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Identifying Southern Forest Types on Aerial Photographs

by

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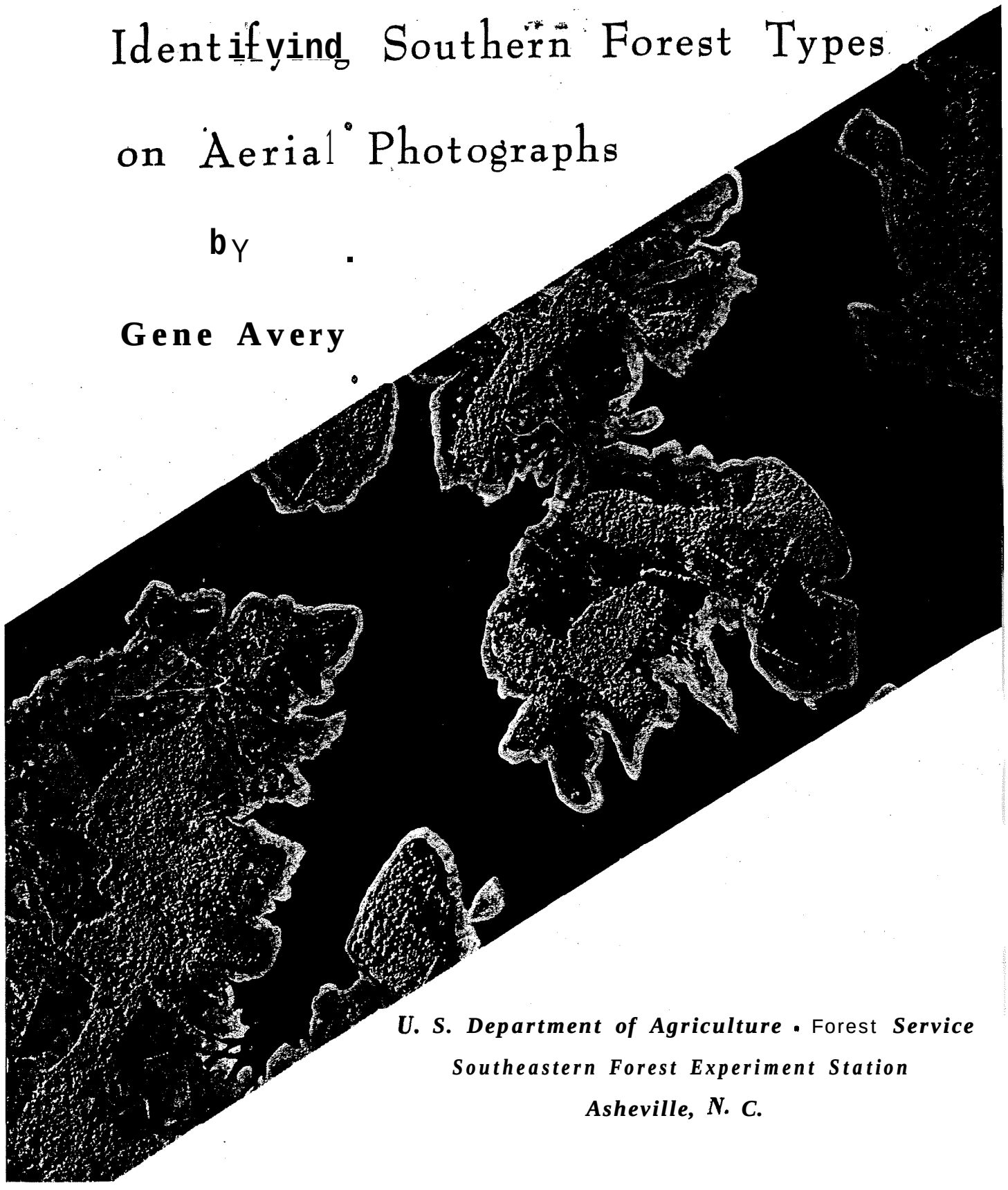

U. S. Department of Agriculture • Forest *Service*

Southeastern Forest Experiment Station

Asheville, N. C.

Cover illustration: Portion of an infrared aerial photograph showing mixed pines (dark crowns) and hardwoods (light gray crowns) near Hiawassee, Georgia. Black areas are open waters of the Chatuge Reservoir.

Identifying Southern Forest Types on Aerial Photographs

by

Gene Avery [1]

This booklet has been prepared to assist photo interpreters in recognizing broad forest types on aerial photographs of the South, and to illustrate primary differences between panchromatic and infrared photography from the standpoint of timber type-mapping.

The ability to delineate forest types on vertical aerial photographs is largely a product of field experience and training. For example, a forester who has worked in both northern and southern Georgia can separate most stands of loblolly-shortleaf pines from longleaf-slash pines on the basis of his knowledge of the range and site requirements of the two species-groups. The photographic image enables him to recognize an area as mixed pines, but final determination of the specific type is often accomplished through mental elimination.

The generalized forest type map shown in figure 1 recognizes four basic types: longleaf-slash pines, loblolly-shortleaf pines, upland hardwoods, and bottomland hardwoods. In many instances, of course, finer photo stratifications can be made, depending on the scale and quality of available, aerial photography and the ability of individual interpreters.

All photographic illustrations are from 9- by 9-inch aerial prints and are shown at the original scale of 1: 15,840 or 4 inches per mile. These panchromatic and infrared photographs are unique in that the paired ex-

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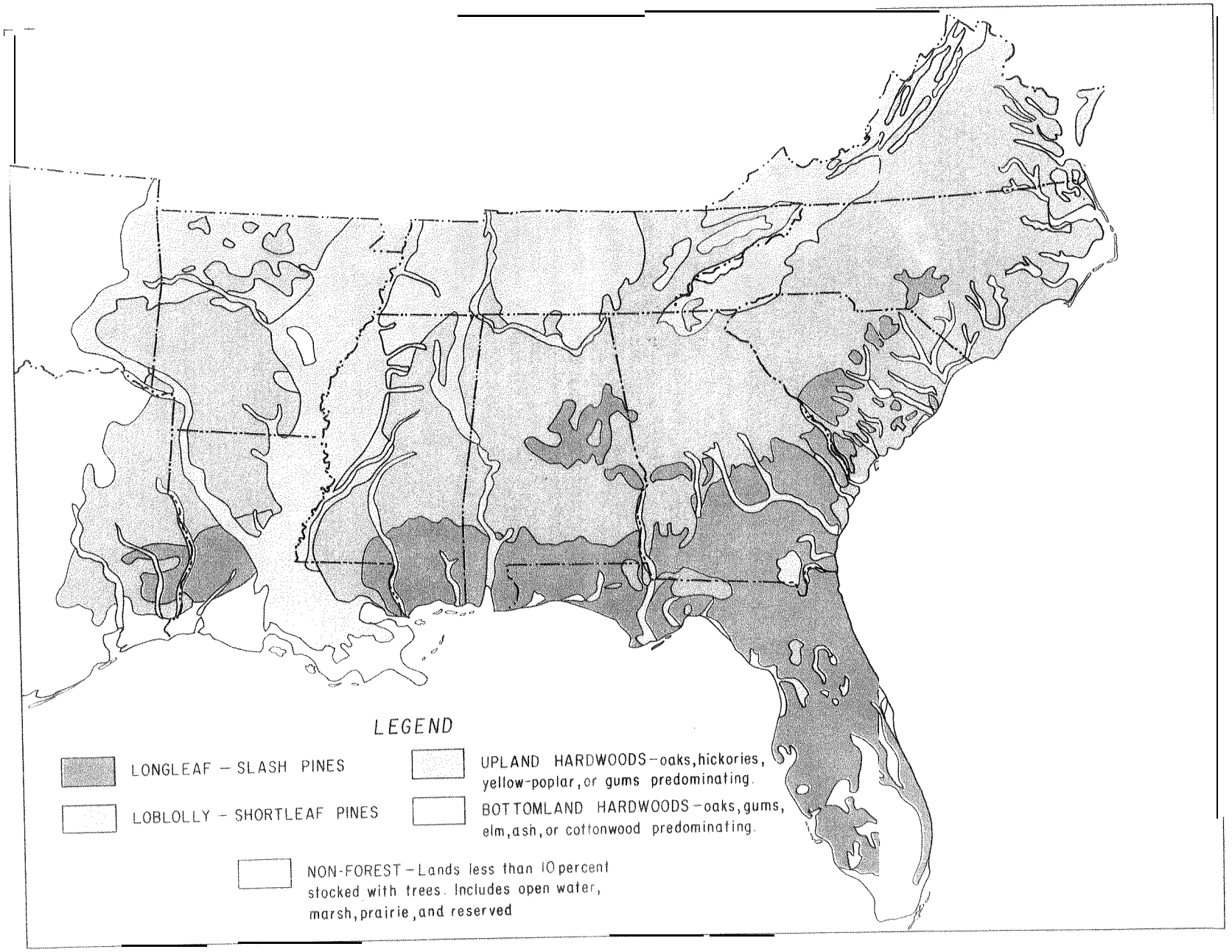
posures were made simultaneously by two aerial cameras mounted in a single aircraft. They were obtained through a cooperative' U. S. Navy-Forest Service project, and flights were specifically planned to depict summer forest conditions in the Coastal Plain, Piedmont, and mountains of North Carolina and Georgia. In preparing illustrations for this booklet, an effort was made to select prints that are reasonably typical of these physiographic regions.

Good quality infrared photographs, if taken during spring or early summer, are usually superior to panchromatic prints for delineating southern forest types. This is especially evident from the ensuing illustrations, because of the striking contrast between dark-toned conifers and lighter-toned hardwoods on the infrared photographs. Panchromatic photography offers slightly better image resolution and less offensive shadows, but these items are ordinarily. less important to the forester than reliable separation of timber types.

Whenever possible, interpreters should rely on stereoscopic pairs of photographs in delineating forest types, for certain details that are obvious when seen three-dimensionally may pass unnoticed when using single prints. Stereo-pairs are not illustrated here, because their advantages are largely forfeited in printing by halftone screening processes. When single prints are used, greatest reliance must be placed on gross identification features, such as distinct tonal contrasts, spatial distribution, physiography, and drainage patterns.

For readers who are occasionally confused by the expression of. photo and map scales as representative fractions, a table of conversion factors appears on the final page of this report.

Figure l.-Generalized forest type map of the South. More detailed information on the range and distribution of softwood species can be obtained from Forest Survey Release 83, issued in 1960 by the Southern and Southeastern Forest Experiment Stations.


LEGEND
LONGLEAF – SLASH PINES
LOBLOLLY – SHORTLEAF PINES
UPLAND HARDWOODS – oaks, hickories, yellow-poplar, or gums predominating.
BOTTOMLAND HARDWOODS – oaks, gums, elm, ash, or cottonwood predominating.
NON-FOREST – Lands less than 10 percent stocked with trees. Includes open water, marsh, prairie, and reserved

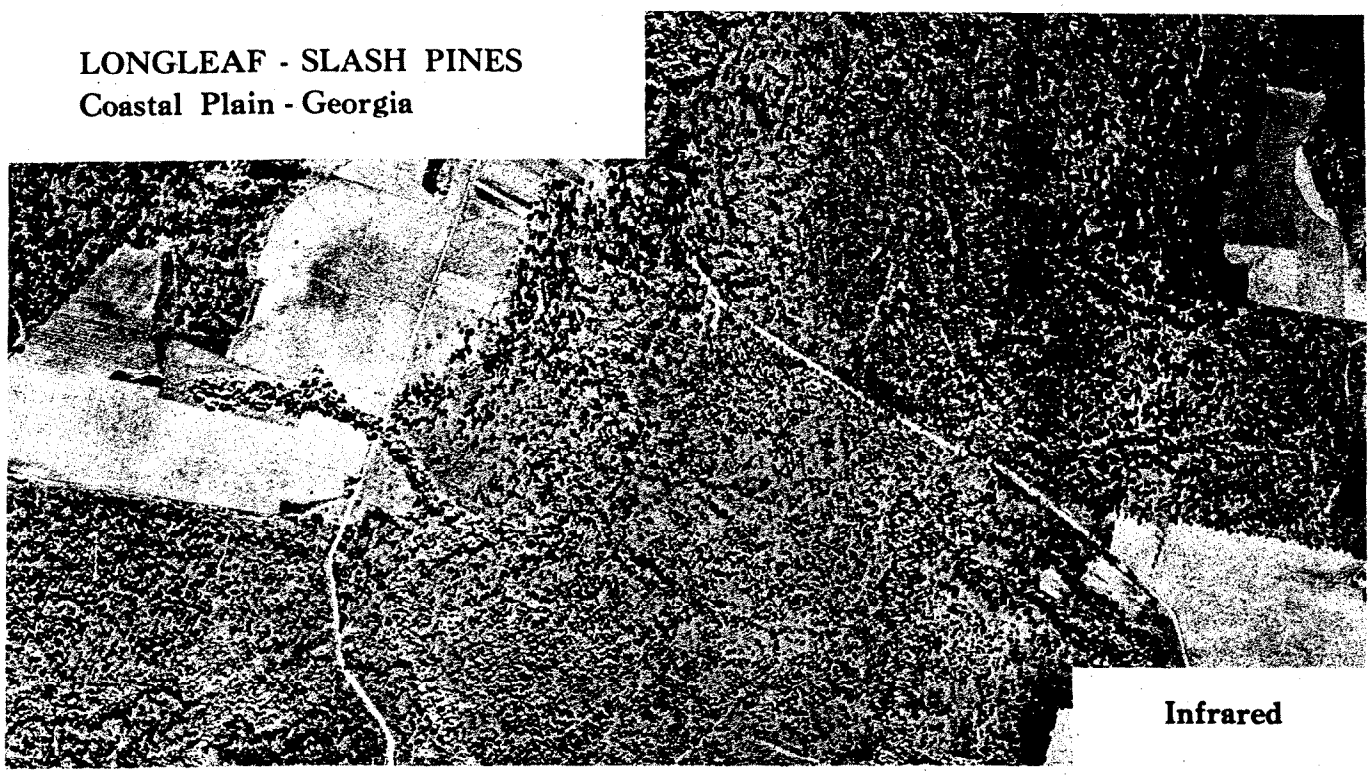


Figure 2.—Longleaf and slash pines, occurring in pure stands or in mixtures with upland oaks, comprise the dominant forest cover on the broad, sandy ridges and flatwoods of the southern Coastal Plain. Natural stands are typically open-grown, often sparsely-stocked, and intercepted by denser zones of bottomland hardwoods that follow irregular drainage courses. This dendritic pattern of hardwood distribution is defined by very light tones. on infrared photography (above), and the darkest tones on panchromatic prints (below).

Longleaf crowns often exhibit a lighter tone than slash pines on infrared photography, but little contrast between these species is evident on panchromatic photos. Where tree shadows fall on level ground, the distinctly pointed and symmetrical character of young longleaf crowns also helps to distinguish this species from slash pine.

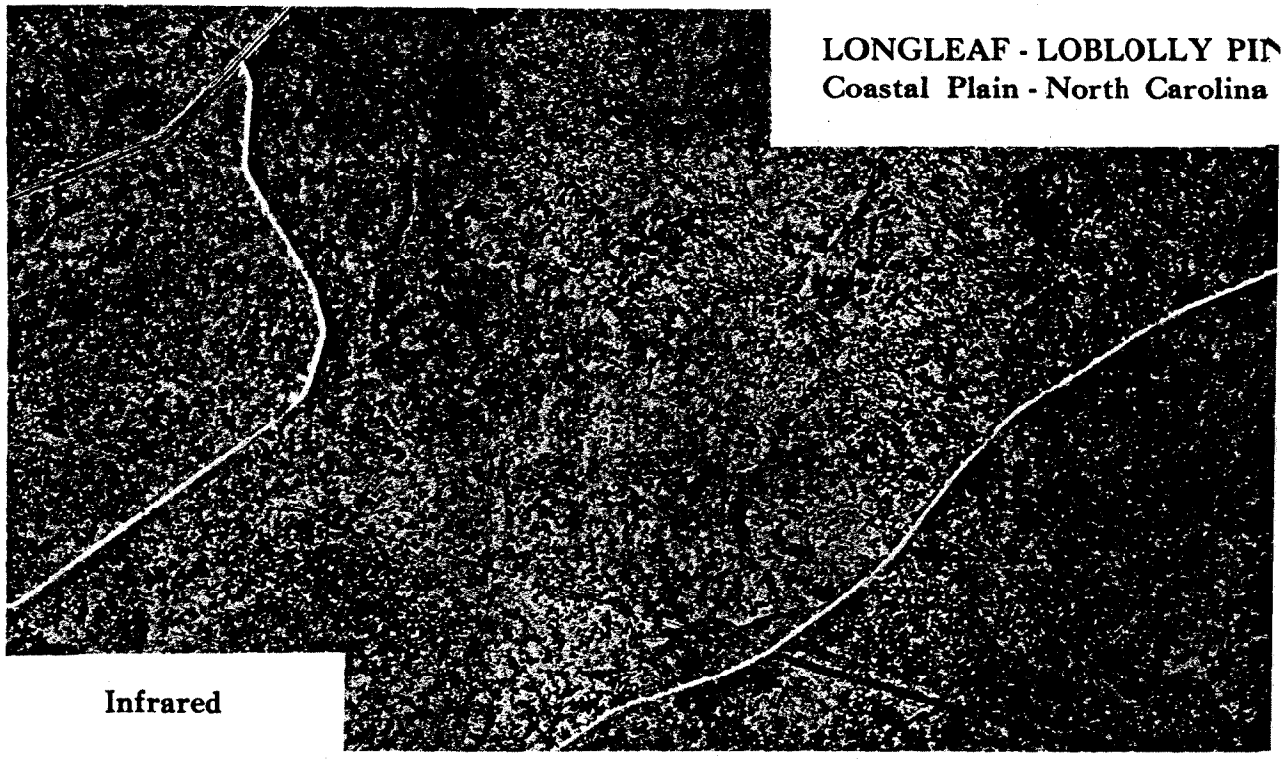
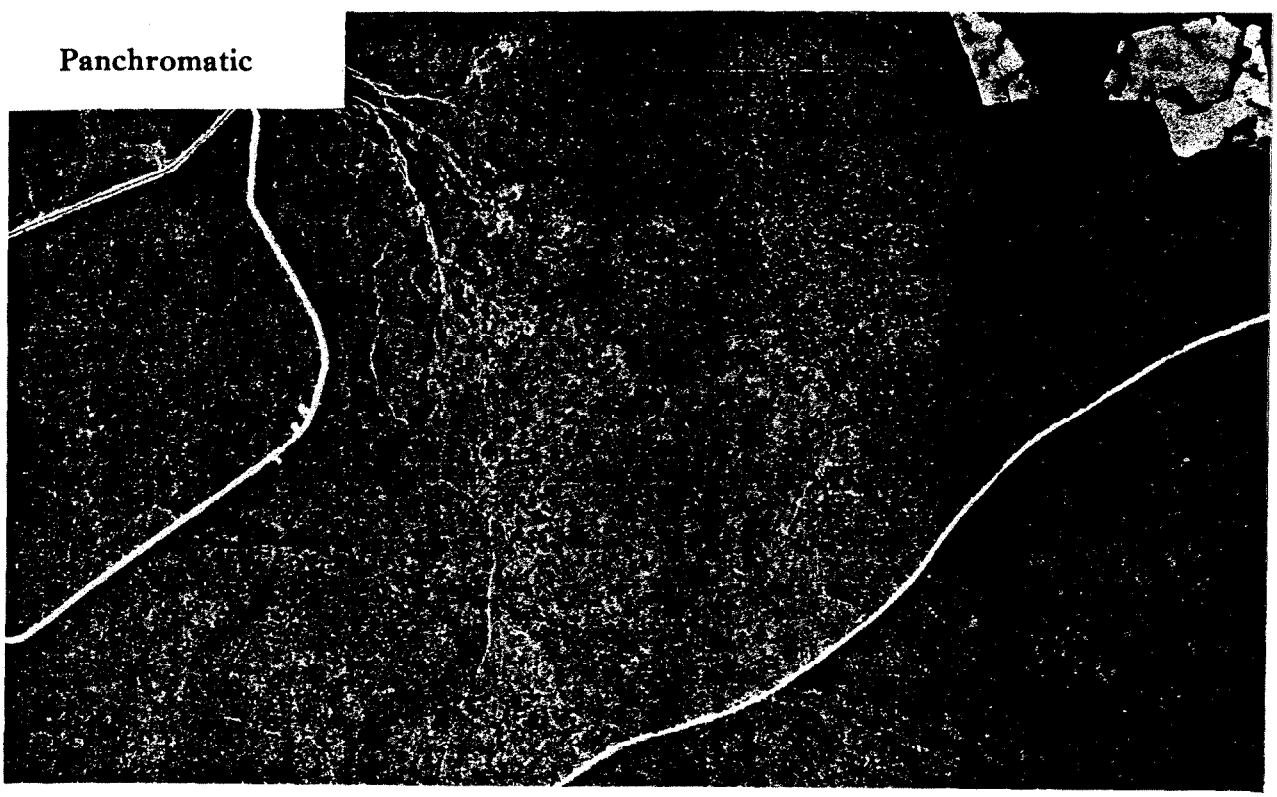


Figure 3.-In the Coastal Plain of North Carolina, longleaf pine may be found in pure stands or in mixture with lowquality hardwoods on dry, upland sites such as the Sandhills area. Loblolly pine commonly occurs on moist sites, occasionally in mixture with bottomland hardwoods, while pond pine is most likely to be encountered in the elliptical-shaped depressions known as *pocosins* or Carolina bays. Slash pine occurs only in plantations, as the natural range of this species does not extend into North Carolina. In the infrared photograph (above), the darker crowns are longleaf and loblolly pines in varying mixtures with upland hardwoods.



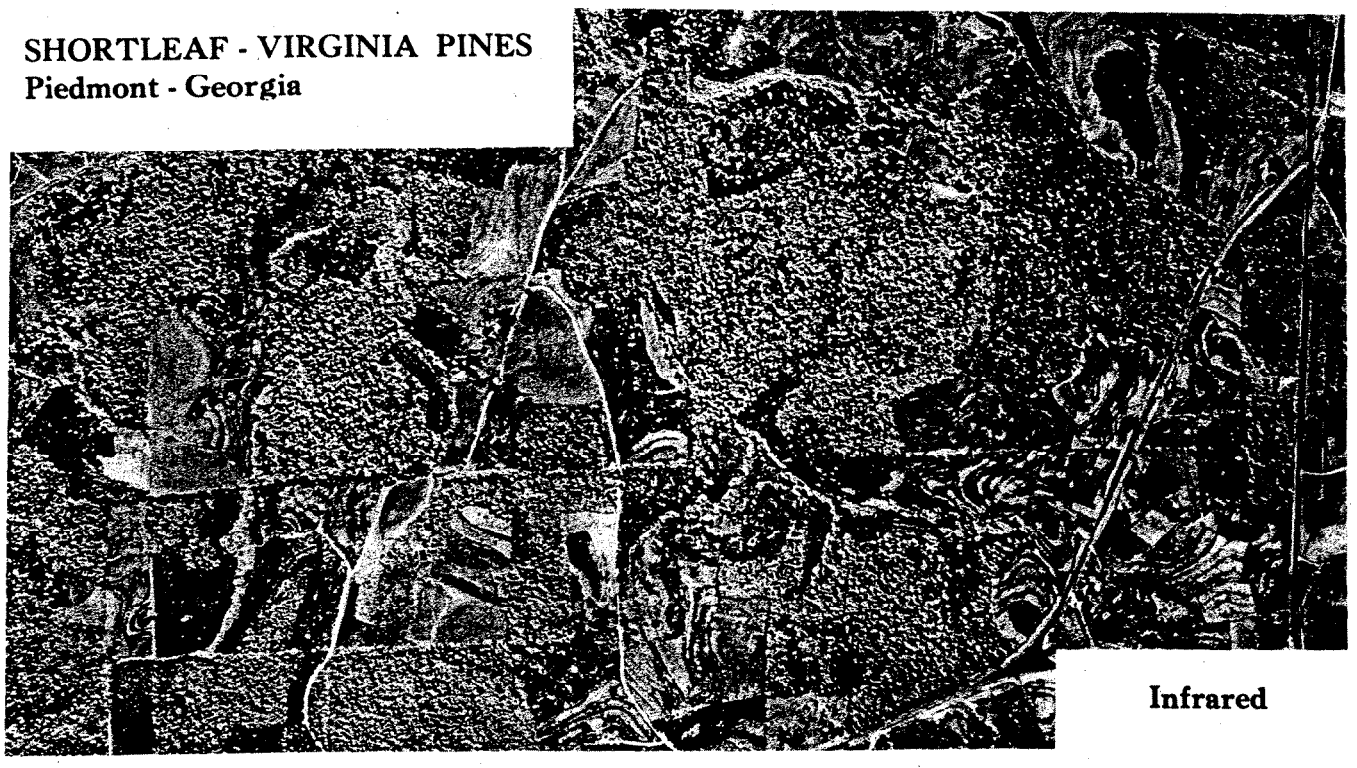
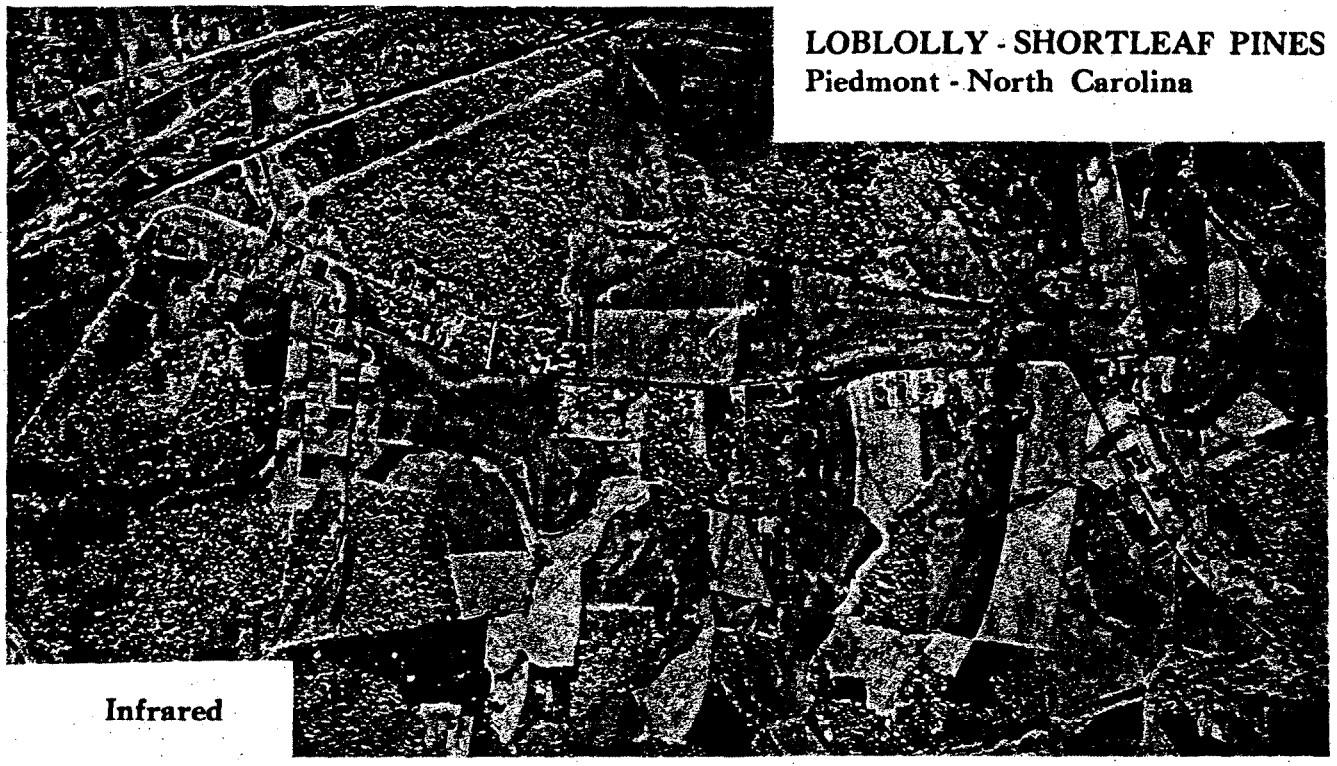


Figure 4.—In the upper Piedmont, shortleaf and Virginia pines are characteristically found growing in close association with upland oaks and hickories. Field contours on these photographs indicate that the topography is relatively steep in this region. Because few natural stands of loblolly pine are found in this sector of northeast Georgia, it may be presumed that most of the conifers shown here (dark crowns on infrared print) are shortleaf and Virginia pines.

These prints constitute a classical comparison of infrared and panchromatic aerial photography for timber type-mapping. Both pure and mixed stands can be readily delineated on the infrared photograph, but type separations would be much more difficult on the even-toned panchromatic print, especially in the case of pine-hardwood mixtures.

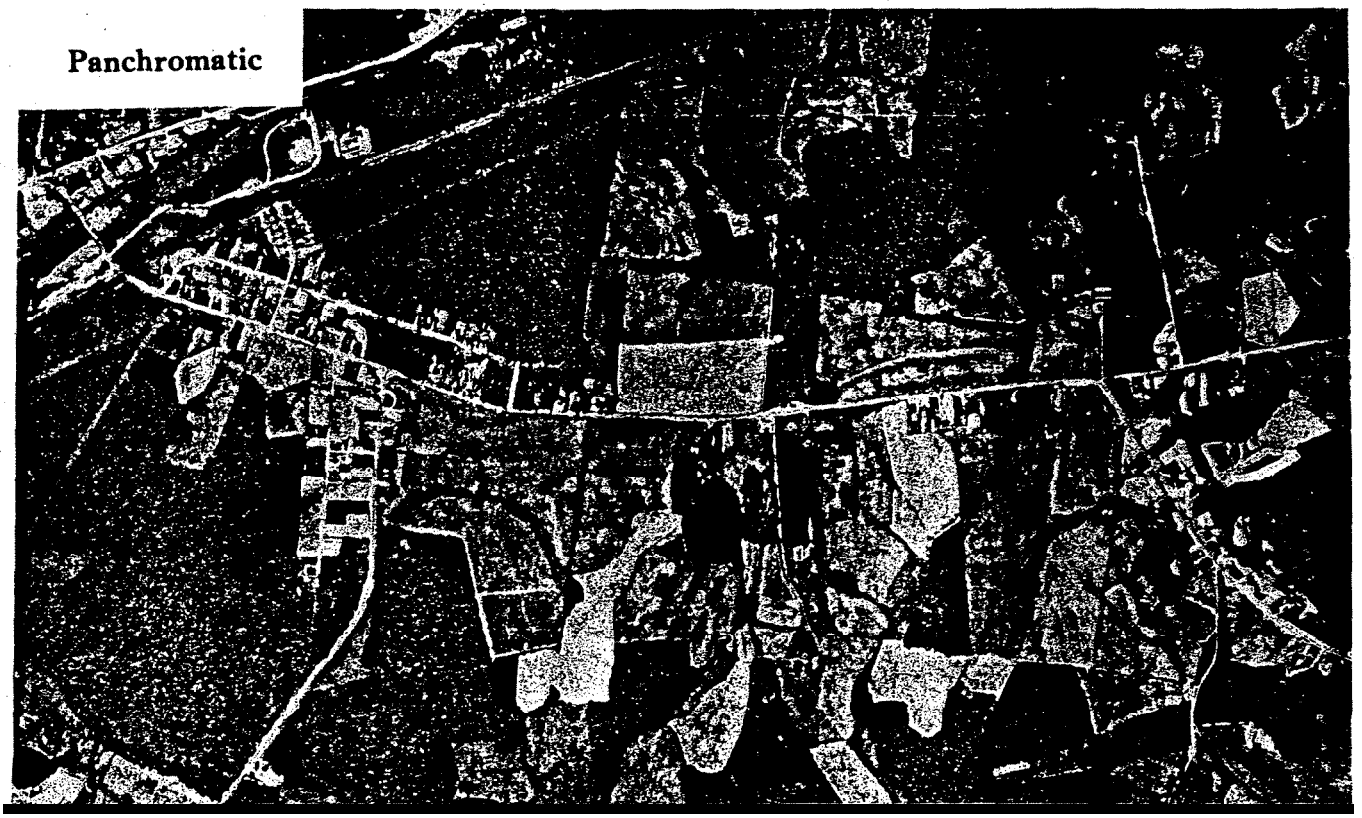
LOBLOLLY - SHORTLEAF PINES
Piedmont - North Carolina



Infrared

Figure S.-An 'irregular patchwork of small farms and woodlots typifies the rolling topography of the lower Piedmont. The original forest cover was predominantly'oak-hickory and mixed stands of upland hardwoods, loblolly, and shonleaf pines. Added to these during the past 10 'to 15 years have been many small plantations of loblolly pine.

On the infrared photograph above; pine plantations and mixed pine-hardwood stands are easily identified. The plantations may also be detected on the panchromatic print by noting the uniform, fine-textured crown patterns, but separation of mixed pine and hardwood stands is more tedious. Light-colored fields indicate recent planting, while the darker ones reflect the beginning of a new crop or pasture lands. A few abandoned areas shown are reseeding naturally to pines.



Panchromatic

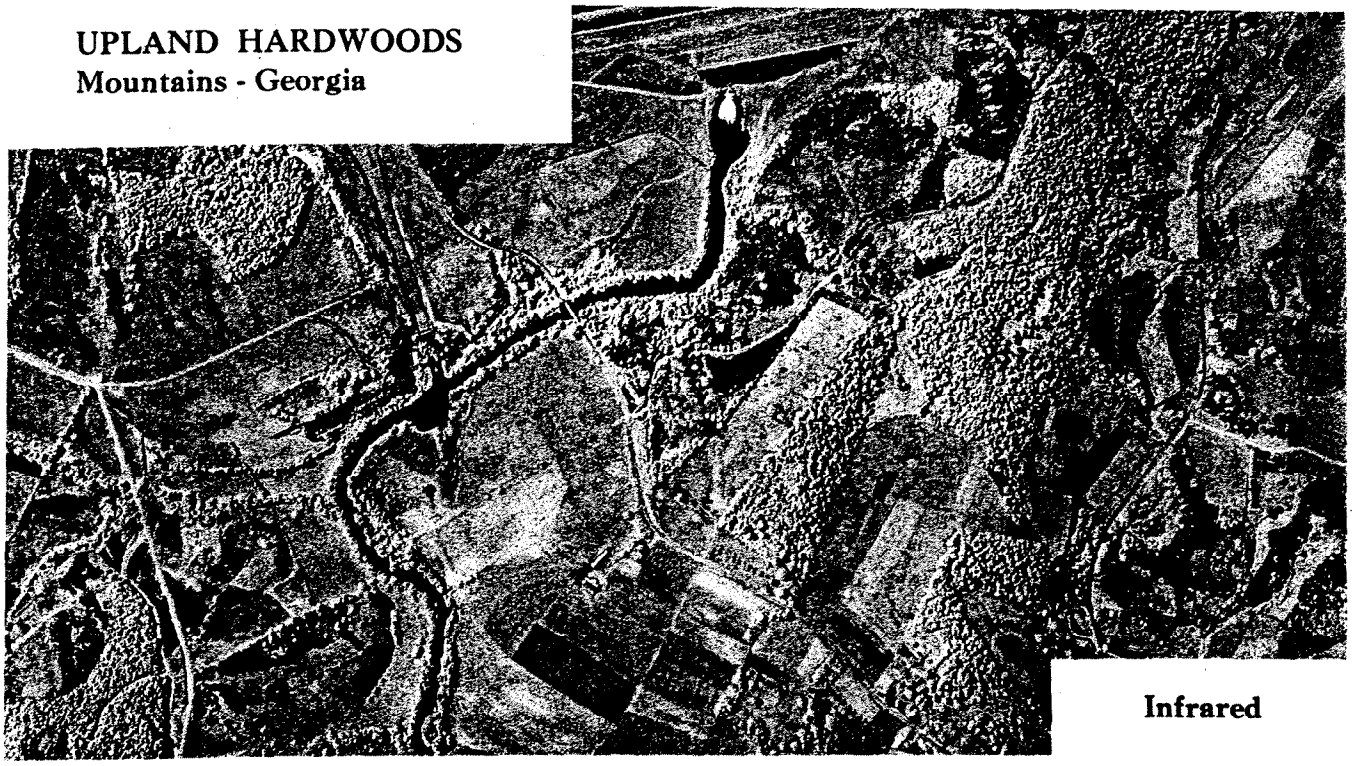
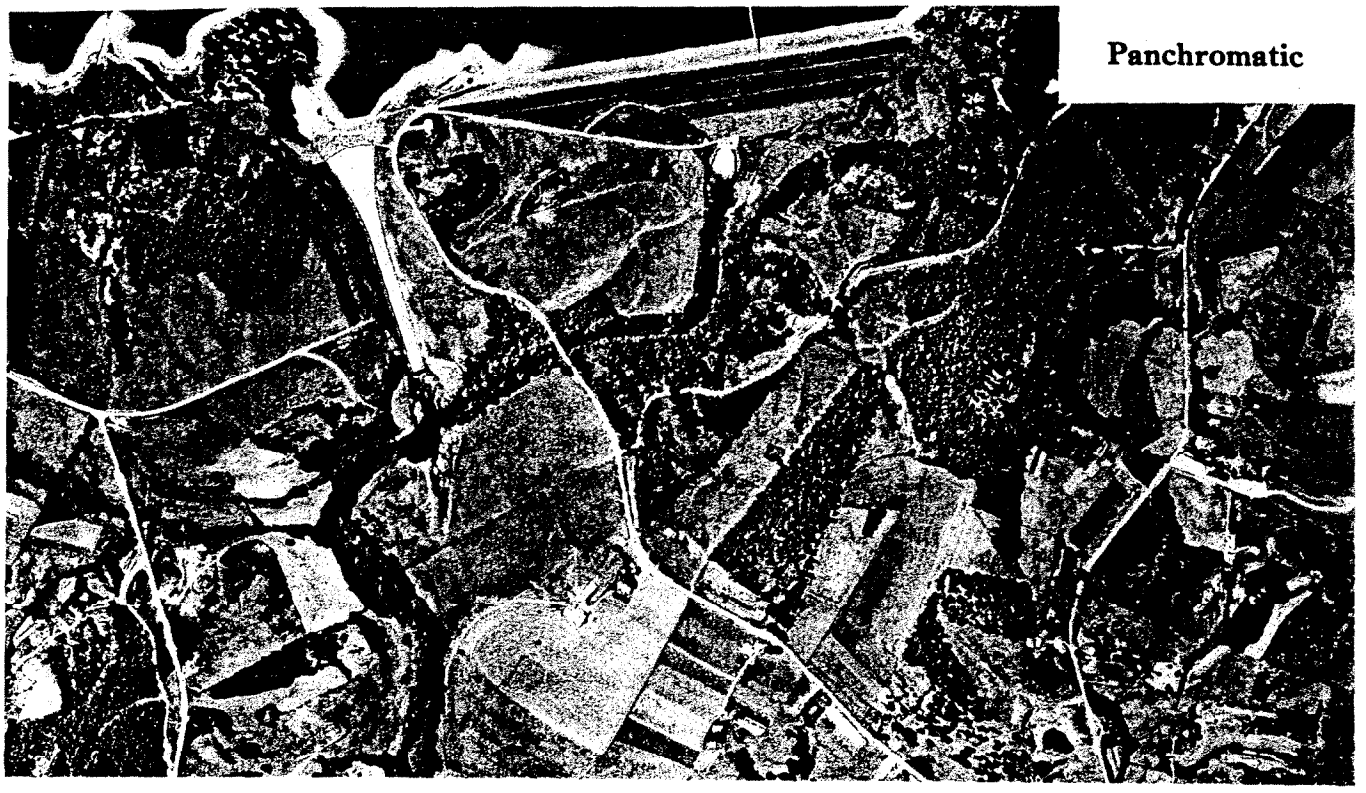


Figure 6.—The large, round-topped hardwoods here (light gray on infrared print) are mostly upland oaks with lesser quantities of hickories and yellow-poplar. The dark-toned conifers are presumably shortleaf, Virginia, or pitch pines. Natural stands of loblolly pine are not found in extreme northeast Georgia.

These illustrations also show the edge of a large reservoir; a large dam and spillway are visible at the top center of each photograph. On the panchromatic print, water in the reservoir and drainage channel appears in a normal grav tone. while it shows up typically black on the infrared exposure.



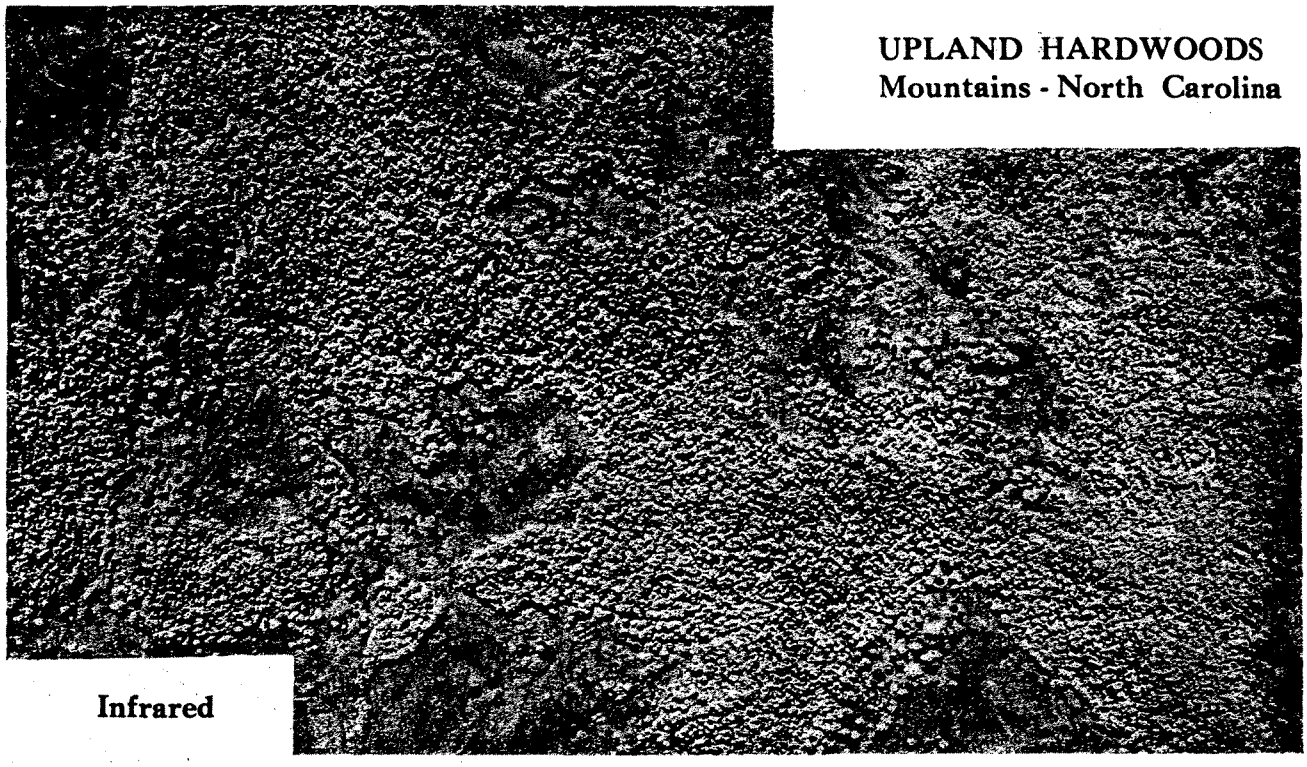
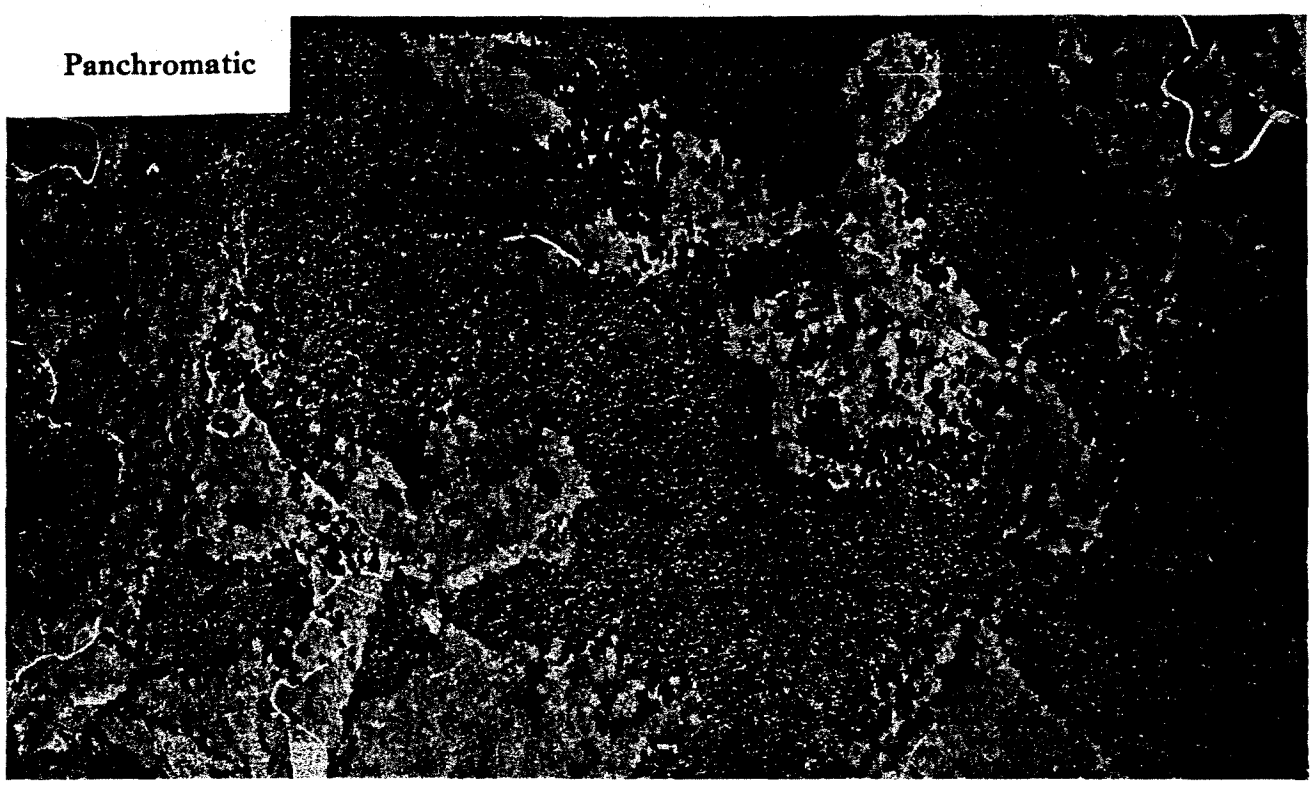
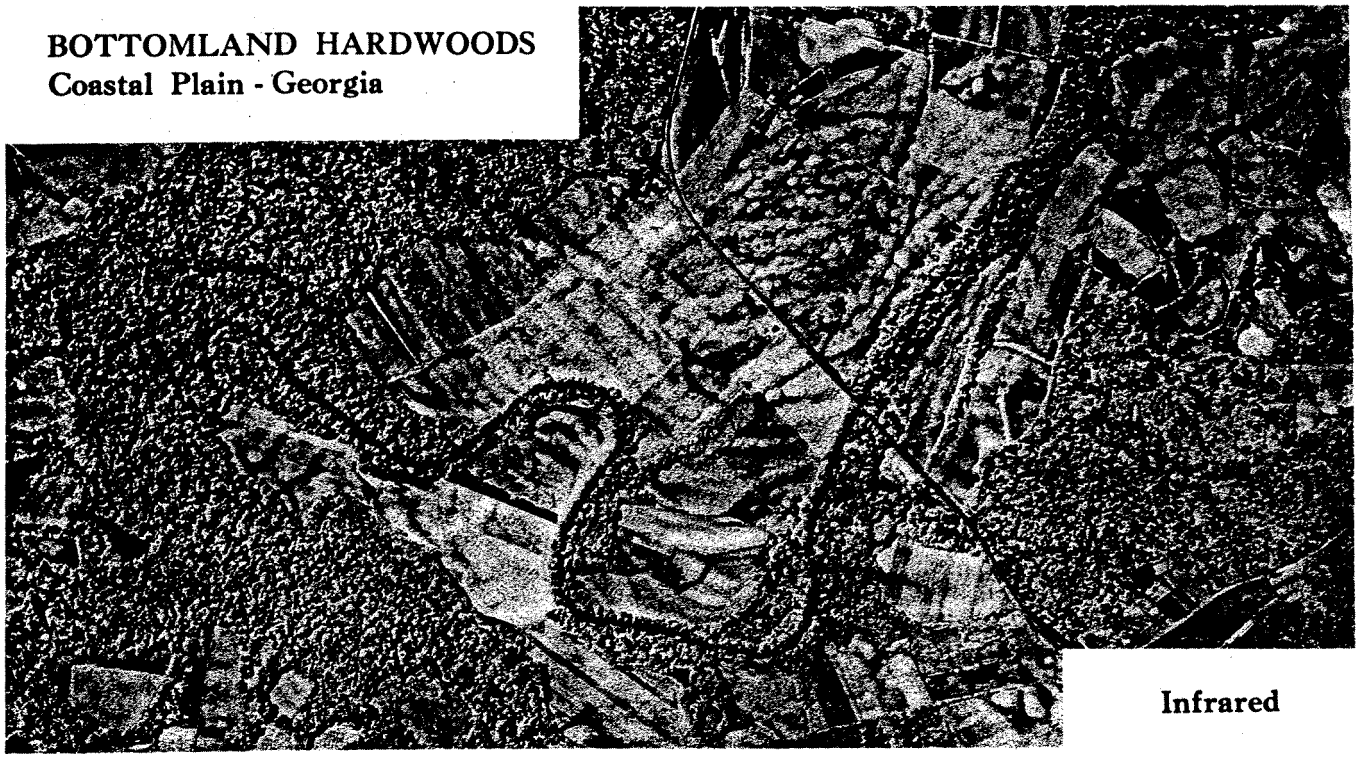


Figure 7.—These photographs from western North Carolina show stands of essentially pure upland hardwoods on ridge tops and upper slopes, while the valleys and lower slopes are devoted to pasture and cropland. Here again, oaks and hickories predominate, with yellow-poplar occurring frequently in coves and on the better, moist sites. Note that roads, trails, and field boundaries are much more easily traced on the panchromatic photograph than on the infrared print.



BOTTOMLAND HARDWOODS
Coastal Plain - Georgia



Infrared

Figure 8.-Species such as cypress, gums, oaks, maples, and magnolias are commonly found in lowland areas and along stream bottoms of the Coastal Plain. Loblolly or spruce pines may also occur in mixture with these hardwoods, as evidenced by the patches of dark crowns at the top of the infrared photograph.

Bottomland hardwood sites are characterized by meandering streams, oxbow lakes, and standing water. Except for cypress-gum stands, heavy shadows and wet soils usually result in photographic tones that are darker than for upland hardwoods, particularly on infrared photographs.

Panchromatic

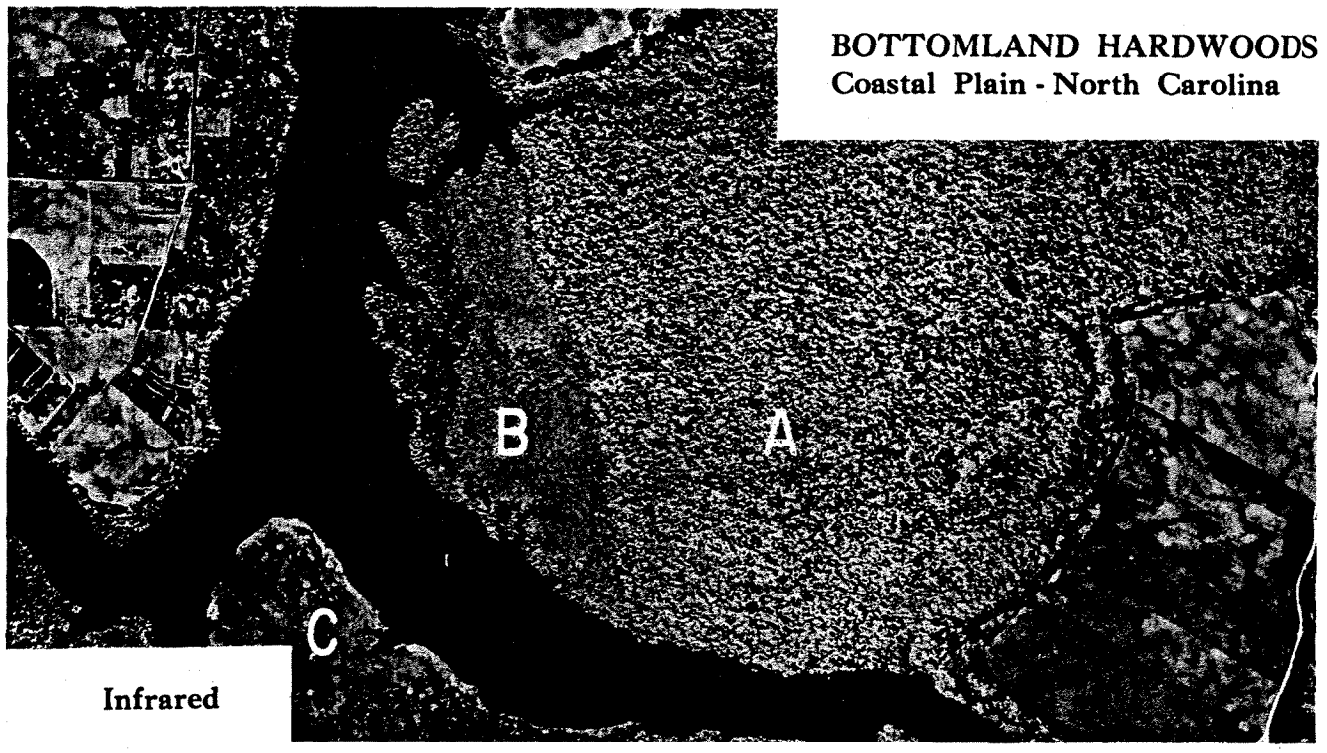


Figure 9. — Individual bottomland hardwood species are rarely separable except where they occasionally occur in pure stands. However, some inferences may be made with regard to type where sharp tonal boundaries exist as on the infrared print above. In areas marked "A," pines are growing in mixture with oaks and gums on relatively welldrained sites; the recently-vegetated flood-plain at "B" is likely to support such wet-site species as gums, cypress, or sycamore; and "C" represents a marshy flat that is currently unsuitable for tree growth.

Cypress can ordinarily be identified only when it occurs in pure stands, as in the small coastal "ponds" that resemble the Carolina bays. When viewed stereoscopically on high-quality photographs, cypress crowns exhibit a light-toned, roughly star-shaped appearance, somewhat like that of tropical palms.

Table 1.—*Scale conversions for vertical aerial photographs* [1]

Representative fraction. (scale)	Feet per inch	Chains per inch	Inches per mile	Acres per square inch	Square miles per square inch
(1)	(2)	(3)	(4)	(5)	(6)
1: 7,920	660.00	10.00	8.00	10.00	0.0156
1: 8,000	666.67	10.10	7.92	10.20	0.0159
1: 8,400	700.00	10.61	7.54	11.25	0.0176
1: 9,000	750.00	11.36	7.04	12.91	0.0202
1: 9,600	800.00	12.12	6.60	14.69	0.0230
1: 10,000	833.33	12.63	6.34	15.94	0.0249
1: 10,800	900.00	13.64	5.87	18.60	0.0291
1:12,000	1,000.00	15.15	5.28	22.96	0.0359
1:13,200	1,100.00	16.67	4.80	27.78	0.043 4
1: 14,400	1,200.00	18.18	4.40	33.06	0.05 17
1:15,000	1,250.00	18.94	4.22	35.87	0.0560
1:15,600	1,300.00	19.70	4.06	3 8.80	0.0606
1: 15,840	1,320.00	20.00	4.00	40.00	0.0625
1:16,000	1,333.33	20.20	3.96	40.81	0.0638
1: 16,800	1,400.00	21.21	3.77	45.00	0.0703
1:18,000	1,500.00	22.73	3.52	51.65	0.0807
1: 19,200	1,600.00	24.24	3.30	58.77	0.0918
1:20,000	1,666.67	25.25	3.17	63.77	0.0996
1:20,400	1,700.00	25.76	3.11	66.34	0.1037
1:21,120	1,760.00	26.67	3.00	71.11	0.1111
1:21,600	1,800.00	27.27	2.93	74.38	0.1162
1:22,800	1,900.00	28.79	2.78	82.87	0.1295
1: 24,000	2,000.00	30.30	2.64	91.83	0.1435
1:25,000	2,083.33	31.57	2.53	99.64	0.1557
1:31,680	2,640.00	40.00	2:00	160.00	0.2500
Method of calculation	$\frac{RFD}{12}$	$\frac{RFD}{792}$	$\frac{63,360}{RFD}$	$\frac{(RFD)^2}{6,272,640}$	$\frac{Acres/sq.\ in.}{640}$

[1] Conversions for scales not shown can be made from' the relationships listed at the bottom of each column. Using the scale of 1:7,920 as an example (col. 1, line 1), the number of feet per inch is computed by dividing the representative fraction denominator (RFD) by 12 (no. of inches per foot). Thus, $7,920 \div 12 = 660$ feet per inch (col. 2). By dividing the RFD by 792 (inches per chain), the number of chains per inch is derived (col. 3). Other calculations can be made similarly. Under column 4, the figure 63,360 represents the number of inches in one mile; in column 5, the figure 6,272,640 is the number of square inches in one acre; and in column 6, the number 640 is acres per square mile.