease of using the key it would be necessary to assemble a representative sample of the persons apt to utilize a key of this type and then have the members of this sample use the key to evaluate a series of stands. The actual compositions of these stands would have to be determined in the field. Error rates, by decision paths, resulting from this test could be used as a measure of the ease of using the key.

As in the case of the validity test, the sample set of stands should include as many different cover types as possible and should occupy as many different site types as possible. If this is done the probability would be high that most, if not all, the decision paths would be explored and that most, if not all, the points of ambiguity would be found by the testers.

A sampling design that would yield these error rates could be developed. Implementing the design, however, would not be simple. The persons making up the testing team would have to be drawn from the population of potential key users, but the team could not include anyone who had been involved in developing the key. The bulk of the team would have to consist of persons not employed by the developing organization (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. Understandably, the time that these organizations are willing to allot to this type of activity is quite limited. Since the amount of time needed to test a key adequately is relatively great, particularly if the testers are to be made 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.

It must be realized that 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 to offer suggestions for possible revisions. No numerical records were kept of these attempts. However, comments generated by this process received attention and the key was modified in response to these comments. This process has undoubtedly made the key easier to use than it otherwise might be.

Test Results

As was mentioned earlier, the plan for the development of the key included provisions for a testing process to determine its validity. To this end approximately half of the prism point data obtained in this field were reserved for the test. It was intended that these data would not be used in the development of the key and consequently would provide the basis for an independent evaluation of the key. The decision to reserve a portion of the original data for the test rather than to acquire new data after the key was complete was made because of inaccessiblity of much of the area and the difficulty of the terrain would make the acquisition of a separate set of data a slow and costly process.

As the key development proceeded it became evident that the situation was far more complex than had been anticipated. Additional field data were obtained, partially in the form of prism point information and partially in the form of nonquantitative observations. Even with these data the key could not be completed and finally the data reserved for the test had to be used in the key development. This step was taken with reluctance because it was realized that it would not be feasible to obtain a new set of test data. The cost would be excessive. As a result, the following discussion does not involve an independent test of the key but rather shows error rates based on the development data. This is not as satisfactory as an independent test would be but it does provide some information regarding the validity of the key.

Table 4 summarizes the validity test when all 721 prism points were evaluated. The results appear very good. The high rate of correct evaluations in the case of the hardwoods is not surprising when one realizes that the cover types are described in such a manner as to permit considerable variability. However, the reverse is true with the pines and yet the error rate remains low. The key apparently is constructed in such a manner as to recognize occurrence patterns with considerable reliability.

The evidence available at this point indicates that the key is fundamentally valid. However, this does not mean that everyone using the key would obtain similar results. The key must be used properly or the results will be unsatisfactory. In the description of the key for the Piedmont Forest Habitat Region (Johnson and Sellmann, 1974) was a statement regarding the attributes of an ideal user of the key. Perhaps it would be well 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, the results of his use of the key should be satisfactory.

Table 4. Results of the tests made to evaluate the validity of the key.

Zone	Site	Pine Would[5] Correct	Pine Would[5] Qualify	Pine Would[5] Wrong	Pine-Hardwoods Would[5] Correct	Pine-Hardwoods Would[5] Qualify	Pine-Hardwoods Would[5] Wrong	Hardwoods Would[5] Correct	Hardwoods Would[5] Qualify	Hardwoods Would[5] Wrong
I	Crest	8	1	1	3	0	1	5	2	0
	Upper slope	6	0	2	9	0	0	13	1	0
	Mid slope				9	0	0	9	0	0
	Saddle				1	0	0	2	0	0
	Lower slope	3	0	0	2	0	1	11	5	0
	Headwaters									
	Cove									
	Branch	0	1	0	1	0	0	11	1	1
	Major stream									
II	Crest	12	3	0	12	4	0	1	1	0
	Upper slope	2	0	0	8	1	0	3	1	0
	Mid slope	13	1	0	1	0	0			
	Saddle									
	Lower slope	5	0	0	7	2	0	1	0	0
	Headwaters									
	Cove									
	Branch									
	Major stream							3	0	0
III	Crest	8	1	1	5	2	0	2	0	0
	Upper slope	5	1	0	3	3	0	6	1	0
	Mid slope	10	0	1	3	1	0	5	0	0
	Saddle							1	0	0
	Lower slope	5	0	1	2	0	0	7	3	1
	Headwaters									
	Cove							2	0	0
	Branch	2	1	0	1	1	0	7	3	0
	Major stream	4	0	0	1	0	0	4	0	0
IV	Crest	8	3	0	7	2	0	0	2	0
	Upper slope				2	1	1	1	3	0
	Mid slope	5	0	0	2	0	0	5	2	0
	Saddle									
	Lower slope	3	0	0	2	0	0	0	0	1
	Headwaters									
	Cove							2	0	0
	Branch							4	0	0
	Major stream							2	0	0
V	Crest	4	0	0	1	0	0	3	0	0
	Upper slope	1	0	1	3	1	0	12	0	0
	Mid slope	7	0	0	10	1	0	16	1	0

[5]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 cover type description recognizes that possibility.

Table 4 continued.

Zone	Site	Correct	Qualify	Wrong	Correct	Qualify	Wrong	Correct	Qualify	Wrong
	Saddle									
	Lower slope				4	0	1	6	3	0
	Headwaters							1	0	0
	Cove									
	Branch				0	0	1	4	0	0
	Major stream									
VI	Crest	3	0	0				1	1	0
	Upper slope	3	0	0	4	2	0	10	1	0
	Mid slope	2	0	0	4	2	0	2	0	0
	Saddle									
	Lower slopes	1	0	0	1	0	0	3	0	0
	Headwaters									
	Cove							1	0	0
	Branch							3	0	0
	Major stream				1	0	0	2	0	0
VII	Crest	1	0	0	4	0	0	1	1	0
	Upper slope	5	0	0	4	1	0			
	Mid slope	4	2	2	1	2	2			
	Saddle									
	Lower slope									
	Headwaters									
	Cove									
	Branch							1	0	1
	Major stream									
VIII	Crest	30	1	0	10	1	0			
	Upper slope	7	0	0	1	0	0	9	4	0
	Mid slope	4	1	0	2	3	0	5	2	0
	Saddle									
	Lower slope	6	0	0	6	0	0	4	2	0
	Headwaters									
	Cove									
	Branch	3	0	0	5	0	0	10	1	0
	Major stream	2	0	0	1	0	0	2	0	0
IX	Crest	24	0	0	8	0	0			
	Upper slope	3	0	0	3	0	0	0	0	1
	Mid slope	12	0	0	5	0	0	3	1	0
	Saddle									
	Lower slope	3	0	0	2	0	0	4	0	0
	Headwaters									
	Cove									
	Branch							8	1	0
	Major stream							7	1	0
		224	16	9	161	30	7	225	44	5

LITERATURE CITED

ADAMS, G.I.; BUTTS, C.; STEPHENSON, L. W.; AND COOKE, W. 1926. *Geology of Alabama.* Ala. Geol. Survey. 312 pp.

ANONYMOUS. 1964. *Forest Cover Types of North America.* Soc. Amer. Foresters, Washington, D.C. 67 pp.

AVERY, T. E. 1966. *Forester's Guide to Aerial Photo-interpretation.* USDA - Forest Service. Agr. Handbook 308. 40 pp.

AVERY, T. E. 1968. *Interpretation of Aerial Photographs.* 2nd Ed. Burgess Pub. Co., Minneapolis, Minn. 324 pp.

CLARK, R. C. 1972. *The Woody Plants of Alabama.* Missouri Botanical Garden Press, St. Louis, Mo. 242 pp.

HARLOW, W. M. AND HARRAR, E. S. 1968. *Textbook of Dendrology.* 5th Ed. McGraw-Hill Book Co., Inc., New York. 512 pp.

HODGKINS, E. J. (ed). 1965. *Southeastern Forest Habitat Regions Based on Physiography.* Auburn Univ. Agr. Exp. Sta. Forestry Dept. Series No. 2. 10 pp.

JOHNSON, E. W. AND SELLMAN, L. R. 1974. *Forest Cover Photo-Interpretation Key for the Piedmont Forest Habitat Region in Alabama.* Auburn Univ. Agr. Exp. Sta. Forestry Dept. Series No. 6. 56 pp.

JOHNSTON, W. D., JR. 1930. *Physical Divisions of Northern Alabama.* Ala. Geol. Survey Bull. 38. 48 pp.

MOESSNER, K. E. 1960. *Training Handbook, Basic Technique in Forest Photo-Interpretation.* USDA - Forest Service. Intermountain For. and Range Exp. Sta. 73 pp. offset.

NORTHROP, K. G. AND JOHNSON, E. W. 1970. *Forest* type identification. *Photogrammetric Engineering.* 36:483-490.

PARKER, R. C. AND JOHNSON, E. W. 1969. *Identification of Forest Condition Classes on Near Vertical Aerial Photographs Taken with a K-20 Camera.* Auburn Univ. Agr. Exp. Sta. Forestry Dept. Series No. 3. 8 pp.

SPURR, S. H. 1960. *Photogrammetry and Photo-Interpretation.* Second Ed. Ronald Press, New York. 472 pp.

WILSON, R. C. *et. al.* 1960. *Photo-Interpretation in Forestry. Chap. 7 in Manual of Photo-Interpretation.* pp. 457-520. Amer. Soc. Photogram., Washington, D.C.

APPENDIX I

Forest Cover Photo-Interpretation Key for the Mountain 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 39, 40, and 41). . . . . .Pine plantation[2]
1. Stand not as above. 2
   2. Stand is on upland site (Figure 11) 3
   2. Stand is on a streambottom site 38
3. Stand is Zone I (figures 10, 51, 52, and 55) 4
3. Stand is not in Zone I. 7
   4. 70 percent or more of the overstory tree crowns are dark grey (figures 22, 23, and 24) . . . 5
   4. Tree crowns are not as above. 6
5. Stand dense with a texture similar to that in figures 13C and 38, regardless of position on slope . .P(1)
5. Stand texture is not as above 39A
   6. 30 to 70 percent of the overstory tree crowns are dark grey (figures 25 through 30 and 37B) 39B
   6. Less than 30 percent of the overstory tree crowns are dark grey (figures 31 through 36 and 37) 39C
7. Stand is in Zone II (figures 10, 51, and 55). 8
7. Stand is not in Zone II 13
   8. 70 percent or more of the overstory tree crowns are dark grey (figures 22, 23, and 24) . . . 9
   8. Tree crowns are not as above 10
9. Stand dense with a texture similar to that in figures 13C and 38, regardless of position on slope . .P(1)
9. Stand texture is not as above . . . . Figure 40A
   10. 30 to 70 percent of the overstory tree crowns are dark grey (figures 25 through 30 and 37B) . . . . Figure 40B
   10. Less than 30 percent of the overstory tree crowns are dark grey (figures 31 through 36 and 37A) . . . . Figure 40C
11. Stand in Zone III (figures 10, 51, and 55) 12
11. Stand is not in Zone III 15
    12. 70 percent or more of the overstory tree crowns are dark grey (figures 22, 23 and 24). . . 13
    12. Tree crowns are not as above 14
13. Stand dense with a texture similar to that in figures 13C and 38, regardless of position on slope . .P(1)
13. Stand texture in not as above. . . . . Figure 41A
    14. 30 to 70 percent of the overstory tree crowns are dark grey (figures 25 through 30 and 37B) . . . . Figure 41B
    14. Less than 30 percent of the overstory tree crowns are dark grey (figures 31 through 36 and 37A) . . . . Figure 41C
15. Stand is in Zone IV (figures 10, 51, and 55) 16
15. Stand is not in Zone IV 19
    16. 70 percent or more of the overstory tree crowns are dark grey (figures 23, 23, and 24) 17
    16. Tree crowns are not as above 18
17. Stand dense with a texture similiar to that in figures 13C and 38, regardless of position on slope . . . . .P(1)
17. Stand texture is not as above . . . . Figure 42A
    18. 30 to 70 percent of the overstory tree crowns are dark grey (figures 25 through 30 and 37B) . . . . Figure 42B

[1]References to photographic tone are applicable to photographs taken using panchromatic film and a deep yellow (e.g., Wratten No. 12) filter. However, they may also be generally applicable in the case of photographs taken with black and white infrared film exposed through a deep yellow (e.g., Wratten No. 12) or deep red (e.g., Wratten No. 89B) filter.

18. Less than 30 percent of the overstory tree crowns are dark grey (figures 31 through 36 and 37A) . . . . Figure 42C
19. Stand is in Zone V (figures 10, 51, 52, and 58) 20
19. Stand is not in Zone V 23
20. 70 percent or more of the overstory tree crowns are dark grey (figures 22, 23, and 24) 21
20. Tree crowns are not as above 22
21. Stand dense with a texture similar to that in figures 13C and 38, regardless of position on slope . . . . P(1)
21. Stand texture is not as above . . . . Figure 43A
22. 30 to 70 percent of the overstory tree crowns are dark grey (figures 25 through 30 and 37B) . . . . Figure 43B
22. Less than 30 percent of the overstory trees crown are dark grey (figures 31 through 36 and 37A) . . . . Figure 43C
23. Stand is in Zone VI (figures 10, 51, 54, 55, 56, and 58) 24
23. Stand is not in Zone VI 27
24. 70 percent or more of the overstory tree crowns are dark grey (figures 22, 23, and 24) . . 25
24. Tree crowns are not as above 26
25. Stand dense with a texture similar to that in figures 13C and 38, regardless of position on slope . . . . P(1)
25. Stand texture is not as above . . . . Figure 44A
26. 30 to 70 percent of the overstory tree crowns are dark grey (figures 25 through 30 and 37B) . . . . Figure 44B
26. Less than 30 percent of the overstory tree crowns are dark grey (figures 31 through 36 and 37A) . . . . Figure 44C
27. Stand is in Zone VII (figures 10, 54, and 55) 28
27. Stand is not in Zone VII 31
28. 70 percent or more of the overstory tree crowns are dark grey (figures 22, 23, and 24) . . 29
28. Tree crowns are not as above 30
29. Stand dense with a texture similar to that in figures 13C and 38, regardless of position on slope . . . . P(1)
29. Stand texture is not as above . . . . Figure 45A
30. 30 to 70 percent of the overstory tree crowns are dark grey (figures 25 through 30 and 37B) . . . . Figure 45B
30. Less than 30 percent of the overstory trees are dark grey (figures 31 through 36 and 37A) . . . . Figure 45C
31. Stand is in Zone VIII (figures 10, 51, 54, 55, and 58) 32
31. Stand is in Zone IX (figures 10, 53, 56, and 57) . . . 35
32. 70 percent or more of the overstory tree crowns are dark grey (figures 22, 23, and 24) 33
32. Tree crowns are not as above 34
33. Stand dense with a texture similar to that in figures 13C and 38, regardless of position on slope . . . . P(1)
33. Stand texture is not as above . . . . Figure 46A
34. 30 to 70 percent of overstory tree crowns are dark grey (figures 25 through 30 and 37B) . . . . Figure 46B
34. Less than 30 percent of overstory tree crowns are dark grey (figures 31 through 36 and 37A) . . . . Figure 46C
35. 70 percent or more of the overstory three crowns are dark grey (figures 22, 23, and 24) 36
35. Tree crowns are not as above 37
36. Stand dense with a texture similar to that in figures 13C and 38, regardless of position on slope . . . . P(1)
36. Stand texture is not as above . . . . Figure 47A
37. 30 to 70 percent of overstory tree crowns are dark grey (figures 25 through 30 and 37B) . . . . Figure 47B
37. Less than 30 percent of overstory tree crowns are dark grey (figures 31 through 36 and 37A) . . . . Figure 47C
38. Stream at or immediately below headwaters area (figures 13A and 14) 39
38. Stream second order or larger, below headwaters area (figures 13B and 15) 59
39. Headwaters area or area just below the headwaters area is cup-shaped or a deep ravine (cove) (Figure 14) 40
39. Headwaters area is not as above. Streams are intermittant and poorly defined. Stands along stream courses are very narrow and difficult to distinguish from surrounding stands 42
40. 70 percent or more of the overstory tree crowns are dark grey (figures 22, 23, and 24). *This condition rarely occurs* . . . . P(8)
40. Tree crowns are not as above 49
41. 30 to 70 percent of the overstory tree crowns are dark grey (figures 25 through 30 and 37B) . . . . .PH(8)
41. Less than 30 percent of the overstory tree crowns are dark grey (figures 31 through 36 and 37A) . . H(4)
42. 70 percent or more of the overstory tree crowns are dark grey (figures 22, 23, and 24) . . 43
42. Tree crowns are not as above 50
43. Stand is in Zone I (figures 10, 51, 52, and 55) . . . .P(5)
43. Stand is not in Zone I 44
44. Stand is in Zone II (figures 10, 51, and 55) . . .P(5)
44. Stand is not in Zone II 45
45. Stand is in Zones III or IV (figures 10, 51, and 55) . . . . P(6)
45. Stand is not in Zones III or IV 46
46. Stand is in Zone V (figures 10, 51, 52, and 58) . . . . P(4)
46. Stand is not in Zone V 47
47. Stand is in Zone VI (figures 10, 51, 54, 55, 56, and 58) . . . . P(3)
47. Stand is not in Zone VI 48
48. Stand is in Zone VII (figures 10, 54, and 55) .P(5)
48. Stand is not in Zone VII 49
49. Stand is in Zone VIII (figures 10, 51, 54, 55, and 58) . . . . P(2)
49. Stand is in Zone IX (figures 10, 53, 56, and 57) .P(13)
50. 30 to 70 percent of the overstory tree crowns are dark grey (figures 25 through 30 and 37B) . 51
50. Less than 30 percent of the overstory tree crowns are dark grey (figures 31 through 36 and 37A) 58
51. Stand is in Zone I (figures 10, 51, 52, and 55) . . PH(5)
51. Stand is not in Zone I 52
52. Stand is in Zone II (figures 10, 51, and 55) . . . . PH(5)
52. Stand is not in Zone II 53
53. Stand is in Zones III or IV (figures 10, 51, and

55) . . . . .PH(6)
53. Stand is not in Zones III or IV 54
54. Stand is in Zone V (figures 10, 51, 52, and 58) . . . . .PH(4)
54. Stand is not in Zone V 55
55. Stand is in Zone VI (figures 10, 51, 54, 55, 56 and 58) . . . . .PH(5)
55. Stand is not in Zone VI 56
56. Stand is in Zone VII (figures 10, 54 and 55) . . . . .PH(5)
56. Stand is not in Zone VII. 57
57. Stand is in Zone VIII (figures 10, 51, 54, 55, and 58) . . . . .PH(2)
57. Stand is in Zone IX (figures 10, 53, 56, and 57) . . . . .PH(13)
58. Stand is in Zones I or V (figures 10, 51, 52, 55, and 58) . . . . H(1)
58. Stand is not in Zones I or V. . . . . H(2)
59. Stand may or may not have an overstory. If an overstory is present this refers only to the understory. Stand is dense and is made up of shrubs rarely exceeding 20 feet in height. The photographic tone is light grey. Such stands are usually found only along slow moving streams on relatively flat valley floors at the foot of main ridges . . . H(8)
59. The stand and site conditions are not as above 60
60. Stand is in Zone IX (figures 10, 53, 56, and 57) 61
60. Stand is not in Zone IX 66
61. Floodplain width is less than 50 feet (less than 0.03 inches on photographs with a scale of 1:20,000) 62
61. Floodplain in width is 50 feet or more (0.03 inches or more on photographs with a scale of 1:20,000) 64
62. 70 percent or more of the overstory tree crowns are dark grey (figures 22, 23 and 24) . . . . .P(10)
62. Tree crowns are not as above 63
63. 30 to 70 percent of the overstory tree crowns are dark grey (figures 25 through 30, and 37B) . . .PH(10)
63. Less than 30 percent of the overstory tree crowns are dark grey (figures 31 through 36, and 37A) . . H(6)
64. 70 percent or more of the overstory tree crowns are dark grey (figures 22, 23, and 24) . . . . P(11)
64. Tree crowns are not as above 65
65. 30 to 70 percent of the overstory tree crowns are dark grey (figures 25 through 30, and 37B) . . .PH(11)
65. Less than 30 percent of the overstory tree crowns are dark grey (figures 31 through 36, and 37A) . . H(6)
66. Stream proper is less than 25 feet in width (or less than 0.015 inches on photographs with a scale of 1:20,000) (figures 13B and 15) 67
66. Stream proper is 25 feet or more in width (or 0.015 inches or greater on photographs with a scale of 1:20,000) (figures 13B and 15) 69
67. 70 percent or more of the overstory tree crowns are dark grey (figures 22, 23, and 24) . . . . .P(9)
67. Tree crowns are not as above 68
68. 30 to 70 percent of the overstory tree crowns are dark grey (figures 25 through 30, and 37B) . . . . .PH(9)
68. Less than 30 percent of the overstory tree crowns are dark grey (figures 31 through 36, and 37A) . . . . H(5)
69. 70 percent or more of the overstory tree crowns are dark grey (figures 22, 23, and 24) 70
69. Tree crowns are not as above 71
70. Stand is in Zone IV (figures 10, 51, and 55) . . . . P(12)
70. Stand is not in Zone IV . . . . P(11)
71. 30 to 70 percent of the overstory tree crowns are dark grey (figures 25 through 30 and 37B) 72
71. Less than 30 percent of the overstory tree crowns are dark grey (figures 31 through 36 and 37A) 73
72. Stand is in Zone IV (figures 10, 51 and 55) . . . . .PH(12)
72. Stand in not in Zone IV . . . . .PH(11)
73. Stand is in Zone IV (figures 10, 51, and 55) . . . . H(7)
73. Stand is not in Zone IV . . . . H(5)

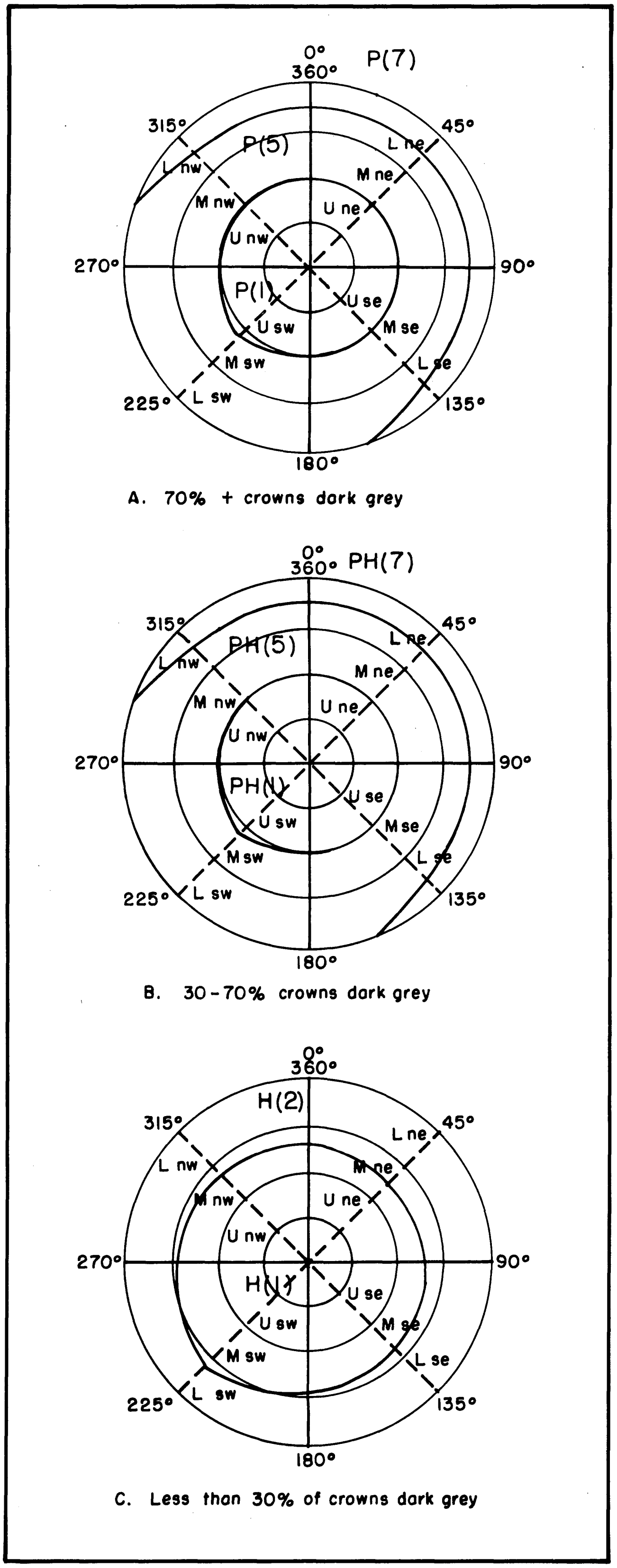


FIGURE 42. Forest cover type distribution, Zone I. If stand occurs on a saddle, use the cover type occurring on mid-slope when the aspect is N45° W.

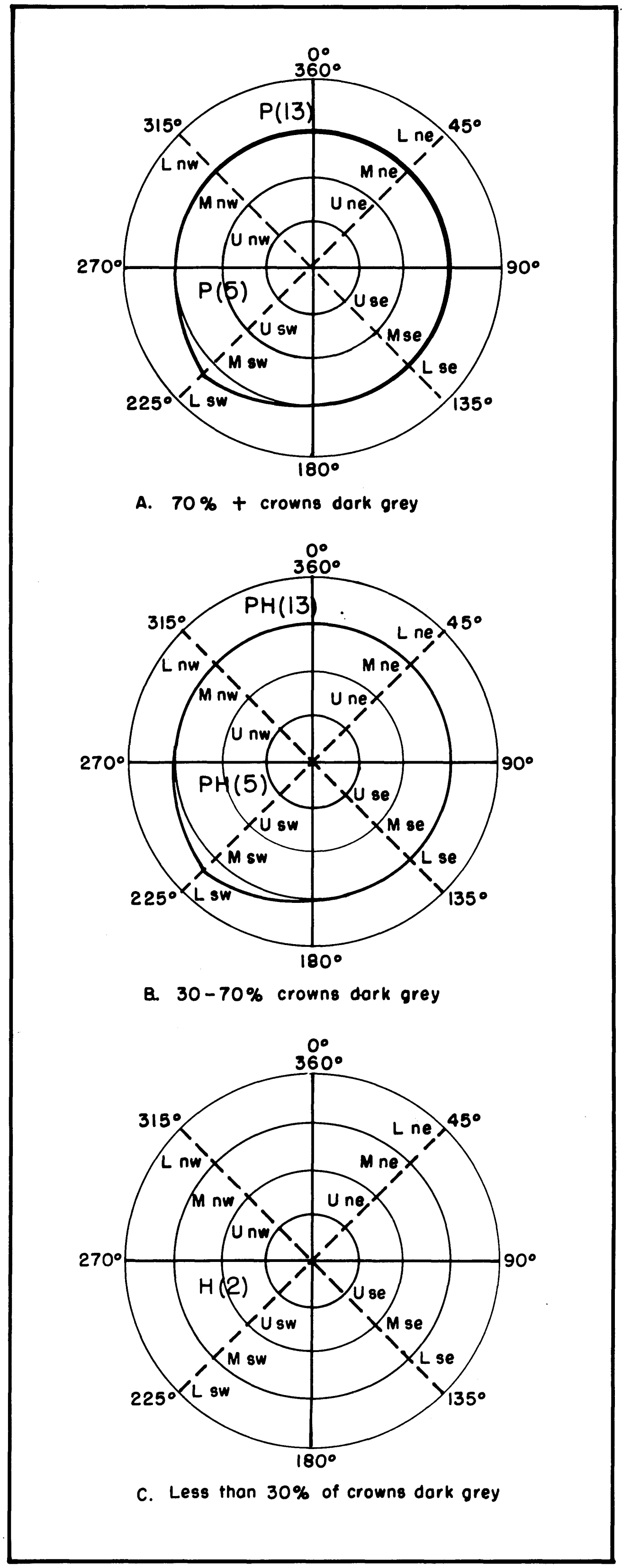


FIGURE 43. Forest cover type distribution, Zone II. If stand occurs on a saddle, use the cover type occurring on mid-slope when the aspect is N45° W.

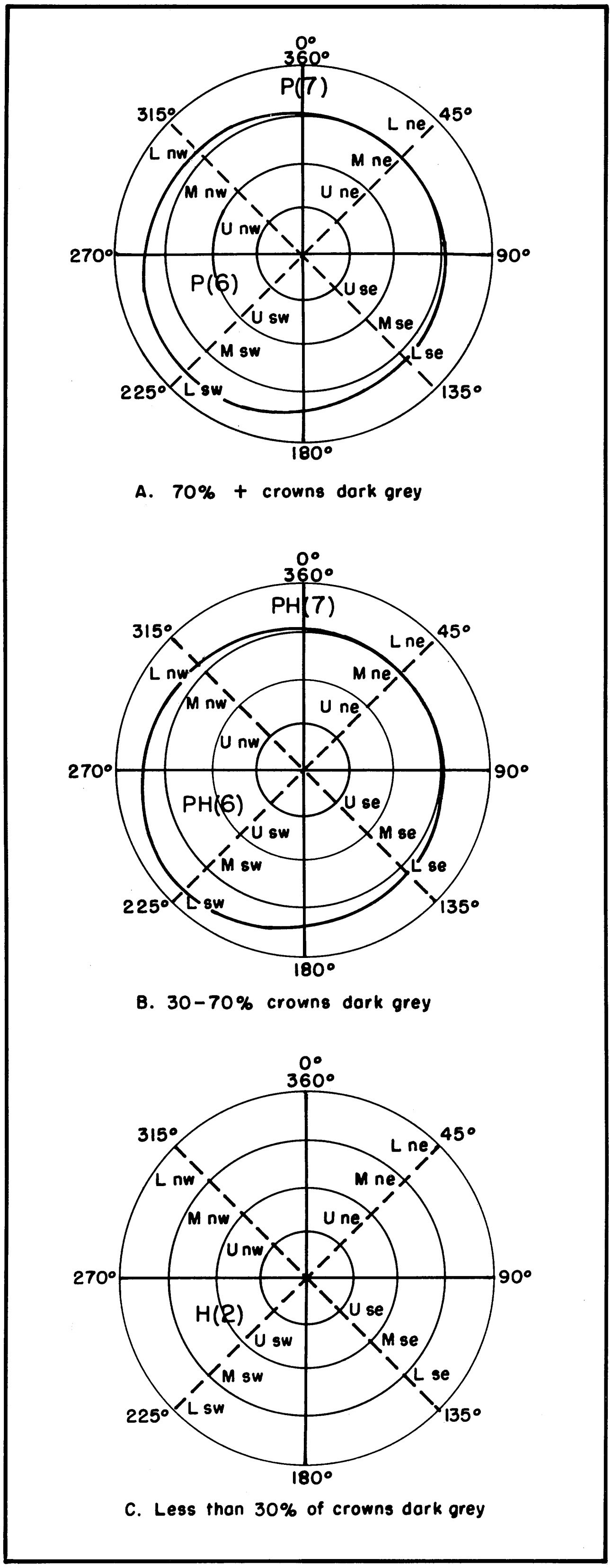


FIGURE 44. Forest cover type distribution, Zone III. If stand occurs on a saddle, use the cover type occurring on mid-slope when the aspect is N45° W.

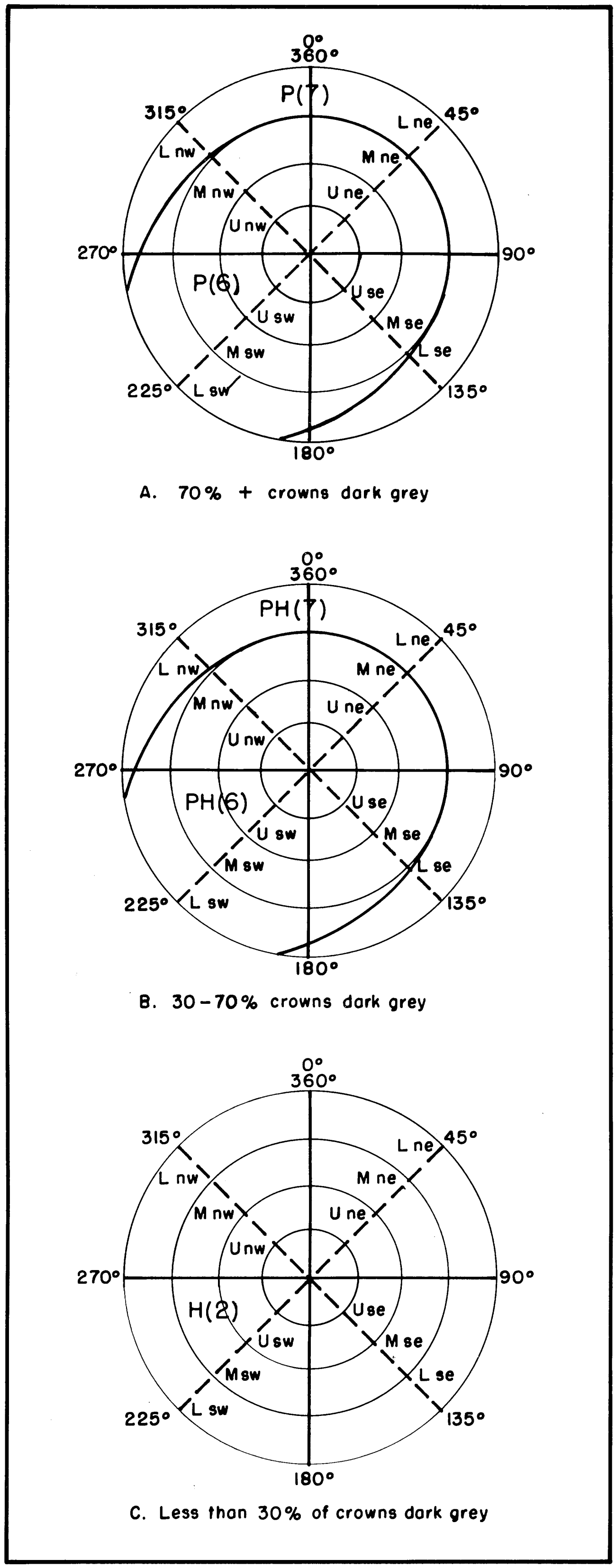
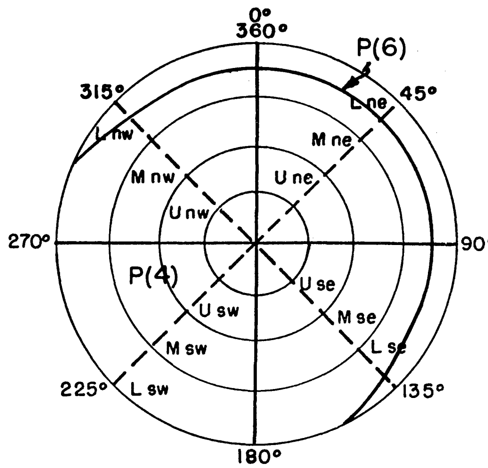
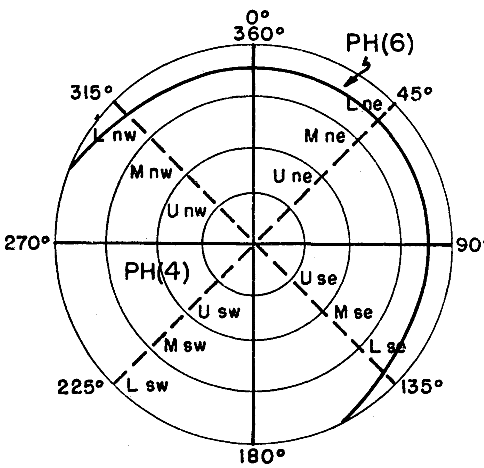


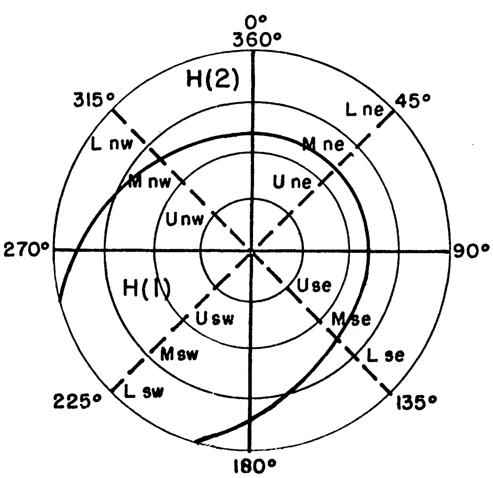
FIGURE 45. Forest cover type distribution, Zone IV. If stand occurs on a saddle, use the cover type occurring on mid-slope when the aspect is N45° W.



A. 70% + crowns dark grey

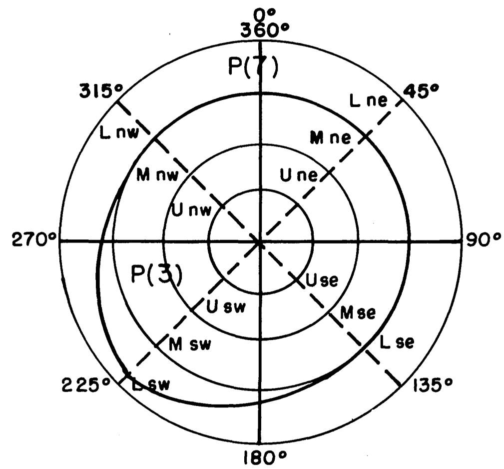


B. 30–70% crowns dark grey

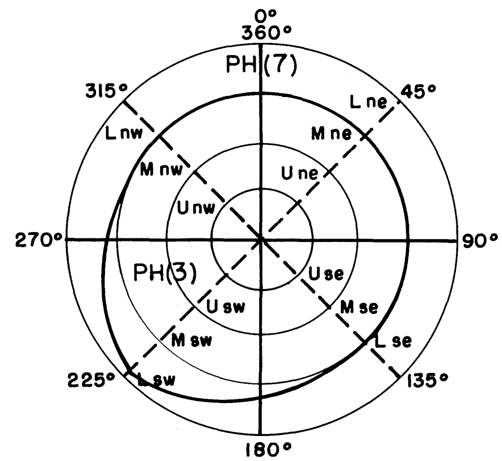


C. Less than 30% of crowns dark grey

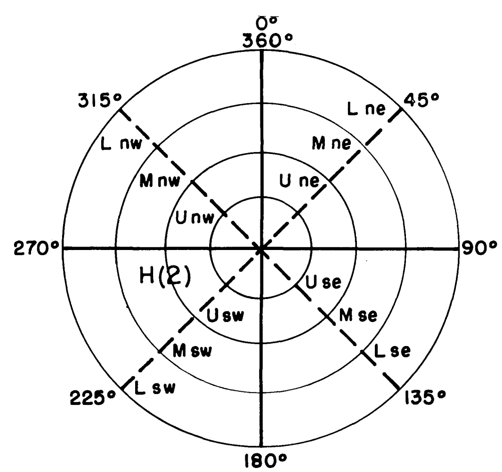
FIGURE 46. Forest cover type distribution, Zone V. If stand occurs on a saddle, use the cover type occurring on mid-slope when the aspect is N45° W.



A. 70% + crowns dark grey

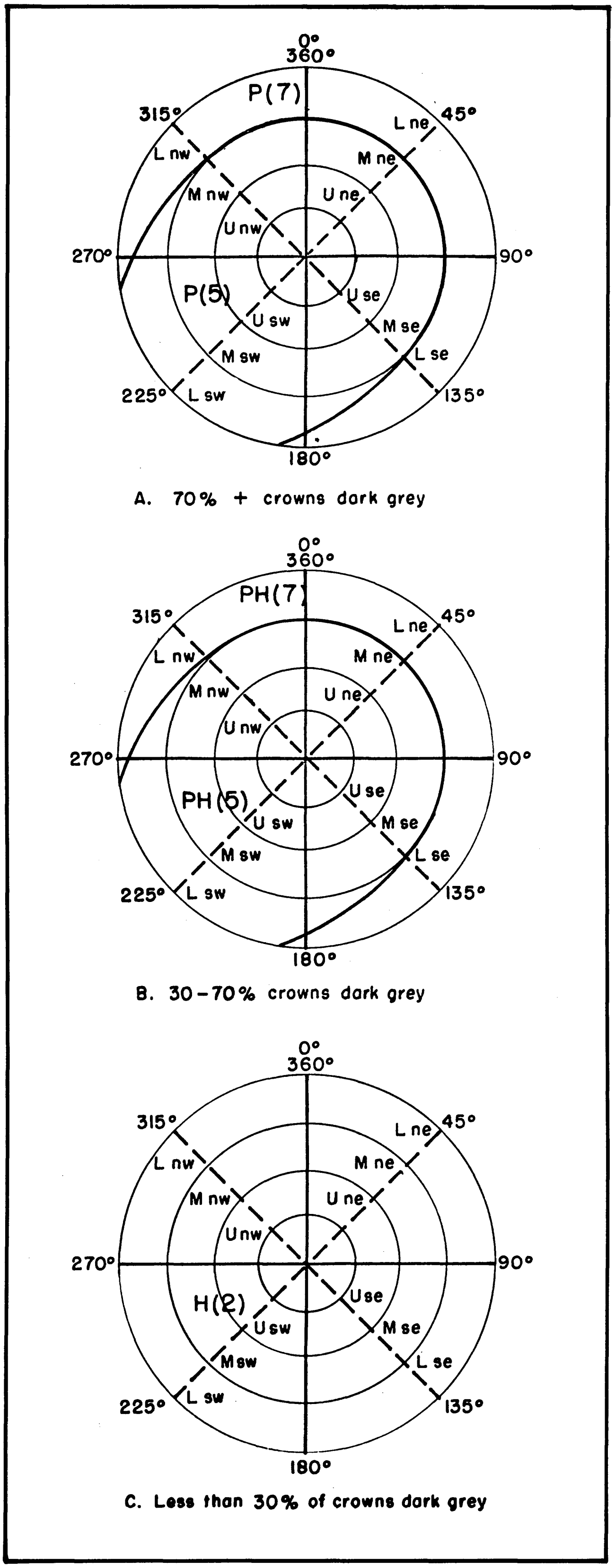


B. 30–70% crowns dark grey



C. Less than 30% of crowns dark grey

FIGURE 47. Forest cover type distribution, Zone VI. If stand occurs on a saddle, use the cover type occurring on mid-slope when the aspect is N45° W.

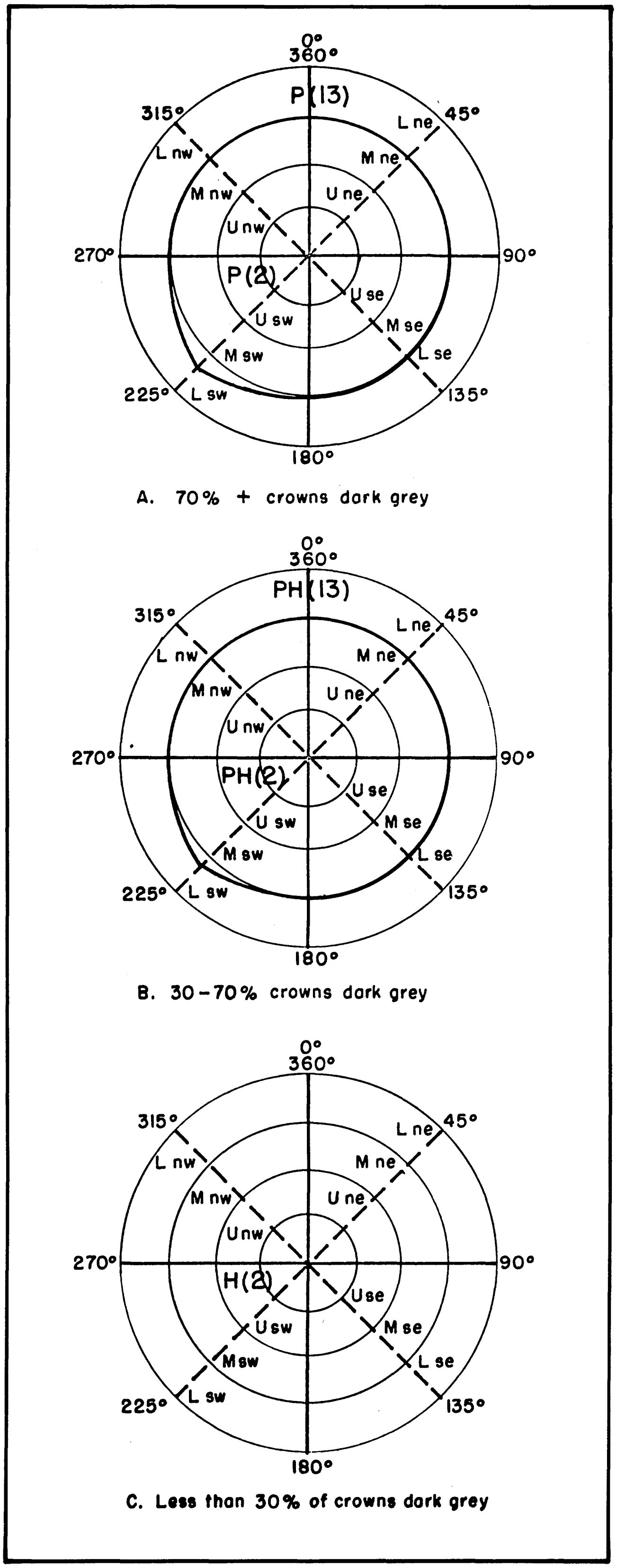


A. 70% + crowns dark grey

B. 30–70% crowns dark grey

C. Less than 30% of crowns dark grey

FIGURE 48. Forest cover type distribution, Zone VII. If stand occurs on a saddle, use the cover type occurring on mid-slope when the aspect is N45° W.

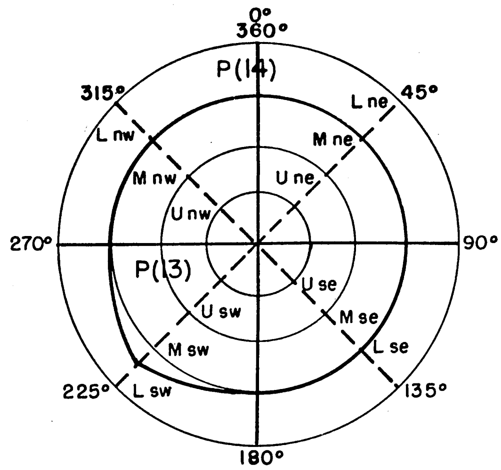


A. 70% + crowns dark grey

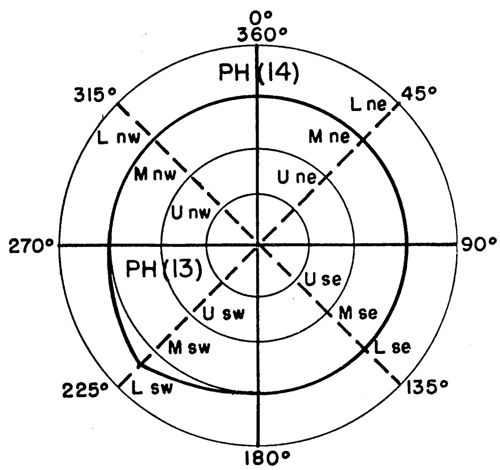
B. 30–70% crowns dark grey

C. Less than 30% of crowns dark grey

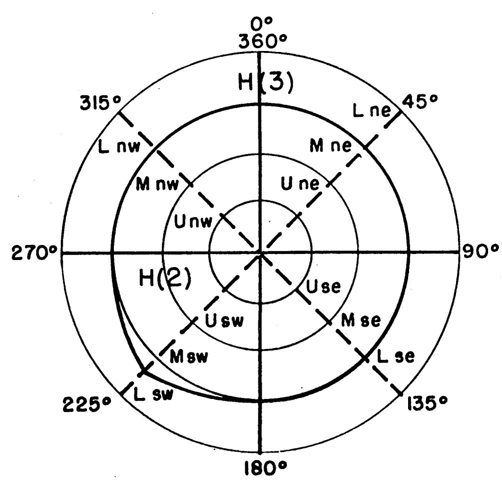
FIGURE 49. Forest cover type distribution, Zone VIII. If stand occurs on a saddle, use the cover type occurring on mid-slope when the aspect is N45° W.



A. 70% + crowns dark grey



B. 30–70% crowns dark grey



C. Less than 30% of crowns dark grey

FIGURE 50. Forest cover type distribution, Zone IX. 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 Mountain Forest Habitat Region

Cover Types Symbol	*Cover Types*	*S.A.F. Equivalents*
P(1)	Virginia Pine	79

Type Description

Pine makes up 70 percent or more of the basal area of the overstory. Virginia pine usually makes up the bulk of the pine component. Longleaf pine and shortleaf pine are common associates. Loblolly pine occurs sporadically. The most common hardwood associate is chestnut oak. Less common hardwood associates include mockernut hickory, blackjack oak, northern red oak, post oak, scarlet oak, southern red oak, and black tupelo.

P(2)	Virginia pine-longleaf pine	

Type Description

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

P(3)	Longleaf Pine	70

Type Description

Pine makes up 70 percent or more of the basal area of the overstory. Longleaf pine usually makes up the bulk of the pine component. Shortleaf pine and Virginia pine are common associates. Loblolly pine occurs sporadically. The most common hardwood associate is blackjack oak. Less common hardwood associates include mockernut hickory, chestnut oak, post oak, scarlet oak, southern red oak, white oak, sweetgum, black cherry, red maple, and black tupelo.

P(4)	Longleaf pine-shortleaf pine Virginia pine	

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. Virginia pine is a common associate. Loblolly pine occurs sporadically. The most common hardwood associates are chestnut oak and post oak. Less common hardwood associates include mockernut hickory, blackjack oak, scarlet oak, southern red oak, black cherry, red maple, and black tupelo.

P(5) Shortleaf pine- 77

Type Description

Pine makes up 70 percent or more of the basal area of the overstory. Shortleaf pine and Virginia pine, in any combination, usually make up the bulk of the pine component. Loblolly pine and longleaf pine are common associates. The most common hardwood associates are blackjack oak and chestnut oak. Less common hardwood associates are mockernut hickory, pignut hickory, black oak, post oak, scarlet oak, southern red oak, white oak, yellow-poplar, sweetgum, black cherry, red maple, and black tupelo.

P(6) Shortleaf pine 75, 80

Type Description

Pine makes up 70 percent or more of the basal area of the overstory. Shortleaf pine usually makes up the bulk of the pine component. Loblolly pine, longleaf pine, and Virginia pine are common associates. Hardwood associates include mockernut hickory, blackjack oak, chestnut oak, northern red oak, post oak, scarlet oak, southern red oak, white oak, sweetgum, black cherry, red maple, and black tupelo.

P(7) 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 and Virginia pine occur sporadically. The most common hardwood associates are northern red oak, southern red oak, white oak, and yellow-poplar. Less common hardwood associates include mockernut hickory, chestnut oak, scarlet oak, sweetgum, black cherry, red maple, black tupelo, and green ash.

P(8) Loblolly pine (cove) 81

Type Description

Pine makes up 70 percent or more of the basal area of the overstory. Loblolly pine is almost always the major pine component. The other pines occur sporadically. The most common hardwood associates are chestnut oak, white oak, yellow-poplar, and sweetgum. Less common hardwood associates include mockernut hickory, pignut hickory, American beech, northern red oak, black cherry, red maple, black tupelo, and green ash.

P(9) Loblolly pine (branch) 81

Type Description

Pine makes up 70 percent or more of the basal area of the overstory. Loblolly pine is almost always the major pine component. Shortleaf pine is a common associate. Longleaf pine and Virginia pine occur sporadically. The most common hardwood associates are white oak, yellow-poplar, sweetgum, and red maple. Less common hardwood associates include mockernut hickory, pignut hickory, American beech, black cherry, black tupelo, and green ash.

P(10) Loblolly pine (branch, Zone IX) 81

Type Description

Pine makes up 70 percent or more of the basal area of the overstory. Loblolly pine is almost always the major pine component. Shortleaf pine and Virginia pine occur sporadically. The most common hardwood associates are shagbark hickory, water oak, white oak, yellow-poplar, and sweetgum. Less common hardwood associates include pignut hickory, river birch, American elm, black cherry, red maple, black tupelo, and green ash.

P(11) Loblolly pine (floodplain) 81

Type Description

Pine makes up 70 percent or more of the basal area of the overstory. Loblolly pine is almost always the major pine component. Shortleaf pine and Virginia pine occur sporadically. The most common hardwood associates are yellow-poplar and sweetgum. Less common hardwood associates include mockernut hickory, pignut hickory, white oak, American sycamore, black cherry, red maple, black tupelo, and green ash.

P(12) Loblolly pine (floodplain-Tallapoosa River) 81

Type Description

Pine makes up 70 percent or more of the basal area of the overstory. Loblolly pine is almost always the major pine component. Shortleaf pine occurs sporadically. The most common hardwood associates are river birch, yellow-poplar, sweetgum, American sycamore, and green ash. Less common hardwood associates include black willow, American beech, water oak, white oak, black cherry, boxelder, red maple, and black tupelo.

P(13) Mixed pines

Type Description

Pine makes up 70 percent or more of the basal area of the overstory. Any of the four pines may dominate the stand but Virginia pine is most common and loblolly pine least common. The most common hardwood associate is blackjack oak. Less common hardwood associates include mockernut hickory, pignut hickory, American beech, chestnut oak, post oak, scarlet oak, southern red oak, white oak, American elm, yellow-poplar, sweetgum, black cherry, red maple, black tupelo, and green ash. This type is used in confused situations, such as transition areas, and consequently is not well defined.

P(14) Mixed pines (Zone IX)

Type Description

Pine makes up 70 percent or more of the basal area of the overstory. Loblolly pine is usually a major component but shortleaf pine and Virginia pine often are dominant. Longleaf pine occurs much less frequently than do the other pines. The most common hardwood associates are southern red oak, water oak, white oak, American elm, yellow-poplar, and sweetgum. Less common hardwood associates include pignut hickory, chestnut oak, scarlet oak, sugarberry, black cherry, red maple, black tupelo, and green ash.

PH(1) Virginia pine-upland hardwoods 78

Type Description

30 to 70 percent of the basal area of the overstory is made up of pine. Virginia pine usually makes up the bulk of the pine component. The most common pine associate is shortleaf pine. Longleaf pine occurs less frequently than shortleaf pine but considerably more often than does loblolly pine. The most common hardwood is chestnut oak. Other common hardwoods are blackjack oak, post oak, scarlet oak, and southern red oak. Less common hardwood associates include mockernut hickory, black oak, northern red oak, black cherry, and black tupelo. In some cases the less common species may become important stand components.

PH(2) Virginia pine-longleaf pine-upland hardwoods

Type Description

30 to 70 percent of the basal area of the overstory is made up of pine. Virginia pine and longleaf pine, in any combination, usually make up the bulk of the pine component. Shortleaf pine is a common associate. Loblolly pine occurs sporadically. The most common hardwoods are blackjack oak and chestnut oak. Other common hardwoods are mockernut hickory, post oak, scarlet oak, and southern red oak. Less common hardwood associates include pignut hickory, black oak, northern red oak, white oak, yellow-poplar, sweetgum, black cherry, red maple, and black tupelo. In some cases the less common species may become important stand components.

PH(3) Longleaf pine-upland hardwoods

Type Description

30 to 70 percent of the basal area of the overstory is made up of pine. Longleaf pine usually makes up the bulk of the pine component. Shortleaf pine and Virginia pine are common associates. Loblolly pine occurs sporadically. The most common hardwoods are mockernut hickory and blackjack oak. Other common hardwoods are pignut hickory, chestnut oak, post oak, scarlet oak, southern red oak, and black tupelo. Less common hardwood associates include white oak, yellow-poplar, sweetgum, black cherry, and red maple. In some cases the less common species may become important stand components.

PH(4) 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. Virginia pine is a common associate. Loblolly pine occurs sporadically. The most common hardwoods are mockernut hickory, blackjack oak, and chestnut oak. Other common hardwoods are black oak, post oak, scarlet oak, and southern red oak. Less common hardwood associates include northern red oak, white oak, black cherry, red maple, and black tupelo. In some cases the less common species may become important stand components.

PH(5) Shortleaf pine-Virginia pine-upland hardwoods

Type Description

30 to 70 percent of the basal area of the overstory is made up of pine. Shortleaf pine and Virginia pine, in any combination, usually make up the bulk of the pine component. Loblolly pine and longleaf pine occur sporadically. The most common hardwoods are mockernut hickory, blackjack oak, and chestnut oak. Other common hardwoods are pignut hickory, black oak, post oak, scarlet oak, and southern red oak. Less common hardwood associates include northern red oak, white oak, yellow-poplar, sweetgum, black cherry, red maple, and black tupelo. In some cases the less common species may become important stand components.

PH(6) Shortleaf pine-upland hardwoods 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. The other pines are much less common. The most common hardwoods are mockernut hickory, blackjack oak, chestnut oak, and white oak. Other common hardwoods are black oak, northern red oak, post oak, scarlet oak, and southern red oak. Less common hardwood associates include pignut hickory, yellow-poplar, sweetgum, black cherry, red maple, and black tupelo. In some cases the less common species may become important stand components.

PH(7) Loblolly pine-shortleaf pine-upland hardwoods

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, usually makes up the bulk of the pine component. Virginia pine is a common associate. Longleaf pine rarely occurs. The most common hardwoods are mockernut hickory and white oak. Other common hardwoods are pignut hickory, northern red oak, scarlet oak, southern red oak, yellow-poplar, and sweetgum. Less common hardwood associates include black oak, chestnut oak, post oak, black cherry, red maple, black tupelo, and green ash. In some cases the less common species may become important stand components.

PH(8) Loblolly pine-cove hardwoods 82

Type Description

30 to 70 percent of the basal area of the overstory is made

up of pine. Loblolly pine is almost always the major pine component. The other pines occur sporadically. The most common hardwoods are chestnut oak, white oak, and yellow-poplar. Other common hardwoods are sweetgum and red maple. Less common hardwood associates include mockernut hickory, pignut hickory, American beech, northern red oak, black cherry, American basswood, black tupelo, and green ash. In some cases the less common species may become important stand components.

PH(9) 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 is almost always the major pine component. Shortleaf pine is a common associate. Longleaf pine and Virginia pine occur sporadically. The most common hardwoods are white oak, yellow-poplar, and red maple. Other common hardwoods are American beech and sweetgum. Less common hardwood associates include mockernut hickory, pignut hickory, hazel alder, chestnut oak, northern red oak, post oak, American elm, American sycamore, black cherry, American basswood, black tupelo, and green ash. In some cases the less common species may become important stand components.

PH(10) Loblolly pine-branch hardwoods (Zone IX) 82

Type Description

30 to 70 percent of the basal area of the overstory is made up of pine. Loblolly pine is almost always the major pine component. Shortleaf pine and Virginia pine occur sporadically. The most common hardwoods are shagbark hickory, water oak, white oak, yellow-poplar, and sweetgum. Other common hardwoods are river birch, black cherry, red maple, and green ash. Less common hardwood associates include mockernut hickory, pignut hickory, hazel alder, American beech, American elm, sugarberry, American sycamore, boxelder, American basswood, and black tupelo. In some cases the less important species may become important stand components.

PH(11) Loblolly pine-floodplain hardwoods 82

Type Description

30 to 70 percent of the basal area of the overstory is made up of pine. Loblolly pine is almost always the major pine component. Shortleaf pine and Virginia pine occur sporadically. The most common hardwoods are American beech, white oak, yellow-poplar, and sweetgum. Other common hardwoods are northern red oak and red maple. Less common hardwood associates include bitternut hickory, mockernut hickory, pignut hickory, hazel alder, chestnut oak, water oak, American sycamore, black cherry, American basswood, black tupelo, and green ash. In some cases the less common species may become important stand components.

PH(12) Loblolly pine-floodplain hardwoods (Tallapoosa River) 82

Type Description

30 to 70 percent of the basal area of the overstory is made up of pine. Loblolly pine is almost always the major pine component. Shortleaf pine occurs sporadically. The most common hardwoods are river birch, yellow-poplar, sweetgum, American sycamore, and green ash. Other common hardwoods are black willow, American beech, water oak, white oak, boxelder, red maple, and black tupelo. Less common hardwood associates include eastern cottonwood, bitternut hickory, pignut hickory, hazel alder, scarlet oak, willow oak, American elm, sweetbay, black cherry, and American basswood. In some cases the less common species may become important stand components.

PH(13) Mixed pines-upland hardwoods

Type Description

30 to 70 percent of the basal area of the overstory is made up of pine. Any of the four pines may dominate the stand but Virginia pine is most common. Common hardwoods are mockernut hickory, pignut hickory, blackjack oak, chestnut oak, post oak, scarlet oak, southern red oak, white oak, yellow-poplar, and sweetgum. Less common hardwood associates include American beech, black oak, northern red oak, American elm, black cherry, red maple, American basswood, and black tupelo. In some cases the less common species may become important stand components.

PH(14) Mixed pines-upland hardwoods (Zone IX)

Type Description

30 to 70 percent of the basal area of the overstory is made up of pine. Loblolly pine is usually a major component but shortleaf pine or Virginia pine may be dominant. Longleaf pine occurs sporadically. Common hardwoods are pignut hickory, southern red oak, water oak, white oak, American elm, yellow-poplar, and sweetgum. Less common hardwood associates include mockernut hickory, shagbark hickory, American beech, chestnut oak, scarlet oak, sugarberry, black tupelo, and green ash. In some cases the less common species may become important stand components.

H(1) Upland hardwoods (dry) 44

Type Description

Less than 30 percent of the basal area of the overstory is made up of pine. The most common pine species depends on the zone, following the pattern of the pure pine stands occurring on equivalent sites. The most common hardwoods are mockernut hickory, blackjack oak, and chestnut oak. Other common hardwoods are black oak, northern red oak, post oak, scarlet oak, southern red oak, and black tupelo. Less common hardwood associates include pignut hickory, white oak, yellow-poplar, black cherry, black locust, red maple, and American basswood. In some cases the less common species may become important stand components.

H(2)	Upland hardwoods (moist)	44

Type Description

Less than 30 percent of the basal area of the overstory is made up of pine. The most common pine species depends on zone, following the pattern of the pure pine stands occurring on equivalent sites. The most common hardwoods are mockernut hickory, chestnut oak, and white oak. Other common hardwoods are pignut hickory, black oak, blackjack oak, northern red oak, post oak, scarlet oak, southern red oak, yellow-poplar, and black tupelo. Less common hardwood associates include American beech, water oak, American elm, sweetgum, black cherry, black locust, red maple, American basswood, and green ash. In some cases the less common species may become important stand components.

H(3)	Upland hardwoods (moist, Zone IX)	52

Type Description

Less than 30 percent of the basal area of the overstory is made up of pine. The most common pine is loblolly pine. Shortleaf pine and Virginia pine occur sporadically. Common hardwoods are pignut hickory, southern red oak, water oak, white oak, American elm, yellow-poplar, and sweetgum. Less important hardwood associates include mockernut hickory, shagbark hickory, American beech, chestnut oak, northern red oak, scarlet oak, sugarberry, black tupelo, and green ash. In some cases the less common species may become important stand components.

H(4)	Cove hardwoods	53, 59

Type Description

Less than 30 percent of the basal area of the overstory is made up of pine. The most common pine is loblolly pine. Shortleaf pine occurs sporadically. The most common hardwoods are chestnut oak, white oak, and yellow-poplar. Other common hardwoods are mockernut hickory, pignut hickory, American beech, northern red oak, sweetgum, red maple, American basswood, and green ash. Less common hardwood associates include black cherry and black tupelo. In some cases the less common species may become important stand components.

H(5)	Branch hardwoods	59

Type Description

Less than 30 percent of the basal area of the overstory is made up of pine. The most common pine is loblolly pine. The other pines occur sporadically. The most common hardwoods are white oak, yellow-poplar, sweetgum, and red maple. Other common hardwoods are pignut hickory, American beech, chestnut oak, northern red oak, and black tupelo. Less common hardwood associates include mockernut hickory, hazel alder, post oak, scarlet oak, southern red oak, water oak, American elm, sweetbay, American sycamore, black cherry, American basswood, and green ash. In some cases the less important species may become important stand components.

H(6)	Branch hardwoods (Zone IX)	59

Type Description

Less than 30 percent of the basal area of the overstory is made up of pine. The most common pine is loblolly pine. The other pines rarely occur. The most common hardwoods are shagbark hickory, white oak, yellow-poplar, sweetgum, and green ash. Other common hardwoods are river birch, water oak, black cherry, red maple, and black tupelo. Less common hardwood associates include black willow, mockernut hickory, pignut hickory, hazel alder, American beech, northern red oak, American elm, sugarberry, American sycamore, boxelder, American basswood, and water tupelo. As the stream and attendant floodplain widen, the percentage of green ash and water tupelo increases. The water tupelo occurs only along the slow moving portions of the streams. In some cases the less common species may become inportant stand components.

H(7)	Floodplain hardwoods (Tallapoosa River)	61

Type Description

Less than 30 percent of the basal area of the overstory is made up pine. The most common pine is loblolly pine. The other pines rarely occur. The most common hardwoods are river birch, yellow-poplar, sweetgum, American sycamore, and green ash. Other common hardwoods are black willow, hazel alder, American beech, water oak, white oak, boxelder, red maple, and black tupelo. Less common hardwood associates include eastern cottonwood, bitternut hickory, pignut hickory, scarlet oak, willow oak, American elm, sweetbay, black cherry, and American basswood. In some cases the less common species may become important stand components.

H(8)	Hazel alder-	

Type Description

Hazel alder makes up 70 percent or more of the crown cover of the stand. Intermixed with the alder, often as an overstory, are yellow-poplar, sweetgum, black willow, and other wet site species.

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.

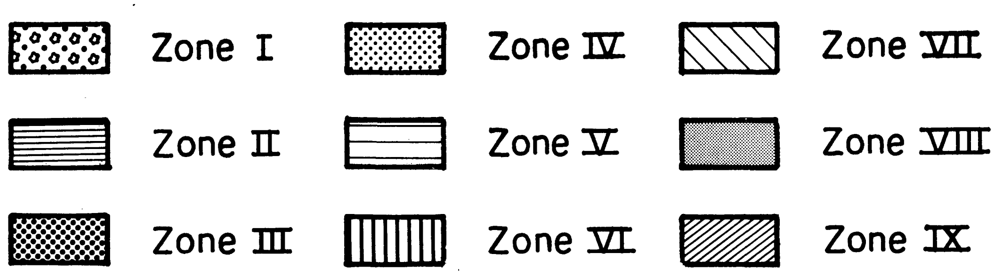
Broad-leaved Trees

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]
Beech Family	*Fagaceae*
American beech	*Fagus grandifolia* Ehrh.
Black oak	*Quercus velutina* Lam.
Blackjack oak	*Quercus marilandica* Muenchh.
Chestnut oak	*Quercus prinus* L.
Northern red oak	*Quercus rubra* L.
Post oak	*Quercus stellata* Wangenh.
Scarlet oak	*Quercus coccinea* Muenchh.
Southern red oak	*Quercus falcata* Michx.
Water oak	*Quercus nigra* L.
White oak	*Quercus alba* L.
Willow oak	*Quercus phellos* L.
Elm Family	*Ulmaceae*
American elm	*Ulmus americana* L.
Sugarberry	*Celtis laevigato* Willd.
Magnolia Family	*Magnoliaceae*
Sweetbay	*Magnolia virginiana* L.
Yellow-poplar	*Liriodendron tulipifera* L.
Witch hazel Family	*Hamamelidaceae*
Sweetgum	*Liquidambar styraciflua* L.
Sycamore Family	*Platanaceae*
American sycamore	*Platanus occidentalis* L.
Rose Family	*Rosaceae*
Black cherry	*Prunus serotina Ehrh.*
Pulse or Pea Family	*Leguminosae*
Black locust	*Robinia pseudoacacia* L.
Maple Family	*Aceraceae*
Boxelder	*Acer negundo* L.
Red maple	*Acer rubrum* L.
Linden Family	*Tiliaceae*
American basswood	*Tilia americana* L.
Tupelo Family	*Nyssaceae*
Black tupelo	*Nyssa sylvatica* Marsh.
Water tupelo	*Nyssa aquatica* L.
Olive Family	*Oleaceae*
Green ash	*Fraxinus pennsylvanica* Marsh.

APPENDIX IV

County Maps Showing Location of the Vegetative Zones of the Mountain Forest Habitat Region

Key



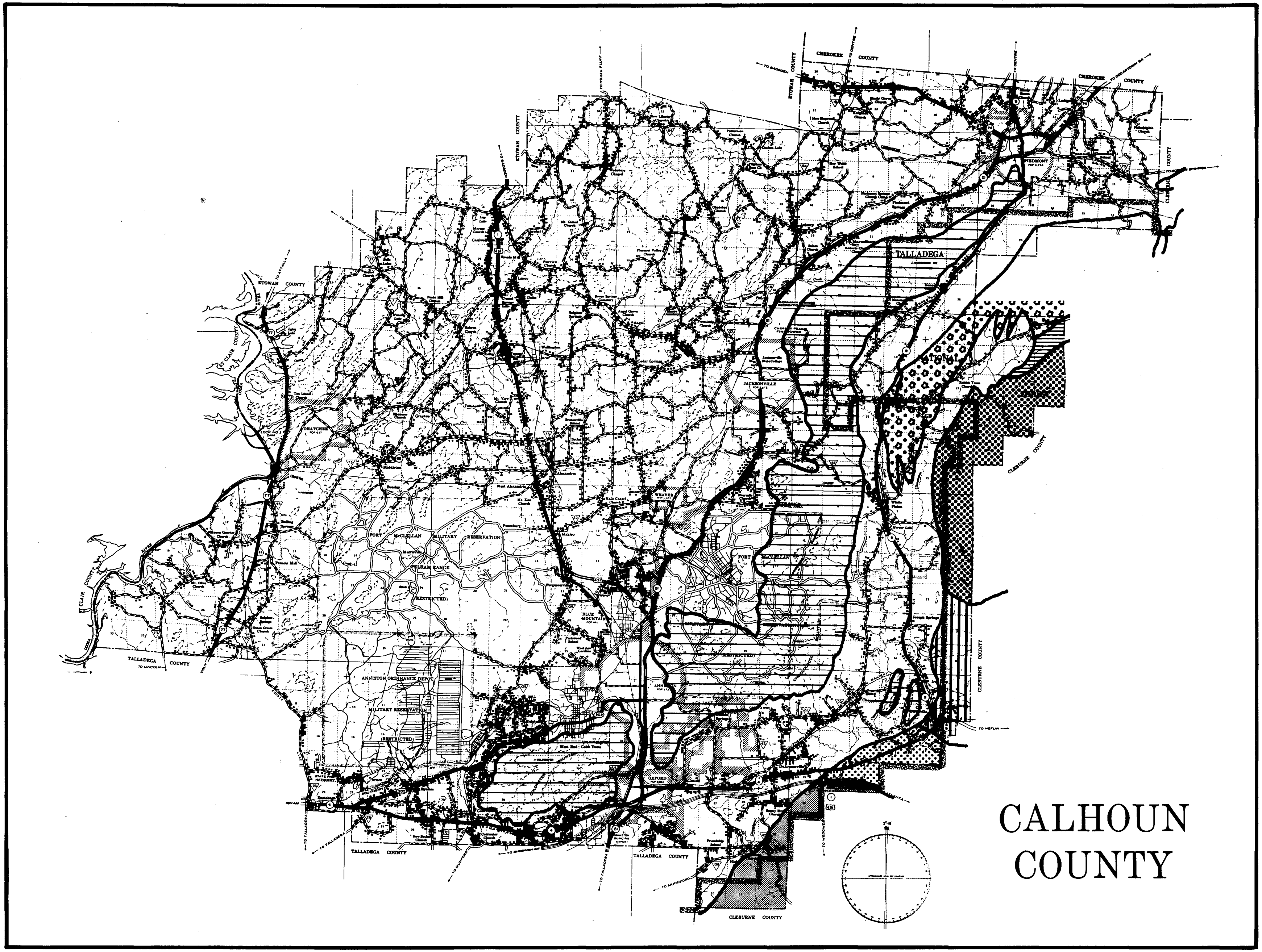


FIGURE 51. Calhoun County.

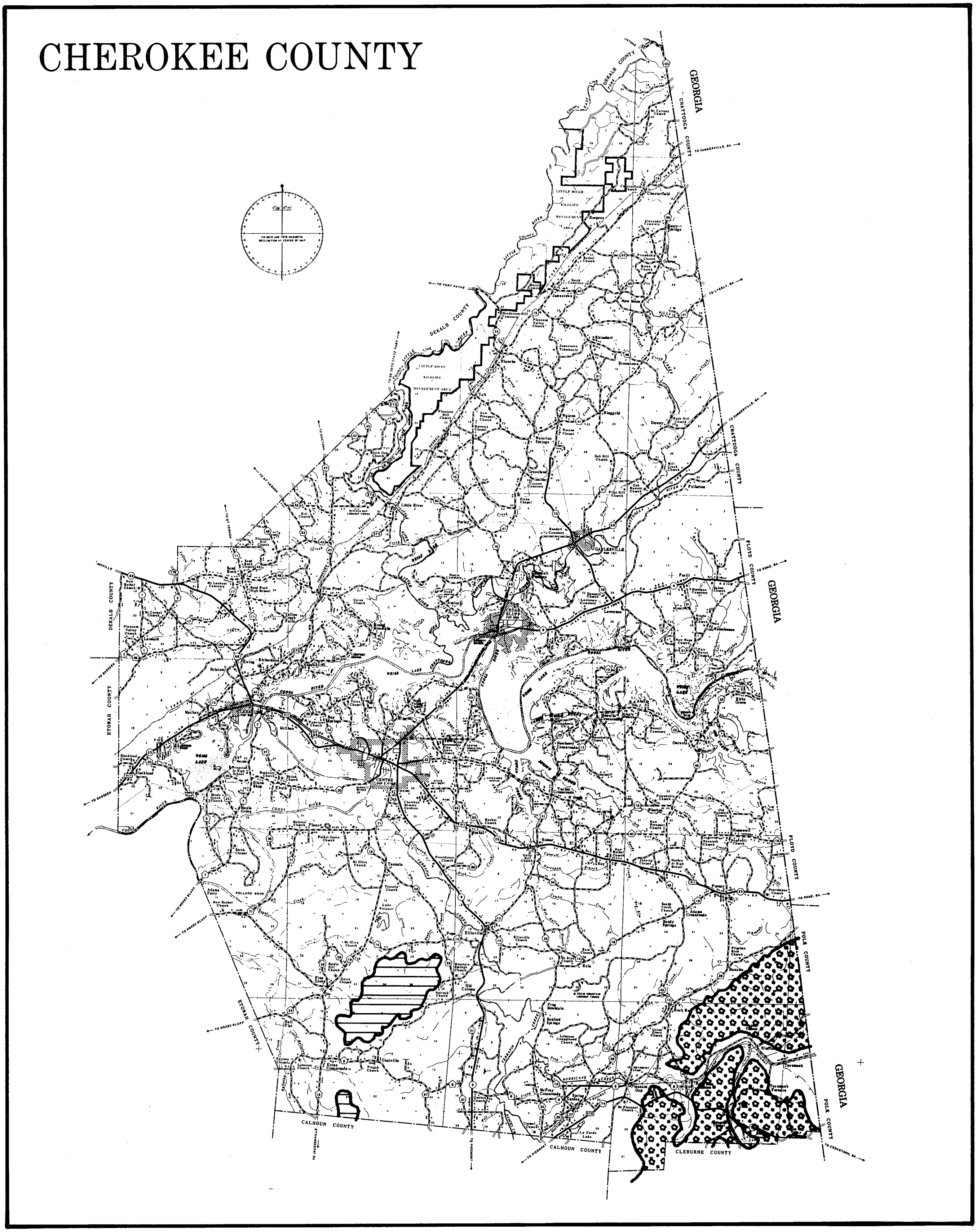


FIGURE 52. Cherokee County.

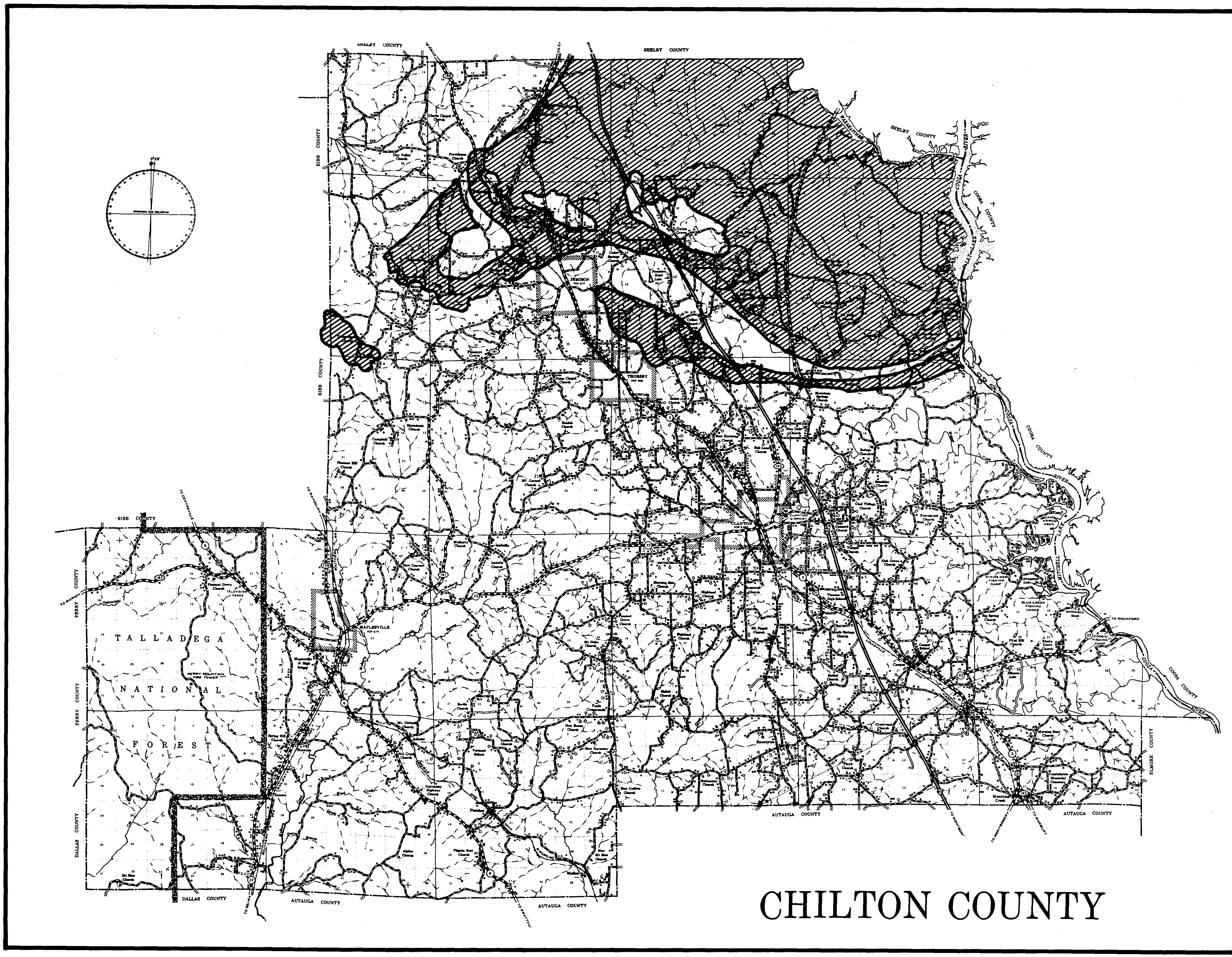


FIGURE 53. Chilton County.

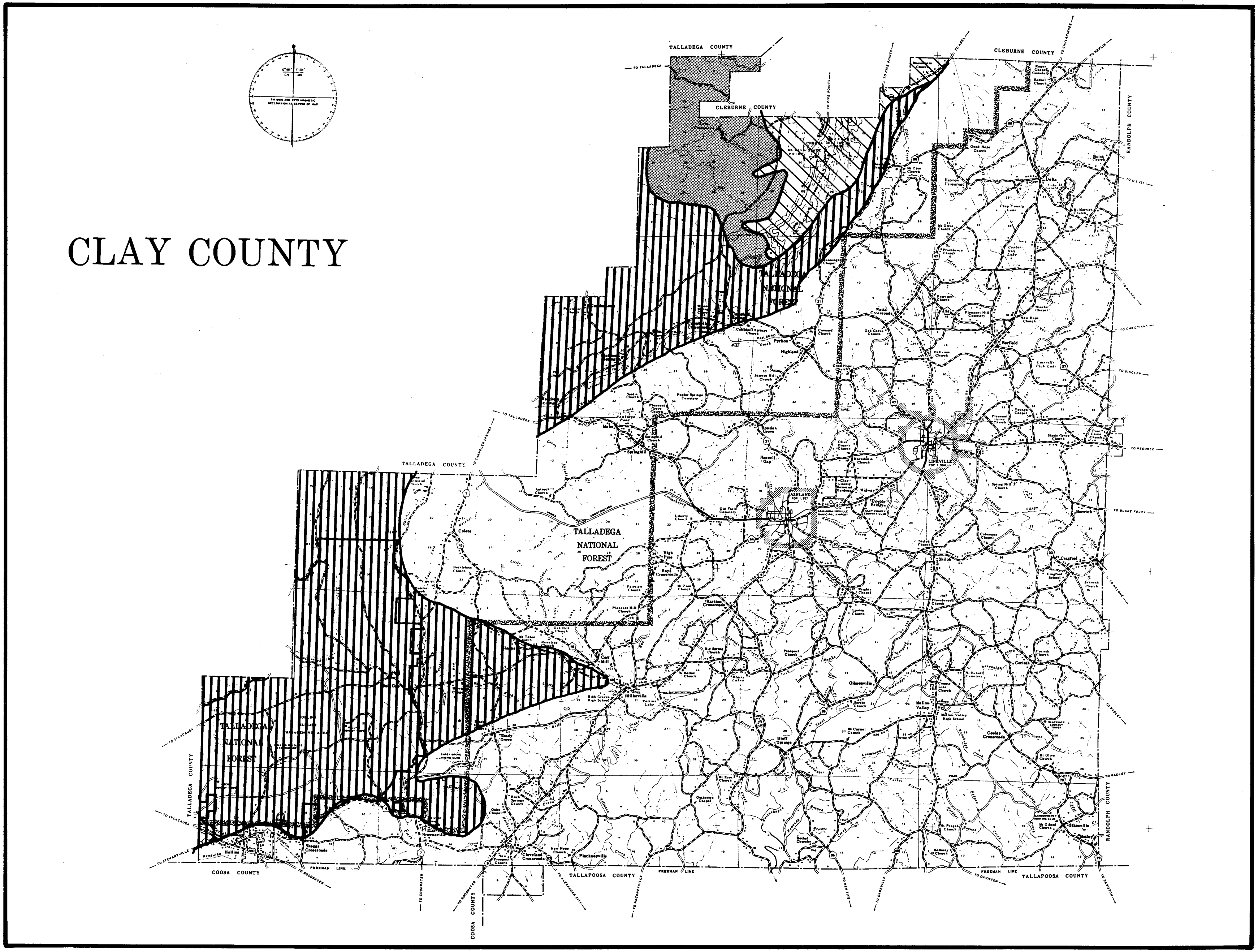


FIGURE 54. Clay County.

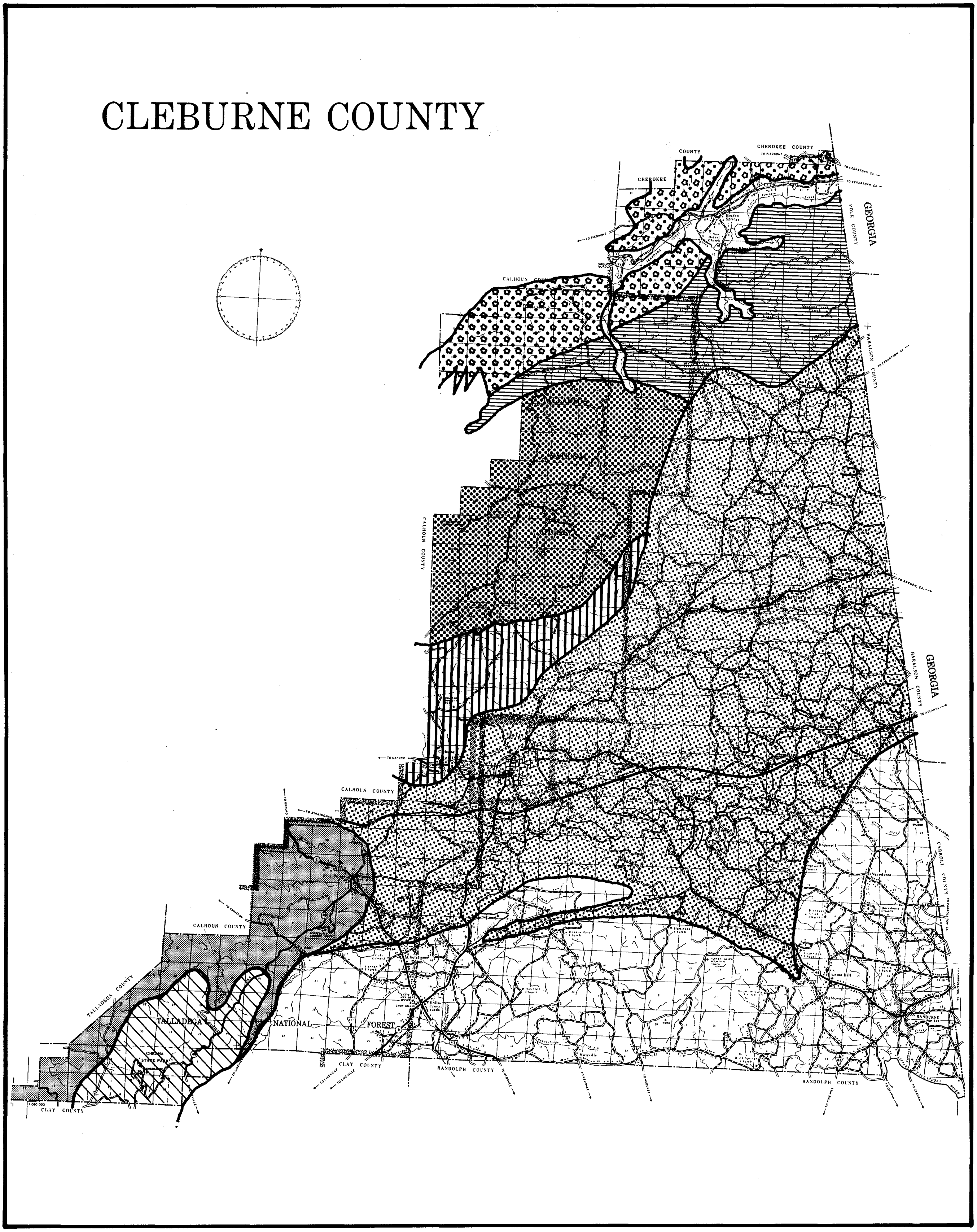


FIGURE 55. Cleburne County.

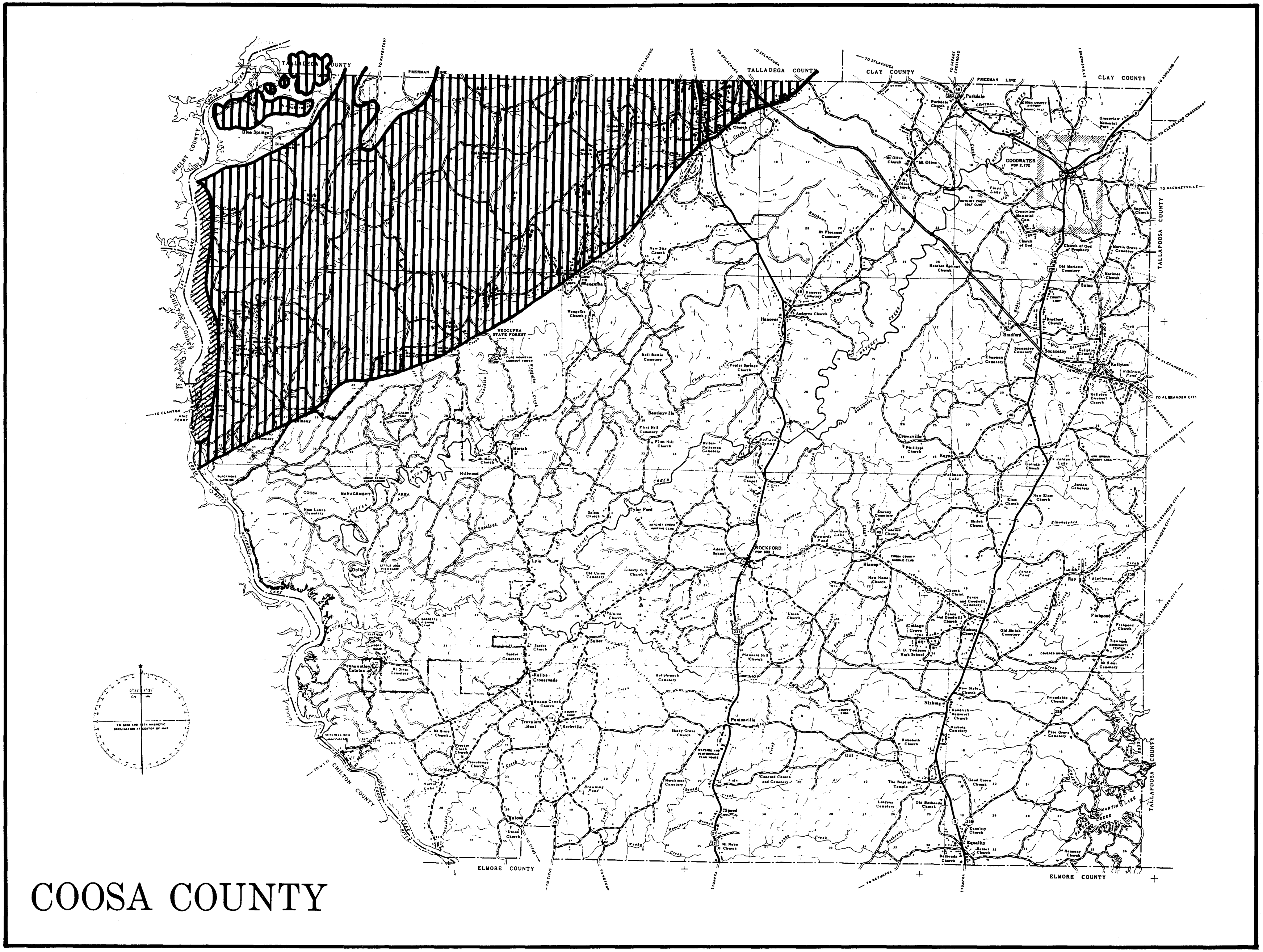
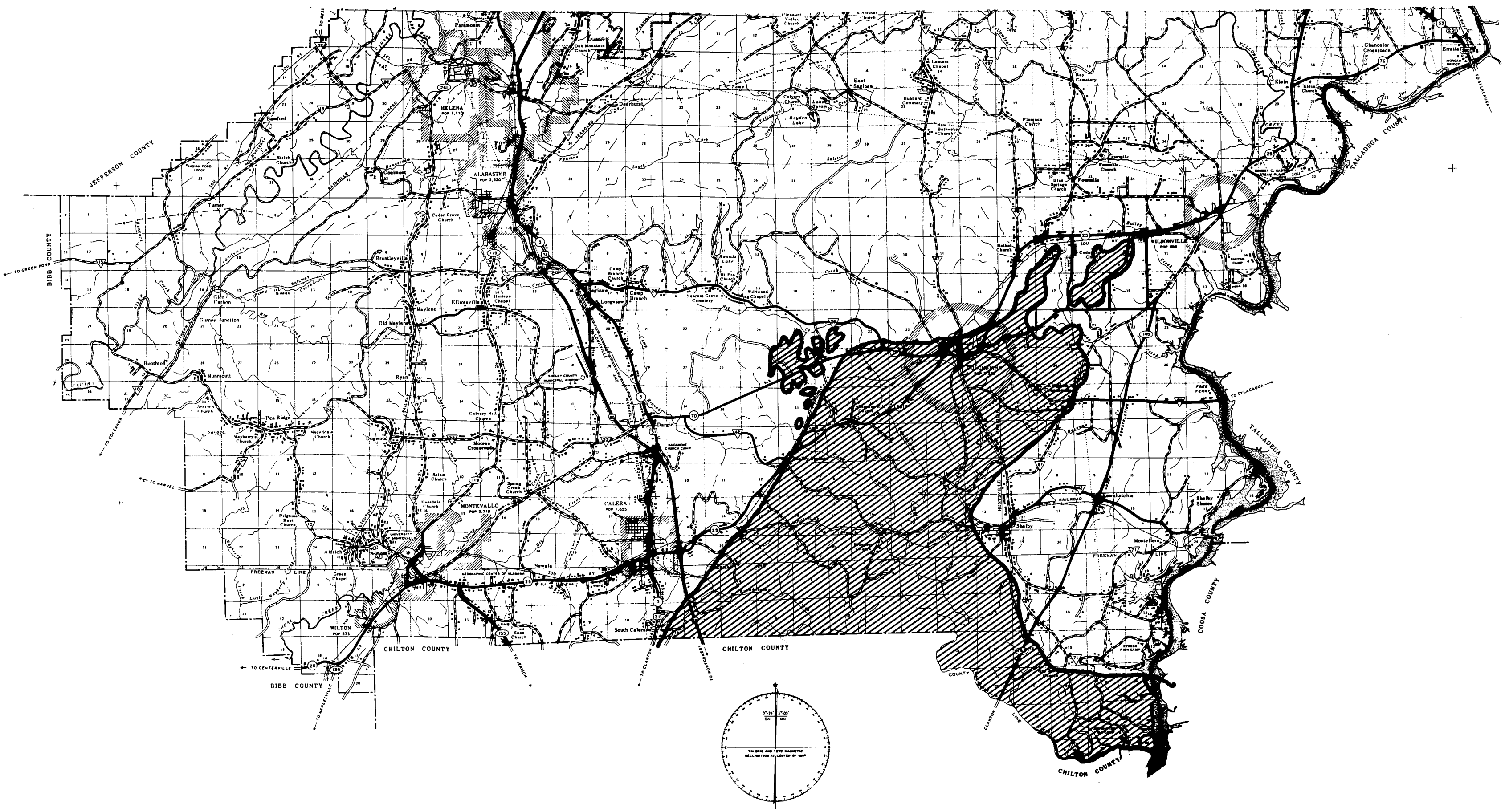


FIGURE 56. Coosa County.



SHELBY COUNTY

FIGURE 57. Shelby County.

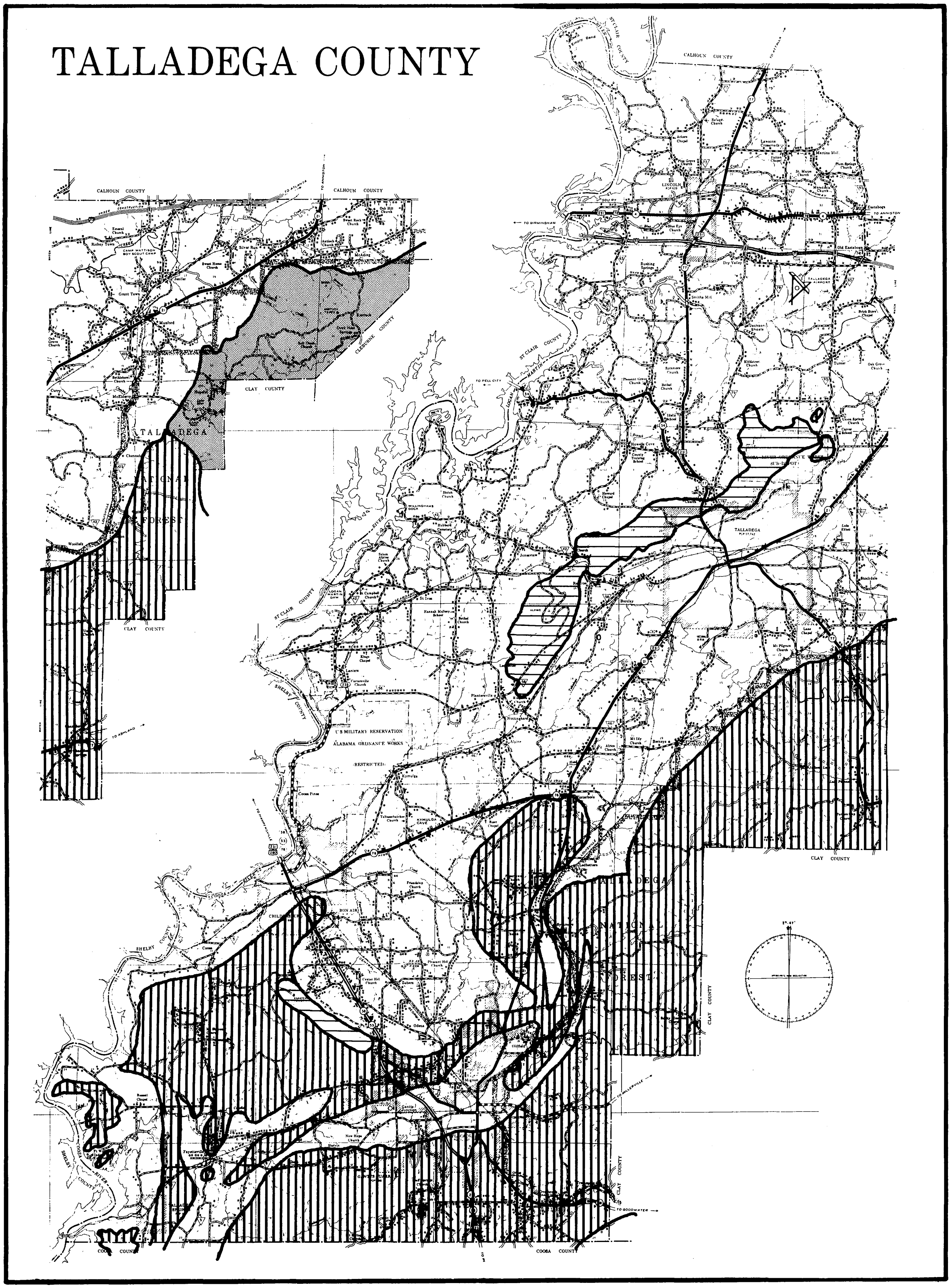
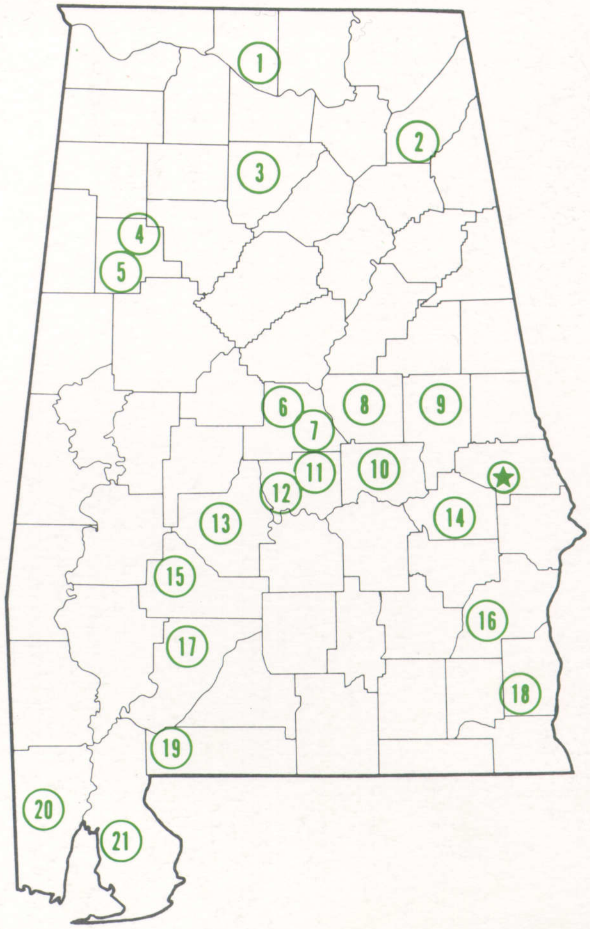


FIGURE 58. Talladega County.

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.