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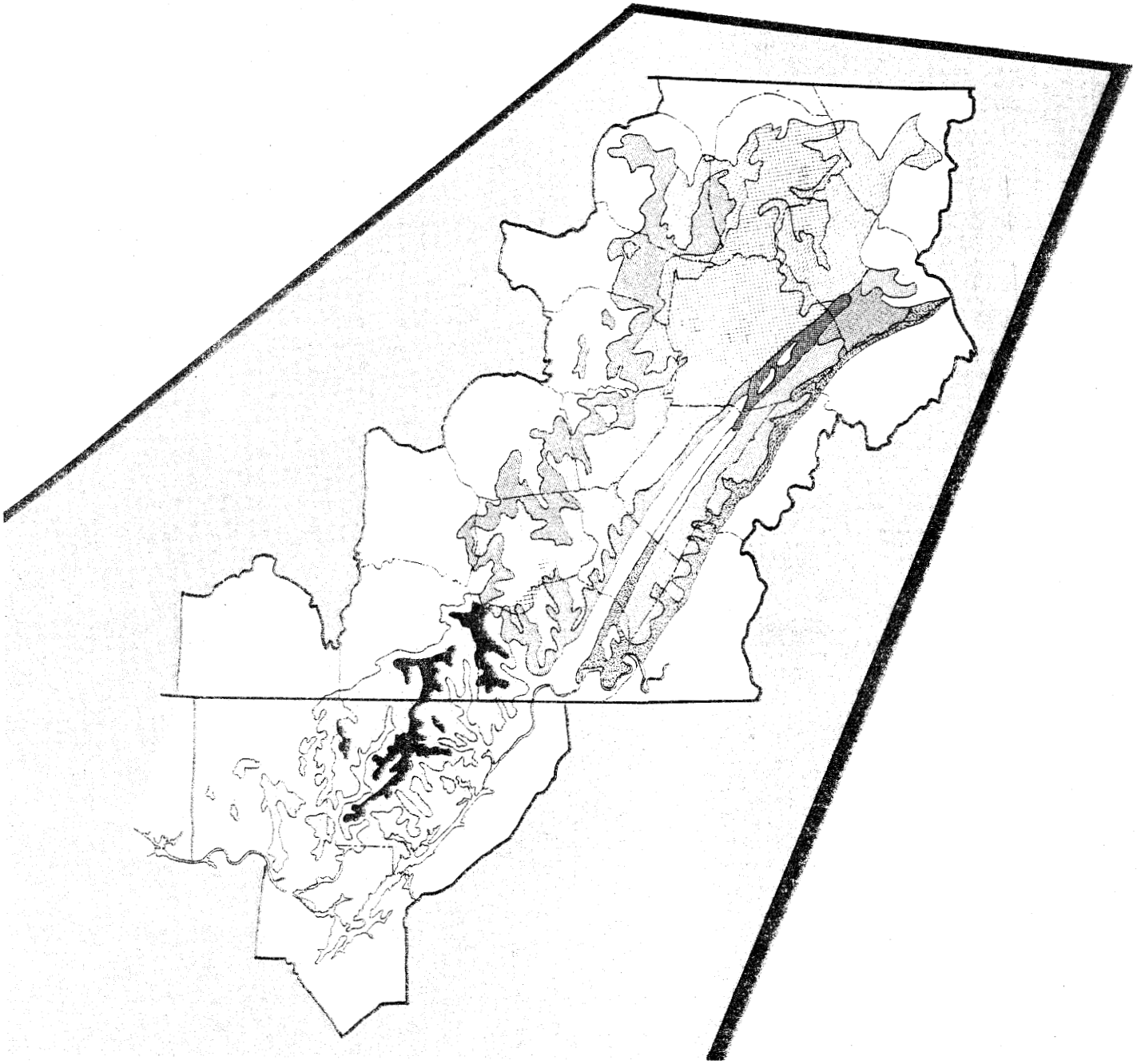
Classification and Evaluation of Forest Sites on the Mid-Cumberland Plateau

Glendon W. Smalley



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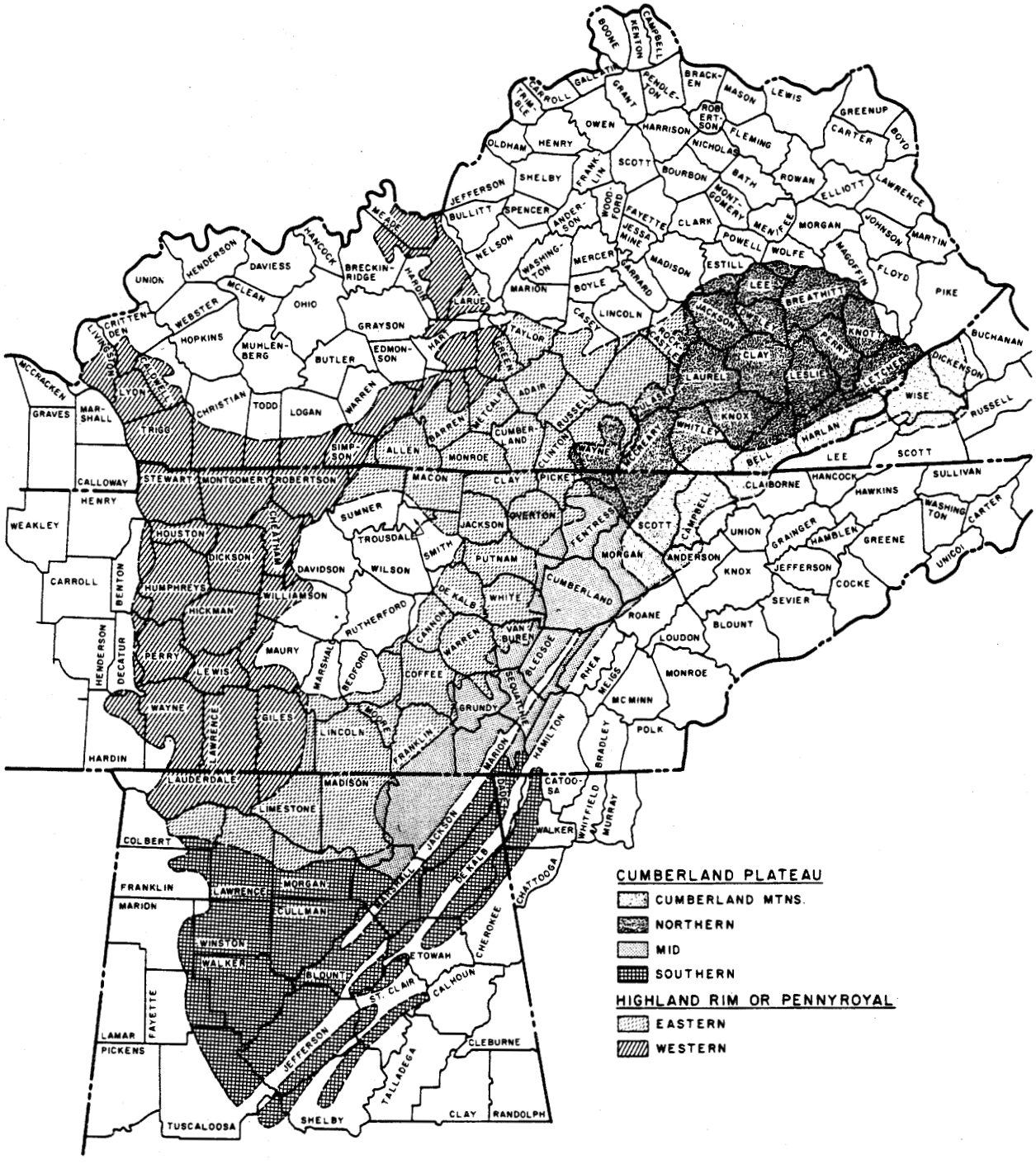

Figure 1—*Physiographic provinces and regions of the Interior Uplands.*

Classification and Evaluation of Forest Sites on the Mid-Cumberland Plateau

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INTRODUCTION

This report classifies and evaluates forest sites on the Mid-Cumberland Plateau (fig. 1) for the management of a number of commercially valuable tree species. It provides forest managers with a land classification system that will enable them to (1) subdivide forest land into logical segments (landtypes) each having about equal productivity, (2) rate productivity, and (3) recognize any limitations and hazards that the landtypes impose on forest management activities. Although soils information is an integral part of this system, users will not need to identify and classify soils or to make laboratory determinations. This report is oriented to timber production because timber is usually a major management objective. However, landtypes can also be the basis for the management and interpretation of other forest resources.

I have drawn freely on much published information on geology, physiography, soils, sites, and yields. In many cases, data specific to this area were not available and information was extrapolated from adjacent regions. Extrapolation was necessary with productivity data in particular. All data sources are documented so the user can gauge the accuracy and reliability of the information.

Productivity and management problem information is presented in a format that follows the outline used by the Soil Conservation Service (SCS) in the Woodland Suitability sections of county soil surveys. This similarity should facilitate the integration of information contained in county soil surveys[1] into this classification system.

This guide represents the best information and collective judgment now available. Nevertheless, it is still incomplete. I trust that forest managers will share their experience with me after applying this site classification system and alert me to shortcomings or needed revisions.

The rationale and methodology for the development of a site classification system for the Interior Uplands appeared in the proceedings of the Second Central Hardwood Forest Conference (Smalley 1978) and the Forest Soils and Site Quality Workshop (Smalley 1979a). Site classification guides for the Southern Cumberland Plateau Region and the Western Highland Rim and Pennyroyal Region have also been published (Smalley 1979b, 1980).

MID-PLATEAU REGION

The Mid-Plateau region covers about 4,450 mi^2, in all or part of 18 counties in Tennessee and 3 in Alabama. The region extends south to north from about north latitude 34°25′ to 36°30′ and east to west from about west longitude 84°35′ to 86°40′. It extends from near Oneida in Scott County, Tenn., to the Tennessee River in Marshall County, Ala., a distance of about 180 mi (fig. 2).

The Mid-Plateau consists of nearly all of the Cumberland Plateau in Tennessee plus that portion in northern Alabama lying north and west of the Tennessee River (Fenneman 1938).

The northern boundary of the Mid-Plateau is about on a line from Oneida to Jamestown in Fentress County. This line marks the northern limit of the undulating, submaturely dissected portion of the Plateau. Here the more dissected western margin of the Plateau has widened until it extends nearly to the western side of the Cumberland Mountain Region (fig. 2). The Cumberland Mountains are easily distinguished by elevation and relief because they are higher and more rugged than the adjacent Plateau. The southern boundary of the Mid-Plateau region is the Tennessee River.

The eastern edge of the region is an escarpment (Cumberland Front), which is straight to smoothly curving and only slightly notched by drainages that empty eastward into the Tennessee River. East of the Mid-Plateau is the Ridge and Valley physiographic province. In contrast, the western edge facing the Eastern Highland Rim, is a very ragged escarpment deeply incised by coves cut by tributaries of the Cumberland, Duck, and Elk Rivers.

The Mid-Plateau is cleft by the Sequatchie Valley, but this limestone valley is considered part of the Ridge and Valley physiographic province.

[1] See Appendix for available soil surveys.

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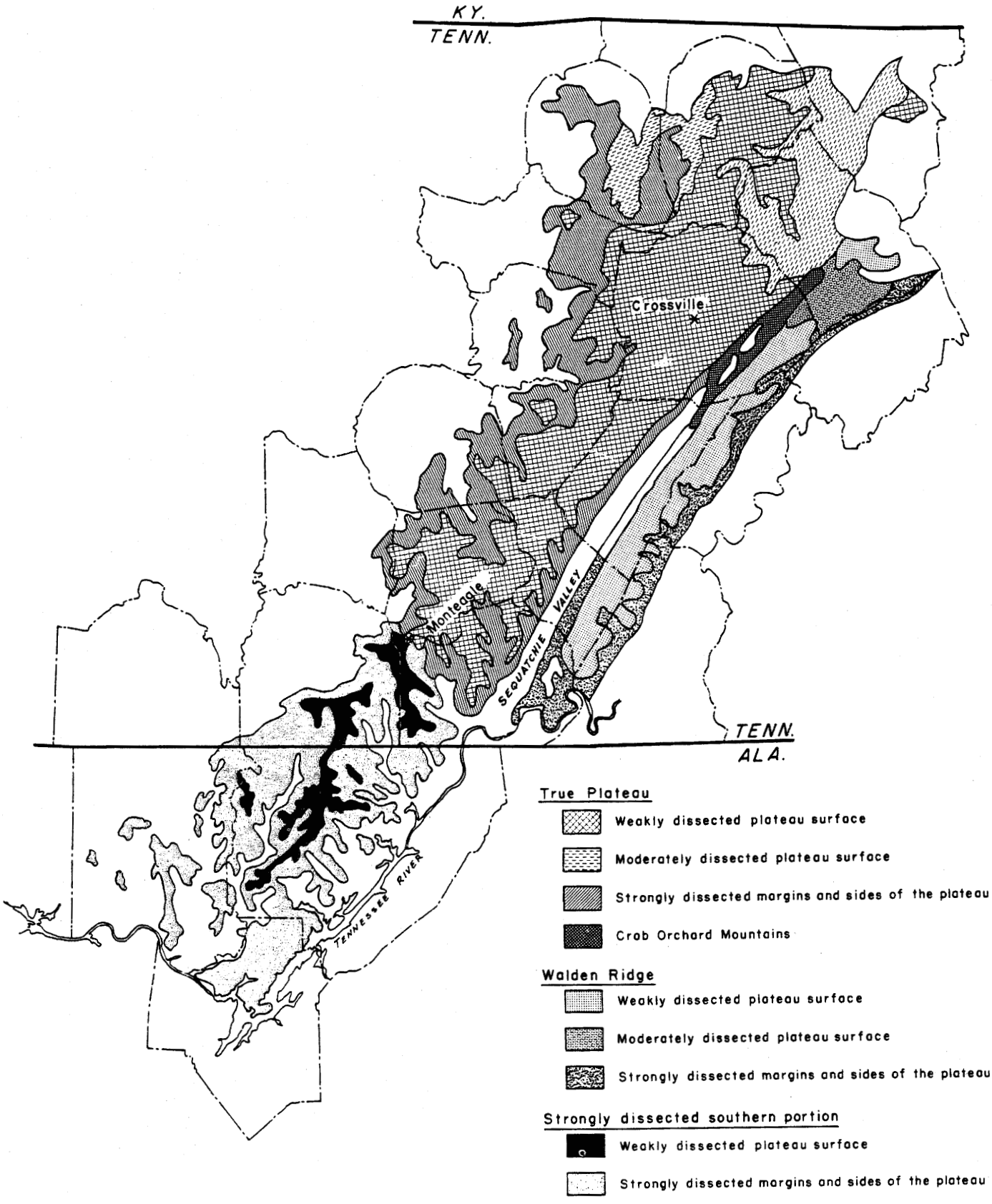

Figure 2—*Subregions and landtype associations of the Mid-Cumberland Plateau region and location of weather stations.*

Climate

The region has a temperature climate characterized by long, moderately hot summers, and short, mild winters. According to Thornthwaite's (1948) classification of climate, it is humid mesothermal. Daily and seasonal weather is controlled largely by alternating cold, dry continental air masses from Canada and warm, moist air from the Gulf of Mexico. During the summer, complete exchanges of air masses are few, and tropical maritime air masses persist for extended periods. Tables 1 and 2 show average monthly and annual precipitation and temperature values, average frost-free periods, and elevation above sea level for two stations in Tennessee (fig. 2).

Mean temperature for the region is about 56°F. The date of last freeze is mid April and the date of first freeze is mid to late October. The frost-free period ranges from 160 to 200 days. The temperature often falls below freezing at night in December, January, and February. The ground freezes to a depth of 2 to 6 in. several times during the average winter season and commonly remains frozen for 2 to 12 days. While air temperature does not appear to vary much across the region, local temperatures vary considerably because of elevation, aspect, and cloud cover. Midafternoon temperatures in the summer range from 5 to 7 degrees lower on the Plateau than in the adjacent limestone valleys or on the Eastern Highland Rim.

Southerly winds prevail from May to September; northerly winds from November to March. Average velocity ranges from 5 to 10 mi/h. Infrequent severe winds are usually associated with late spring and summer thundershowers.

Annual precipitation averages about 59 in. and ordinarily is fairly well distributed throughout the year, but short periods of very wet or very dry weather are common. Rainfall decreases slightly from south to north. Precipitation is greatest from December through March. Least precipitation is from August through October. Thunderstorms with high-intensity rainfall and occasionally hail occur on more than 50 days each year, mostly in the late spring and summer months. Snowfall seldom exceeds a few inches and melts in a few days. Soils are wettest from December to April and driest from July to October. Tree growth is commonly retarded because of insufficient soil moisture for periods of a few to several days up to six times each growing season.

Soil dryness during the growing season can also be shown by "frequency of drought days" data (Knetsch and Smallshaw 1958). A drought day is a day when precipitation and evapotranspiration data indicate that soil moisture content is below the wilting point. At Sewanee (6 miles southwest of Monteagle, Tenn.) drought days are most likely in August, when the probability of 10 drought days per month is 27 percent. The next highest probability of drought days is in June, July, and September when the probability of 10 drought days is 15 to 18 percent. At Crossville, drought days are most likely in July, August, and October when the probability of 10 drought days per month is 16 to 18 percent. These low probabilities indicate that precipitation on the Plateau is well-distributed throughout the growing season in most years. These data were calculated for soils having 4 inches of available moisture storage. The probability of drought will be greater on soils with less storage capacity and vice vera.

Nearly all surface streams on the Plateau stop flowing in late summer and autumn.

Geology, Topography, and Soils

The Plateau is capped by Pennsylvanian rocks, but Mississippian rocks crop out on lower slopes below the escarpment. Rocks of Cambrian-Ordovician age are exposed in the Sequatchie Valley, and Cambrian strata have been thrust to the surface along the eastern escarpment (Wilson and Stearns 1958).

Bedrock of the Plateau surface is sandstone, shale, and conglomerate belonging to the Gizzard, Crab Orchard Mountains, and Crooked Fork Groups. Age of surface rocks decreases from south to north (Swingle and others 1966).

The southern half of the Mid-Plateau consists of a thin overthrust sheet of Pennsylvanian rocks. The northern limit of this overthrust sheet is a complex series of faults that cross the Plateau from Elverton on the east to Spencer on the west. The thrust sheet is known to extend southward at least to Alabama. North of the fault complex and west of the Cumberland Mountain Region is an area undisturbed by thrust faulting.

Table 1.—*Average monthly and annual precipitation in inches for two weather stations on the Mid-Cumberland Plateau*[a]

Station and County	Years of Record	Elevation Ft.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Monteagle															
Grundy, TN	38	1940	6.37	6.18	6.59	5.54	4.31	4.29	5.45	4.23	3.92	3.13	4.72	6.25	60.98
Crossville															
Cumberland, TN	65	1810	5.62	5.51	6.08	5.08	4.16	4.48	5.09	4.09	3.98	2.75	4.38	5.60	56.82

[a]U.S. Department of Commerce (1976).

Table 2.—*Average monthly and annual temperature in °F and length of warm period for two weather stations on the Mid-Cumberland Plateau*[a]

Station and County	Years of Record	Jan.	Feb.	Mar.	Apr.	May.	June	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Year	Warm Period Days[b]
Monteagle Grundy, TN	38	38	40	47	58	66	72	75	74	69	59	47	39	57	199
Crossville Cumberland, TN	63	34	36	44	55	63	70	73	72	66	56	45	36	45	159

[a]U.S. Department of Commerce (1976).
[b]Mean period from last 32° F to first 32° F.

This geologic break would seem to be a logical division between the Northern and Mid-Plateau Regions. However, soils formed from these overthrust rocks are no different than those formed in the undisturbed area (Elder and Springer 1978). Consequently, the boundary between the Northern and Mid-Plateau Regions is defined mostly by the degree of surface dissection.

The Sequatchie Valley, which bisects the Plateau, is a subsidiary (deeper seated) break in the Cumberland Plateau overthrust system. Rocks from the southeast were pushed up and over rocks to the northwest along a break that is now the west side of the Sequatchie Valley. This overriding block was folded into an arch or anticline. The southeast flank dips gently, but the northwest flank is steep and locally even vertical. Along most of the crest of this anticline, resistant Pennsylvanian rocks were broken or finally eroded, exposing less resistant carbonate rocks into which the Sequatchie River has cut. At the head of the Valley, Pennsylvanian strata have been locally breached and erosion has cut into the underlying Mississippian carbonate rocks, forming Grassy and Crab Orchard Coves. Essentially Grassy Cove is a 3,800-acre sinkhole (Lane 1953). Northeast of these coves are the Crab Orchard Mountains, representing the unbreached northern end of the Sequatchie Valley anticline. Other lower mountains (Peavine, Hatfield, Chestnut Oak Ridge, and Cardiff Ridge) represent the remains of surficial anticlines of the Cumberland Plateau overthrust sheet (Wilson and Stearns 1958).

Topography of the Mid-Plateau ranges from gentle to rugged and complex, and slope varies from nearly level to very steep. Depressions are common on the undulating Plateau surface. Sinkholes have developed along the ragged western edge and on the deeply dissected southern portion, where the sandstone caprock is thin or absent and limestone exposed. Relief is commonly 100 to 400 ft in the interior of the Plateau, and is 1,000 ft or more at the escarpments bordering the Highland Rim and Ridge and Valley physiographic provinces.

The undulating Plateau surface averages 1,700 to 2,000 ft above sea level in Tennessee but declines southward to less than 1,500 ft in northern Alabama. Some crests of the Mid-Plateau, particularly the Crab Orchard Mountains, exceed 2,200 ft. Highest elevations are associated with the mountains at the northern end of the Sequatchie Valley. Several peaks exceed 2,600 ft; Hinch Mountain is the highest with an elevation of 3,040 ft. The floor of Grassy Cove is about 1,600 ft.

On the Mid-Plateau, upland soils have developed from a variety of sedimentary rocks. Soils derived from sandstone and conglomerate are common in the south, central, and northwest sections of the Plateau, where surface rocks are thick sandstone members of the Crab Orchard group. Soils derived from shale members of the Crooked Fork group are heavier textured than those derived from sandstone. These clayey soils are recognized in a distinctive series of landtypes and occur from northern Rhea and southeastern Cumberland Counties, Tenn. northward along the western edge of the Cumberland Mountains. Inextensive areas of shale-derived soils also occur south of highway I-24, where thick shale members of the Gizzard group are exposed (Wilson and Stearns 1958, Swingle and others 1966).

Soils vary from deep to shallow and are mostly well drained. All are acid and low in fertility. Common soils are Hartsells, Albertville, Lonewood, Ramsey, Hector, and Gilpin. Smooth areas are suited to agriculture, but forests occupy 65 percent to as much as 85 percent of Mid-Plateau counties (Hedlund and Earles 1971, 1973).

There are no extensive floodplains or terraces associated with the drainage network. Most permanent streams have cut deep V- or narrow U-shaped channels, usually rimmed with sandstone ledges. Floodplains are long and narrow. Soils are deep, moderately well drained to well drained, and moderately fertile. Common soils are Sewanee, Ealy, and Clifty.

Below the Plateau escarpment are steep, rock-strewn colluvial slopes. All are forested except for a few benches. Productivity varies greatly with aspect and slope position. Soils on upper slopes developed in colluvium from sandstone-, siltstone-, and shale-derived soils; on lower slope, soils developed in residuum from limestone. Common soils are Grimsley, Jefferson, Bouldin, and Allen.

Gradient, aspect, slope length, and soil moisture are important factors in the delineation of landtypes described later. Slope and topography affect the rate and amount of both surface runoff and subsurface movement of soil water. Soil loss by erosion increases as

slope gradient and length increase. Although surface runoff is rare under forested conditions, it is an important factor during road construction, logging, and other forest management operations. Soils on steep slopes are often shallower than soils on more nearly level terrain. Deposition of sediments on gentle terrain by surface runoff is greatest below the longer and steeper slopes.

Generally, the steeper the gradient and the longer the slope, the greater the subsurface flow of soil water downslope. As a consequence, plants on lower slopes grow for longer periods without moisture stress. Subsurface flow may result in excessively wet soil with poor aeration at the base of long slopes. Lower slopes below the Plateau escarpment are an exception. Here, soil water percolates deep into the porous limestone instead of moving downslope in the soil.

Aspect affects air and soil temperatures. Soil temperatures tend to be lower on north-facing than on south-facing slopes. In deep, narrow gorges that cleft the Plateau surface, shading is an important site factor because it mollifies the usual warm microclimate of south and west slopes to one more nearly like cool north and east slopes. Because soils on north-facing slopes tend to retain moisture for longer periods during the growing season, both rate of tree growth and species composition are better on north-facing than on south-facing slopes.

In soil taxonomy, temperature regime is one of several differentiae used to group soils within a subgroup having similar physical and chemical properties (Soil Survey Staff 1975). On the Mid-Cumberland Plateau, two soil temperature classes are recognized—mesic and thermic. Mean annual temperature of mesic soils ranges from 8° to 15° C (47° to 59° F) and thermic soils from 15° to 22° C (59° to 72° F). Both classes also have a difference of 5° C (9° F) or more between mean summer and mean winter soil temperature. All temperature measurements are at a depth of 50 cm or at a lithic or paralithic contract, whichever is shallower.

Nearly all soils mapped in the Alabama portion of the Mid-Plateau are thermic. In Tennessee, mean annual soil temperature on the Plateau is less than 15° C, but both mesic and themic soils are recognized.

Vegetation

Braun (1950) assigned the Cumberland Plateau in Tennesee and northern Alabama to the Cliff Section of the Mixed Mesophytic Forest Region, although mixed oak and oak-hickory communities were dominant and mixed mesophytic communities were restricted to coves or gorges. This assignment was made on the supposition that mixed mesophytic communities would be dominant when the Plateau became maturely dissected. It would have been more meaningful to classify and map existing vegetation patterns, not those which may develop millenia from now.

Researchers have studied vegetation of the Mid-Plateau extensively in recent years, but they have emphasized the cove communities (e.g., Caplenor 1979, Quarterman and others 1972, Schmalzer and others 1978). Compared to the coves, the pine and hardwood communities on the submaturely dissected Plateau surface have been little studied (McCarthy 1976, Smith 1977, Wade 1977).

All of these studies have sought to identify and classify existing forest communities, i.e., typical descriptive botanical studies. Some investigators have used correlation and/or multiple regression techniques to predict the importance of overstory species to soil and topographic factors. Except for the effort by the SCS to determine mean site indices of selected tree species by soil series, no attempt has been made to determine relative or absolute productivity of Plateau forest sites other than on a regional basis (Hedlund and Earles 1971, 1973).

SUBREGIONS AND LANDTYPE ASSOCIATIONS

Subregions

The Sequatchie Valley and Crab Orchard Mountains form a convenient line for subdividing the Mid-Plateau region. That part of the plateau west of the Sequatchie Valley is called by the name applied to the whole—The Cumberland Plateau—which is the typical or *True Plateau* (Subregion 1). That part of the plateau east of the Sequatchie Valley is called *Walden Ridge* (Subregion 2), named for Elijah Walden, one of the famous "Long Hunters" of the Daniel Boone era (Luther 1977). Southwest of Battle Creek on highway I-24 on a line from Kimball to Monteagle, Tenn. the plateau is so dissected it bears little resemblance to a plateau. This *Strongly Dissected Portion* is Subregion 3 (fig. 2).

1. The *True Plateau* has an undulating surface submaturely dissected by young valleys whose steepness and depth increase toward the Plateau edges. Only a few drainages such as Battle Creek and the Little Sequatchie River have breached the east-facing escarpment of the Sequatchie Valley. On the west the escarpment is cleft by many deep coves, which penetrate the Plateau for miles. These coves usually end in box canyons, where streams cascade over the sandstone escarpment. Some of the waterfalls are scenic attractions. Fall Creek Falls in Van Buren County, Tenn. is 256 ft in height—more than twice as high as Niagara Falls (Luther 1977). Sinkholes are common along the western margin, where the sandstone cap is thin or absent and limestone exposed.

For convenience the Crab Orchard Mountains and other lesser mountains associated with the Sequatchie Valley anticline and the Cumberland Plateau overthrust sheet (Wilson and Stearns 1958) are included in Subregion 1.

2. *Walden Ridge* is more dissected than the True Plateau. Nearly all surface drainage is southeastward

into the Tennessee River. The surface is dissected by young valleys whose steepness and depth increase toward the escarpment. A few streams have formed short box canyons, and everywhere streams cascade over the sandstone escarpment in scenic waterfalls. South of the Tennessee River gorge, Walden Ridge becomes Sand Mountain, which was classified as the Table Plateau Subregion in the Southern Cumberland Plateau regional guide (Smalley 1979b).

3. In the *Strongly Dissected Portion* maturely dissected, strongly sloping land predominates, and surface drainage is mostly southward to the Tennessee River. Steep, rocky coves and broad limestone valleys comprise most of the drainage network. The limestone valleys belong to the adjacent Ridge and Valley or Eastern Highland Rim physiographic regions. The small proportion of undulating land on the Plateau surface is dissected by young valleys whose steepness and depth increase toward the escarpment. Waterfalls are common throughout the subregion where streams cascade over the sandstone escarpment. Outliers are common; Monte Sano Mountain east of Huntsville, Ala. is a good example. These outliers are remnants of the Plateau that have been cut off during past erosion cycles. Some outliers have had the sandstone caprock eroded away and appear as limestone knobs and ridges projecting above the surrounding surface of the Eastern Highland Rim and Sequatchie Valley.

Landtype Associations

Each subregion was further divided into landtype associations (LTA) that correspond closely to soil associations shown on general soil maps of Alabama and Tennessee (Hajeck and others 1975; Elder and Springer 1978). Landtype associations A and C occur in all three Subregions. LTA-B occurs in Subregions 1 and 2, and LTA-D occurs only in Subregion 1 (table 3).

A. *Weakly Dissected Plateau Surface.* This LTA corresponds to soil association H11 (Hartsells-Lonewood-Ramsey-Gilpin) in Tennessee and extends south into northeastern Alabama, where it merges with soil association 12 (Hartsells-Linker-Albertville). Also included is soil association 14 (Hartsells-Wynnville-Albertville) on Gunters Mountain in Marshall County, Ala., and two areas of soil association H12 (Hartsells-Ramsey-Gilpin) near Huntsville in Scott County and Wartburg in Morgan County, Tenn.

Landtype Association-A consists mostly of broad undulating to rolling ridges flanked by gentle to moderately steep side slopes. Only the larger creeks and rivers have perennial flow. Valleys in the upper reaches of stream systems are U-shaped and may contain poorly drained flats. Further downstream, cross sections become narrow U- to V-shaped and channels are usually bounded by outcrops of sandstone.

Undulating parts of LTA-A have moderately deep to deep, well drained, loamy soils, while steeper parts have shallower soils. Soils developed mostly in residuum from sandstone and, in places, from siltstone or shale.

Smoother parts have been cleared for agriculture, particularly in the vicinity of Crossville, Tenn. and Skyline, Ala. There is considerable acreage of abandoned fields that is reverting to woodland. Fifteen landtypes are recognized: 1–15.

B. *Moderately Dissected Plateau Surface.* This LTA corresponds to soil association H22 (Ramsey-Hartsells-Grimsley-Gilpin) in Tennessee.

Landtype Association-B consists of narrow to moderately broad ridges flanked by moderately steep to steep side slopes. Stream channels are incised into the Plateau surface and cross sections are narrow U- or V-shaped and bounded by sandstone ledges. Close to the Plateau edge, stream channels are narrow and steep-sided, and end abruptly at the Plateau escarpment.

Landtype Association-B occurs in a wide band bordering the Cumberland Mountain region in Morgan and Scott Counties, Tenn. It is also associated with the Obey River in Overton and Fentress Counties, Tenn. In the latter area, LTA-B replaces LTA-C as the transition zone between the Plateau top and the Eastern Highland Rim.

The well drained, loamy, and stony soils are derived from sandstone and shale. Landtype Association-B has a higher portion of shale-derived soils than does LTA-A.

Nearly all of LTA-B is forested. Most agricultural activity is classified as family subsistence. Fifteen landtypes are recognized: 1–15.

C. *Strongly Dissected Margins and Sides of the Plateau.* This LTA corresponds to soil association H21 (Bouldin-Rock outcrop-Ramsey) in Tennessee and soil association 13 (Hartsells-Rockland, limestone-Hector) in Alabama.

Landtype Association-C represents the strongly dissected margins of the Plateau above the escarpment and steep colluvial slopes below the escarpment. This LTA occurs on both the east and west sides of the Plateau and around the Sequatchie Valley and other coves that indent the Plateau. It is the dominant LTA in Subregion 3 (Strongly Dissected Portion).

On top of the Plateau, LTA-C consists mostly of narrow ridges flanked with steep side slopes. Stream channels are V-shaped and usually bounded by sandstone ledges.

The loamy, shallow to moderately deep soils are formed mostly in residuum from sandstone and, in places, from siltstone and shale.

Below the escarpment LTA-C consists of steep colluvial slopes with numerous rock ledges, boulders, and benches. These slopes extend from the sandstone escarpment down to the adjacent limestone valleys. Escarpment slopes may be exposed or sheltered in the deep gorges that penetrate the western side of the Mid-Plateau region.

Table 3.—*Subregions and landtype associations of the Mid-Cumberland Plateau region*

Subregion	Landtype association
1. True Plateau	A. Weakly dissected plateau surface B. Moderately dissected plateau surface C. Strongly dissected margins and sides of the plateau D. Crab Orchard Mountains
2. Walden Ridge	A. Weakly dissected plateau surface B. Moderately dissected plateau surface C. Strongly dissected margins and sides of the plateau
3. Strongly dissected portion	A. Weakly dissected plateau surface C. Strongly dissected margins and sides of the plateau

Soils on upper slopes are shallow to deep, loamy, well drained, and contain varying amounts of coarse fragments. The surface is strewn with sandstone rocks and boulders. These soils developed in colluvium and alluvium from soils on the Plateau top. On lower slopes the silty and clayey, flaggy soils are well drained to somewhat poorly drained and derived from clayey residuum from limestone. Limestone rockland is extensive.

Nearly all of LTA-C is forested. Some benches have been cleared, but most have reverted to woodland. Thirteen landtypes are recognized: 2–7 and 14–20.

D. *Crab Orchard Mountains*. This LTA includes the Crab Orchard Mountains and the peaks surrounding Grassy and Crab Orchard coves. It corresponds to the northern part of soil association H21 (Bouldin-Rockoutcrop-Ramsey) and a small portion of H22 (Ramsey-Hartsells-Grimsley-Gilpin).

Landtype Association-D consists of narrow to moderately broad mountain ridges flanked by moderately steep to very steep side slopes. Northwest-facing slopes tend to be steeper than southeast-facing slopes. Local relief is nearly 1,000 ft in places. These uplands are dissected by a moderately well developed dendritic drainage system. However, floodplains are narrow or nonexistent because of steep topography.

Loamy and clayey soils are well drained to somewhat excessively drained and derived from sandstone or shale residuum. Soils on steep mountain slopes developed in colluvium from alternating strata of sandstone and shale. Shaly talus slopes are common. Eight landtypes are recognized: 2–7 and 14–15.

LANDTYPES

I have divided each landtype association into landtypes, which are the smallest unit of the landscape recognized in this classiciation system. Wertz and Arnold (1975) describe landtypes as visually identifiable areas each being reasonably uniform in soils and productivity and resulting from similar climatic and geological processes.

The Mid-Cumberland Plateau has 20 landtypes distributed among three subregions and four LTA's (table 4). Some are common to all four associations, while others are characteristic of only one LTA. Figures 3 to 5 depict how these landtypes occur on the landscape in each of the LTA's.

Letters in the upper right-hand corner of each landtype description identify the LTA's in which each landtype occurs.

Aspect distinguishes some landtypes and is recorded as either north or south. North aspects include all azimuths from 315° (northwest) to 135° (southeast). The remainder of the azimuth circle represents south aspects.

Each landtype is described in terms of nine elements. The **Geographic Setting** provides an overall description of the landtype, specifying both where it occurs on the landscape and its relation to other landtypes. Slope was classified in accordance with SCS standards (Soil Survey Staff 1951).

Slope Classes and Correspnding Percent of Slope

Slope percent	Class
0–2	Level or nearly level
2–6	Gently sloping
6–10	Sloping
10–15	Strongly sloping
15–25	Moderately steep
25–45	Steep
45 +	Very steep

The most prevalent soil series are listed under **Dominant Soils.** These series names reflect the most recent designations in soil classification and link this site classification system with county soil surveys published by the SCS. Users who wish more detailed information can refer to soil series descriptions issued by the SCS.

The kind of **Bedrock** or **Soil Parent Material** and **Depth to Bedrock** are listed next. **Soil Texture** is described in terms of the 12 conventional classes, which are based on percentages of sand, silt, and clay-size particles (Soil Survey Staff 1951).

The conventional seven **Soil Drainage** classes are: *very poorly drained, poorly drained, somewhat poorly drained, moderately well drained, well drained, somewhat excessively drained,* and *excessively drained* (Soil Survey Staff 1951). **Relative Soil Water Supply** of each landtype is rated in five classes: *very low, low, medium, high,* and *very high*. This qualitative rating is

Table 4.—*Summary of landtypes and their occurrence by subregion and landtype associations*

Landtype number and name of subregion	Landtype association[a]
True Plateau	
1. Broad undulating sandstone uplands	A,B
2. Broad sandstone ridges—north aspect	A,B,C,D
3. Broad sandstone ridges—south aspect	A,B,C,D
4. Narrow sandstone ridges and convex upper slopes	A,B,C,D
5. North sandstone slopes	A,B,C,D
6. South sandstone slopes	A,B,C,D
7. Sandstone outcrops and shallow soils	A,B,C,D
8. Broad shale ridges—north aspect	A,B
9. Broad shale ridges—south aspect	A,B
10. Upper shale slopes—north aspect	A,B
11. Upper shale slopes—south aspect	A,B
12. Lower shale slopes—north aspect	A,B
13. Lower shale slopes—south aspect	A,B
14. Footslopes, terraces, and streambottoms with good drainage	A,B,C,D
15. Terrace, streambottoms, and depressions with poor drainage	A,B,C,D
16. Plateau escarpment and upper sandstone slopes and benches—north aspect	C
17. Plateau escarpment and upper sandstone slopes and benches—south aspect	C
18. Lower limestone slopes, benches, and spur ridges—north aspect	C
19. Lower limestone slopes, benches, and spur ridges—south aspect	C
20. Limestone outcrops and shallow soils	C
Walden Ridge	
1. Broad undulating sandstone uplands	A,B
2. Broad sandstone ridges—north aspect	A,B,C
3. Broad sandstone ridges—south aspect	A,B,C
4. Narrow sandstone ridges and convex upper slopes	A,B,C
5. North sandstone slopes	A,B,C
6. South sandstone slopes	A,B,C
7. Sandstone outcrops and shallow soils	A,B,C
8. Broad shale ridges—north aspect	A,B
9. Broad shale ridges—south aspect	A,B
10. Upper shale slopes—north aspect	A,B
11. Upper shale slopes—south aspect	A,B
12. Lower shale slopes—north aspect	A,B
13. Lower shale slopes—south aspect	A,B
14. Footslopes, terraces, and streambottoms with good drainage	A,B,C
15. Terraces, streambottoms and depressions with poor drainage	A,B,C
16. Plateau escarpment and upper sandstone slopes and benches—north aspect	C
17. Plateau escarpment and upper sandstone slopes and benches—south aspect	C
18. Lower limestone slopes, benches, and spur ridges—north aspect	C
19. Lower limestone slopes, benches, and spur ridges—south aspect	C
20. Limestone outcrops and shallow soils	C
Strongly dissected portion	
1. Broad undulating sandstone uplands	A
2. Broad sandstone ridges—north aspect	A,C
3. Broad sandstone ridges—south aspect	A,C
4. Narrow sandstone ridges and convex upper slopes	A,C
5. North sandstone slopes	A,C
6. South sandstone slopes	A,C
7. Sandstone outcrops and shallow soils	A,C
14. Footslopes, terraces, and streambottoms with good drainage	A,C
15. Terraces, streambottoms and depressions with poor drainage	A,C
16. Plateau escarpment and upper sandstone slopes and benches—north aspect	C
17. Plateau escarpment and upper sandstone slopes and benches—south aspect	C
18. Lower limestone slopes, benches, and spur ridges—north aspect	C
19. Lower limestone slopes, benches, and spur ridges—south aspect	C
20. Limestone outcrops and shallow soils	C

[a]See table 3.

based on the available water-holding capacity of the dominant soils (a function of soil texture and thickness), but allowances are made for the influence of soil drainage, topographic position, and aspect.

Soil fertility is described as *very low, low, moderately low, moderate, moderately high, high,* or *very high.* Because soils of the Mid-Cumberland Plateau are fairly acid and derived from rocks with few weatherable minerals, the most fertile soils in the region are rated only moderate (Francis and Loftus 1977).

The most common woody species in the overstory are listed under **Vegetation** in approximate order of abundance. Important understory species are listed also, including some distinctive herbaceous groups. Although not listed, reproduction of overstory species is usually present in the understory. Loblolly pine is native only in northern Alabama and southern Tennessee but has been planted north of its range on converted sites and abandoned fields. Species nomenclature follows Little (1979) and Fernald (1950).

FOREST MANAGEMENT INTERPRETATIONS

Each landtype is evaluated in terms of productivity for selected species of trees and species desirability for timber production. Also, each landtype is rated for five soil-related problems that may affect forest management operations.

Productivity

Productivity of commercially valuable species is expressed as site index and as average annual growth in cubic feet per acre. Site index is the total height attained by dominant and codominant trees at some specified age.

For all naturally occuring species, site indices are the means of values from soil survey interpretations for dominant soils in each landtype. Interpretations are issued by the SCS as part of each soil series description. SCS personnel obtained height and age measurements in well-stocked, even-aged, essentially unmanaged stands that had not been damaged excessively by fire, insects, disease, or grazing. These stands were located on soils representing, as nearly as possible, the modal concept of each soil series. SCS personnel then used published site index curves (Beck 1962; Broadfoot 1960, 1963; Broadfoot and Krinard 1959; Curtis and Post 1962; Defler 1937; Doolittle and Vimmerstedt 1960; Nelson and others 1961; Schnur 1937; Tennessee Valley Authority 1948[2]; and U.S. Forest Service 1929) to convert height and age data to site indices. Curves for all species are based on age 50 years. Sometimes when site indices were available for one species, estimates for other species were made by using Doolittle's (1958) site index comparisons. When necessary, I adjusted these SCS site index values for aspect and slope position based on experience and soil-site research (Carmean 1975).

Site indices, base age 25 years from seed, are given for loblolly and shortleaf pines in plantations established on abandoned fields (Smalley and Bower 1971) when data for specific landtypes were available. Also site indices, base age 25 years from seed, are given for eastern white pine plantations established on abandoned fields (Vimmerstedt 1962). These values were calculated by assuming that site index, base age 50 years, of plantations would be equal to site index of natural stands reported by the SCS. These base age 50 site indices were converted to base age 25 following Vimmerstedt's (1962, p. 5) instructions.

In a few cases when no values were available, site indices (base age 50 years) of important species were estimated. Where they occur in tables 5 to 24, these estimated values are enclosed in parentheses.

Average annual growth expressed in cubic feet per acre was calculated from available yield tables (Doolittle 1956, McCarthy 1933, Nelson and others 1961, Schnur 1937, U.S. Forest Service 1929, and Winters and Osborne 1935). The yield tables represent either normal or fully stocked conditions. Annual growth rates for all naturally occurring species or forest types were averaged over 50 years.

Average annual growth rates for loblolly and shortleaf pine plantations were derived from Smalley and Bailey's (1974a, 1974b) variable-density yield tables, and a planting density of 1,000 seedlings per acre was assumed. Average growth was based on 40 years, the oldest age reported in the yield tables. Average annual growth rates for eastern white pine plantations were derived from Vimmerstedt's (1962) variable-density yield tables, and a planting density of 1,037 seedlings per acre (6 × 7 feet spacing) was assumed. Average growth was based on 35 years, the oldest age reported in the yield tables.

Though our productivity data are the best available, all site curves and yield tables except those for plantation-grown loblolly and shortleaf pine were developed either for geographic areas larger than but including the Mid-Cumberland Plateau or for areas other than the Mid-Cumberland Plateau.

Yields were not expressed in a common merchantability standard, so care should be exercised in comparing average annual yields of species both within and between landtypes. Footnotes to tables 5 to 24 specify merchantability standards used.

Management Problems

Plant Competition rates the invasion of unwanted plants after openings are made in the canopy. Plant

[2]Site index curves for eastern redcedar based on data from 271 plots throughout the Tennessee River Valley

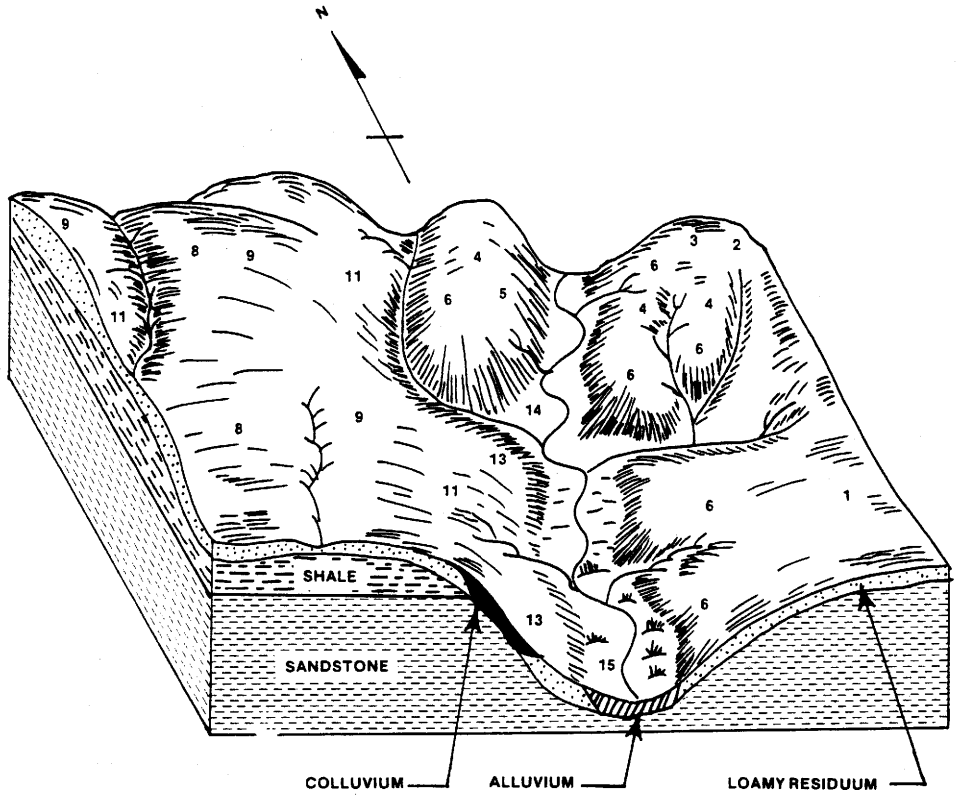

Figure 3—*Landtypes characteristic of Landtype Associations A (weakly dissected plateau surface) and B (moderately dissected plateau surface) in all subregions with soils formed from sandstone (right) and shale (left).*

LEGEND

1. Broad undulating sandstone uplands.
2. Broad sandstone ridges—north aspect.
3. Broad sandstone ridges—south aspect.
4. Narrow sandstone ridges and convex upper slopes.
5. North sandstone slopes.
6. South sandstone slopes.
8. Broad shale ridges—north aspect.
9. Broad shale ridges—south aspect.
11. Upper shale slopes—south aspect.
13. Lower shale slopes—south aspect.
14. Footslopes, terraces, and streambottoms with good drainage.
15. Terraces, streambottoms, and depressions with poor drainage.

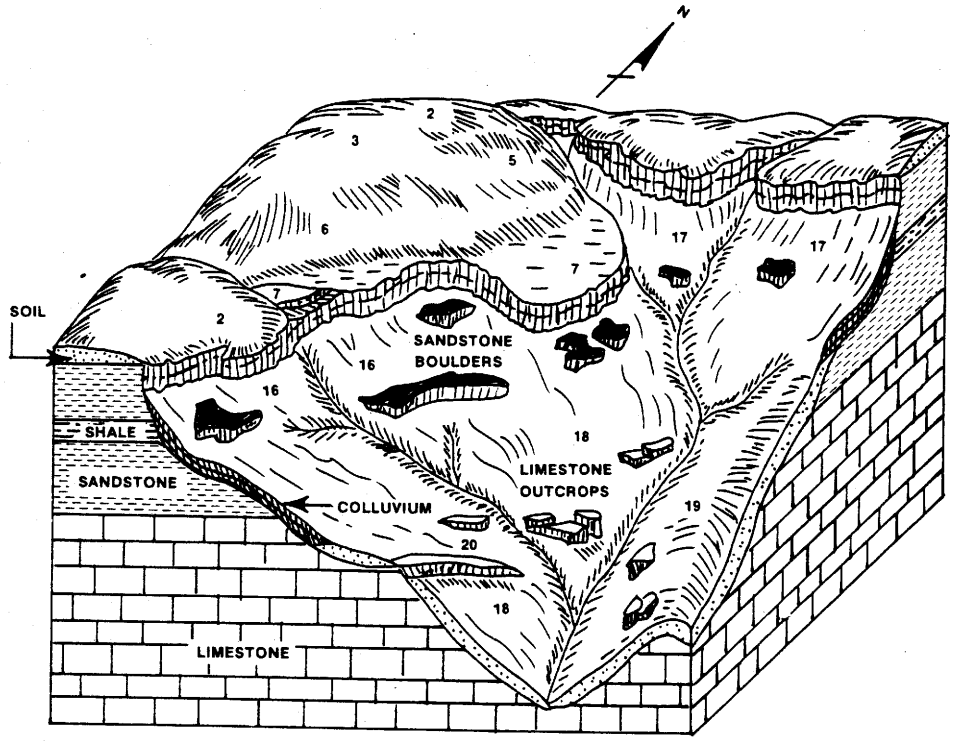

Figure 4.—*Landtypes characteristic of Landtype Association C (strongly dissected margins and sides of the plateau) in all subregions.*

LEGEND

2. Broad sandstone ridges—north aspect.
3. Broad sandstone ridges—south aspect.
5. North sandstone slopes.
6. South sandstone slopes.
7. Sandstone outcrops and shallow soils.
16. Plateau escarpment and upper sandstone slopes and benches—north aspect.
17. Plateau escarpment and upper sandstone slopes and benches—south aspect.
18. Lower limestone slopes, benches, and spur ridges—north aspect.
19. Lower limestone slopes, benches, and spur ridges—south aspect.
20. Limestone outcrops and shallow soils.

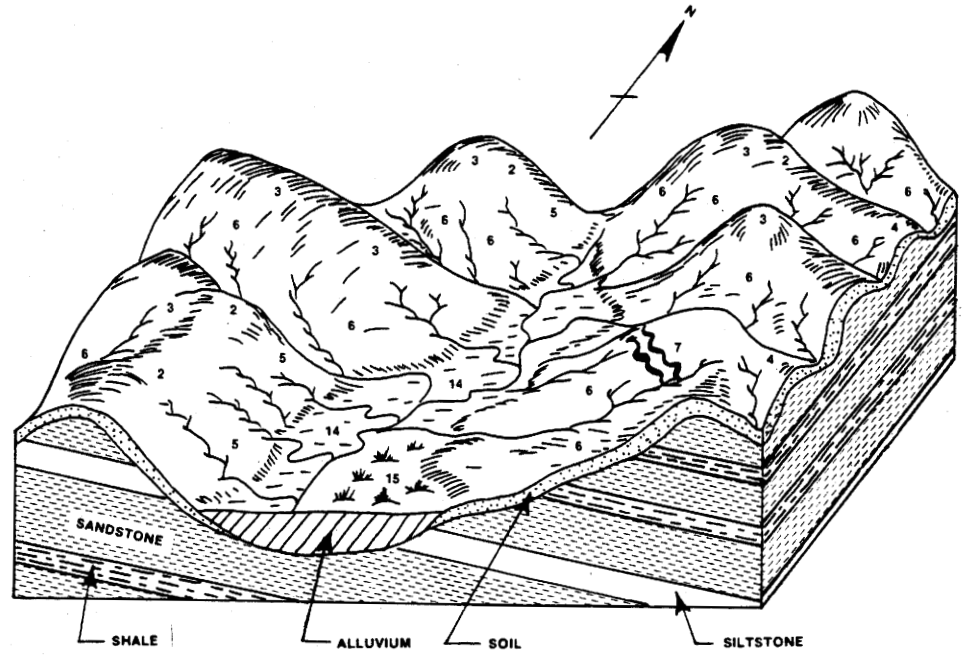

Figure 5.—*Landtypes characteristic of Landtype Association D (Crab Orchard Mountains) in Subregion 1 (True Plateau).*

LEGEND

2. Broad sandstone ridges—north aspect.
3. Broad sandstone ridges—south aspect.
4. Narrow sandstone ridges and convex upper slopes.
5. North sandstone slopes.
6. South sandstone slopes.
7. Sandstone outcrops and shallow soils.
14. Footslopes, terraces, and streambottoms with good drainage.
15. Terraces, streambottoms, and depressions with poor drainage.

competition is *slight* if unwanted plants do not prevent adequate natural regeneration, interfere with early growth, or restrict normal development of planted or seeded seedlings. Competition is *moderate* if unwanted plants delay establishment and hinder the growth of regenerated seedlings or if they retard the eventual development of a fully stocked stand. Competition is *severe* if unwanted plants prevent adequate restocking without extensive site preparation or special maintenance practices. Competition ratings in tables 5 to 24 represent regional averages, and competition on a given landtype may vary as a result of past land use.

Seedling Mortality is the loss of artificially established tree seedlings as influenced by soils and topographic conditions, assuming that planting is done properly and plant competition is insignificant. Rating is *slight* if expected mortality is 0 to 25 percent, *moderate* if expected mortality is 26 to 50 percent, and *severe* if mortality is more than 50 percent. If the rating is moderate or severe, special preparation of the seedbed and special planting techniques are often necessary to insure a fully stocked stand.

Equipment Limitations are restrictions on the use of conventional wheeled or tracked equipment. Soil and topographic characteristics (e.g., slope, drainage, texture, and rockiness) influence equipment limitations, sometimes necessitating the use of different kinds of equipment and methods of operation, or restricting the season when equipment is used. Generally, limitation is *slight* if slope is 20 percent or less and farm machinery can operate efficiently during all seasons. The rating is *moderate* if slope is 20 to 30 prcent, limits the use of ordinary farm machinery, and requires track-type equipment; or if soil wetness prevents the use of logging vehicles for 2 to 6 months a year. The rating is *severe* if slope exceeds 30 percent, making track-type equipment inadequate and requiring power vehicles and other special equipment; or if wetness prevents use of vehicles for 6 months or more a year.

Erosion Hazard is the degree of potential soil erosion that can occur during and after forest management operations that expose soil along roads, skid trails, fire lanes, and landing areas. The ratings assume that the forest is well managed and protected from fire and grazing. Soil and topographic characteristics considered in rating hazard of erosion include slope, infiltration, permeability, water holding capacity, and resistance to detachment of soil particles by rainfall and runoff. *Slight* indicates that no special measures are needed, *moderate* indicates that some attention needs to be given to erosion control, and *severe* indicates that intensive erosion-control measures are needed.

Windthrow Hazard measures how soils affect root development and how firmly soils hold trees. The hazard is *slight* if rooting depth is more than 20 inches and trees withstand most winds, *moderate* if effective rooting depth is 10 to 20 inches and some trees are blown down during excessive soil wetness and strong winds, and *severe* if effective rooting depth is 10 inches or less and trees will not stand alone in strong winds.

Species Desirability

Three categories are used for rating **Species Desirability** of species that commonly occur on each landtype. *Most Desirable* species are those that have potential for fast growth, high value, or both. *Acceptable* species are those with moderate growth rate or value. *Least Desirable* species are those with slow growth, poor quality, or both. These ratings represent the average situation for the region. The presence or absence of local markets could result in a species being assigned to another category.

USING THE SYSTEM

This guide will allow professional foresters, forest landowners, landuse specialists, forest researchers, and other resource professionals to make onsite determinations of site productivity and will provide a site-dependent framework for forest management planning and forest research.

To make onsite determinations of productivity on a particular tract of land, the user must first determine the subregion and LTA in which the particular tract of land occurs by referring to tables 3 and fig 2. Landtypes common to each LTA are shown in table 4. Landtype descriptions and landscape drawings (figs. 3 to 5) will enable the user to identify specific landtypes. Information about productivity, severity of management problems, and species desirability are shown on pages facing the landtype descriptions (tables 5 to 24).

This site classification system provides a sound biological basis for forest management planning because it recognizes inherent site differences and soil-related hazards. When the system is adopted, landtypes become the basic unit of management. Continuous Forest Inventory or other forest inventory systems can easily be incorporated into this site classification system to obtain information on acreage, stocking, composition, and growth of forests by landtypes. Once productivity data are available for landtypes on a specific tract, they should be substituted for the regional values in the appropriate tables.

Users should be aware that productivity will vary within a landtype. This variation should be handled as a sampling problem dependent on the desired precision of the productivity information. To sample some landtypes adequately, users with existing inventory systems may be required to install new plots or points. Excessive variation in productivity within a landtype may indicate the need to divide that landtype into more homogenous units.

A logical vehicle to transfer this site classification system into a valuable forest management tool is a

landtype map (fig. 6), which can be used in all phases of management from day-to-day activities to long-range planning. The number and scale of maps will depend on size of ownership and how intensively one wishes to manage. Landtypes can be mapped at scales of 1:10,000 to 1:60,000 and at these scales, areas as small as 2 acres can be recognized on the larger scale maps. Smoothness of the terrain will determine maximum size. So the U.S. Geological Survey 7½-minute quadrangle sheets (1:24,000) make excellent base maps on which to delineate landtypes. Black and white or color aerial photos, particularly stereo pairs, can also serve as base maps. A reasonable amount of ground checking should be part of the mapping process. Owners or managers of large tracts should explore the advantages of computer-generated mapping of landtypes and other physical and biological features of the landscape (Beeman 1978). A photo-interpretation key for forest cover is available for Subregion 3—Strongly Dissected Portion (Johnson and Sellman 1979).

For forest researchers, this site classification system provides a basis for stratifying study areas. The system also aids in identifying and isolating problems that need to be researched. For example, it became apparent in compiling site index and growth information that little mensuration data specific to the region are available. Finally, the system provides researchers with a vehicle for quick transfer of research results to the practitioner. Study results can be reported on the basis of their applicability to specific landtypes.

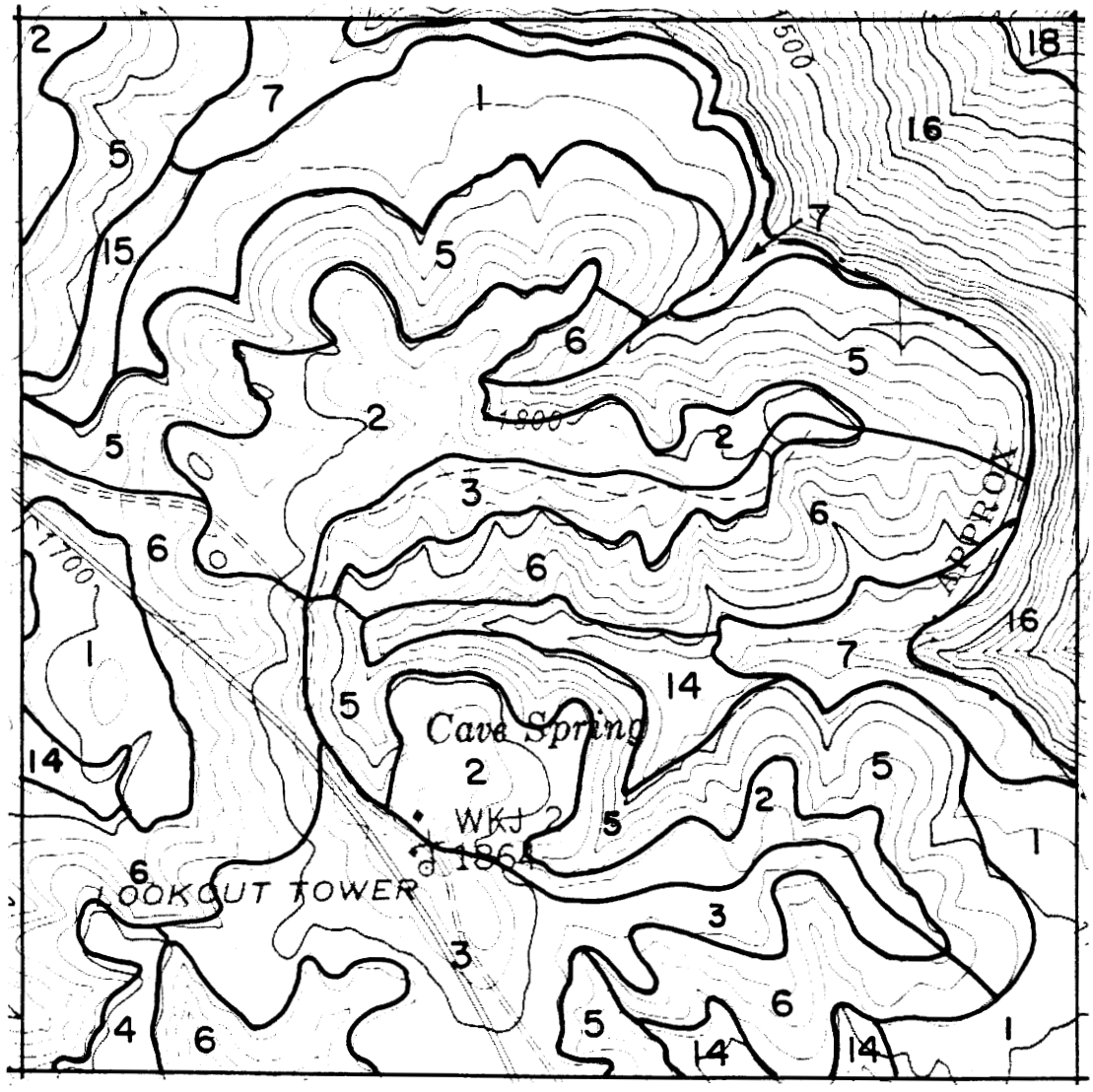

Figure 6.—*A sample landtype map showing Landtype Associations A (weakly dissected plateau surface) and C (strongly dissected margins and sides of the plateau) in Subregion 3. Map covers a tract of about 700 acres on the Franklin-Marion State Forest located in the northwest quarter of the Orme Quadrangle, Marion County, Tenn. Scale is 1:12,000. See table 4 for names of landtypes.*

Description of Landtype 1: Broad Undulating Sandstone Uplands

Geographic setting—Moderately deep to deep, loamy and clayey soils on level to sloping broad ridges that typically occupy the smoother and higher parts of the landscape in all subregions but more frequently in Subregion 1. Slope does not exceed 10 percent, but the area with slope greater than 6 percent is small and aspect is not a dominant factor. These uplands may range up to 0.5 mile in width. Soils developed in loamy residuum from sandstone or from interbedded sandstone and shale. In some places a 2- to 3-foot silty mantle (presumably loess) occurs over the residuum. This landtype grades into steeper broad ridges (Landtypes 2 and 3) or into midslopes (Landtypes 5 and 6).

Dominant soils—Hartsells, Linker, Lonewood, Crossville, Lily, and Clarkrange are more common in Subregions 1 and 2, while Albertville, Enders, Nauvoo, and Wynnville are more common in Subregion 3. Volume of sandstone, and in places shale, fragments is 35 percent or less in the solum, but deeper horizons may contain more. Clarkrange and Wynnville soils have fragipans at depths of 18 to 28 inches.

Bedrock—Sandstone and conglomerate with thin strata of shale and siltstone in places.

Depth to bedrock—20 to 90 inches.

Texture—Loam, fine sandy loam, and silt loam; sometimes gravelly, stony, or flaggy.

Soil drainage—Well drained except Clarkrange and Wynnville soils are moderately well drained.

Relative soil water supply—Medium.

Soil fertility—Moderately low.

Vegetation—White oak, scarlet oak, southern red oak, chestnut oak, hickories, black oak, blackgum, red maple, shortleaf pine, Virginia pine, and loblolly pine; occasional yellow-poplar, eastern white pine, post oak, sweetgum, black locust, black cherry, and eastern redcedar. Dogwood, sassafras, sourwood, serviceberry, persimmon, sumac, hawthorns, viburnums, vacciniums, azaleas, American holly, and smilax are common understory species.

Table 5.—*Forest management interpretations for Landtype 1: Broad Undulating Sandstone Uplands. Footnotes appear on page 56.*

PRODUCTIVITY				
Species	Site index		Average annual growth cubic feet per acre	
	Natural Stands[1]	Old-field Plantations[2]	Natural Stands[3]	Old-field Plantations[4]
E. white pine	75	52	126	145
Shortleaf pine	65	45	113	102
Loblolly pine	75	50	114	117
Virginia pine	70		92	
E. redcedar	30			
Upland oaks	60		43	
Yellow-poplar	85		80	

MANAGEMENT PROBLEMS				
Plant Competition	Seedling Mortality	Equipment Limitations	Erosion Hazard	Windthrow Hazard
Moderate	Slight	Slight	Slight	Slight

SPECIES DESIRABILITY		
Most desirable	Acceptable	Least desirable
E. white pine	Hickories	E. redcedar
Shortleaf pine	White oak	Post oak
Loblolly pine	Chestnut oak	Sassafras
Virginia pine	Black oak	Serviceberry
Yellow-poplar	S. red oak	Black locust
	Scarlet oak	American holly
	Sweetgum	Red maple
	Black cherry	Blackgum
		Dogwood
		Sourwood
		Persimmon

Description of Landtype 2:
Broad Sandstone Ridges—North Aspect

Geographic setting—Moderately deep to deep, loamy soils on nearly level to steep north-facing portions of broad ridgetops and adjoining convex upper slopes in all subregions. This landtype extends from the ridge crest down to where the slope becomes linear or nearly so. At this point gradient usually increases noticeably. Slope ranges from 2 to 35 percent and is dominantly greater than 6 percent. Soils developed in loamy residuum from sandstone or from interbedded sandstone and shale. In some places a 2- to 3-foot silty mantle (presumably loess) occurs over the residuum. Rock fragments occur on the surface in places. This landtype may occur below broad undulating uplands (Landtype 1) while north midslopes (Landtype 5) occur below it. This landtype may lie adjacent to Landtypes 14 and 15 in the heads of hollows.

Dominant soils—Hartsells, Linker, Lonewood, Crossville, and Lily are more common in Subregions 1 and 2, while Albertville, Enders and Nauvoo are common in Subregion 3.

Bedrock—Sandstone and conglomerate with thin strata of shale and siltstone in places.

Depth to bedrock—20 to 72 inches.

Texture—Loam, fine sandy loam, and silt loam; sometimes gravelly, stony, or flaggy. Volume of sandstone, and in places, shale fragments in the solum is 35 percent or less, but deeper horizons may contain more.

Soil drainage—Well drained.

Relative soil water supply—Medium.

Soil fertility—Moderately low.

Vegetation—White oak, scarlet oak, southern red oak, chestnut oak, hickories, black oak, blackgum, red maple, shortleaf pine, Virginia pine, loblolly pine, and eastern white pine; occasional yellow-poplar, northern red oak, black cherry, black locust, post oak, white ash, and eastern redcedar. Dogwood, sassafras, serviceberry, sourwood, persimmon, sumac, viburnums, vacciniums, azaleas, smilax, and American holly are common understory species.

Table 6.—*Forest management interpretations for Landtype 2: Broad Sandstone Ridges—North Aspect. Footnotes appear on page 56.*

PRODUCTIVITY				
Species	Site index		Average annual growth cubic feet per acre	
	Natural Stands[1]	Old-field Plantations[2]	Natural Stands[3]	Old-field Plantations[4]
E. white pine	75	52	126	145
Shortleaf pine	65	45	113	102
Loblolly pine	70	55	104	133
Virginia pine	70		92	
E. redcedar	40			
Upland oaks	65		48	
Yellow-poplar	80		71	

MANAGEMENT PROBLEMS				
Plant Competition	Seedling Mortality	Equipment Limitations	Erosion Hazard	Windthrow Hazard
Moderate	Slight	Slight to moderate	Slight to moderate	Slight

SPECIES DESIRABILITY		
Most desirable	Acceptable	Least desirable
E. white pine	Hickories	E. redcedar
Shortleaf pine	White oak	Sassafras
Loblolly pine	Post oak	Serviceberry
Virginia pine	Chestnut oak	Black locust
Yellow-poplar	N. red oak	American holly
	Black oak	Red maple
	S. red oak	Blackgum
	Scarlet oak	Dogwood
	Black cherry	Sourwood
	White ash	Persimmon

Description of Landtype 3: Broad Sandstone Ridges—South Aspect

Geographic setting—Moderately deep to deep, loamy soils on nearly level to steep south-facing portions of broad ridgetops and adjoining convex upper slopes in all subregions. This landtype extends from the ridge crest down to where the slope becomes linear or nearly so. At this point gradient usually increases noticeably. Slope ranges from 2 to 35 percent and is dominantly greater than 6 percent. Soils developed in loamy residuum from sandstone or from interbedded sandstone and shale. In some places a 2- to 3-foot silty mantle (presumably loess) occurs over the residuum. Rock fragments occur on the surface in places. South-facing ridges tend to be somewhat steeper and have shallower soils with a higher rock content than north-facing ridges. This landtype may occur below broad undulating uplands (Landtype 1) while south midslopes (Landtype 6) occur below it. This landtype may lie adjacent to Landtypes 14 and 15 in the heads of hollows.

Dominant soils—Hartsells, Linker, Lonewood, Crossville, and Lily are more common in Subregions 1 and 2, while Albertville, Enders, and Nauvoo are more common in Subregion 3.

Bedrock—Sandstone and conglomerate with thin strata of shale and siltstone in places.

Depth to bedrock—20 to 72 inches.

Texture—Loam, fine sandy loam, and silt loam; sometimes gravelly, stony, or flaggy. Volume of sandstone, and in places, shale fragments in the solum is 35 percent or less, but deeper horizons may contain more.

Soil drainage—Well drained.

Relative soil water supply—Medium.

Soil fertility—Moderately low.

Vegetation—White oak, scarlet oak, chestnut oak, southern red oak, hickories, black oak, post oak, blackgum, red maple, Virginia pine, shortleaf pine, and loblolly pine; occasional black locust, eastern redcedar, eastern white pine, and yellow-poplar. Dogwood, sassafrass, sourwood, persimmon, vacciniums, sumac, viburnums, serviceberry, and smilax are common understory species.

Table 7.—*Forest management interpretations for Landtype 3: Broad Sandstone Ridges—South Aspect.* *Footnotes appear on page 56.*

PRODUCTIVITY				
Species	Site index		Average annual growth cubic feet per acre	
	Natural Stands[1]	Old-field Plantations[2]	Natural Stands[3]	Old-field Plantations[4]
Shortleaf pine	60	45	102	102
Loblolly pine	65	55	95	133
Virginia pine	65		70	
E. redcedar	35			
Upland oaks	60		43	

MANAGEMENT PROBLEMS				
Plant competition	Seedling mortality	Equipment limitations	Erosion hazard	Windthrow hazard
Moderate	Slight to moderate	Slight to moderate	Slight to moderate	Slight

SPECIES DESIRABILITY		
Most desirable	Acceptable	Least desirable
E. white pine	Hickories	E. redcedar
Shortleaf pine	White oak	Post oak
Loblolly pine	Chestnut oak	Sassafras
Virginia pine	Black oak	Serviceberry
Yellow-poplar	S. red oak	Black locust
	Scarlet oak	Red maple
		Blackgum
		Dogwood
		Sourwood
		Persimmon

Description of Landtype 4: Narrow Sandstone Ridges and Convex Upper Slopes

Geographic setting—Shallow to moderately deep, loamy soils on gently sloping to steep, winding narrow ridgetops and adjoining convex upper slopes in all subregions. Below this landtype are midslopes (Landtypes 5 and 6). Landtype 4 is more common in LTA-C (strongly dissected margins and sides of the plateau) and LTA-D (Crab Orchard Mountains). Slope ranges from 0 to 40 percent. Typically this landtype is no wider than 250 feet. Rock fragments, mostly sandstone and conglomerate, are common on the surface.

Dominant soils—Hector, Mountainburg, Ramsey, Hartsells, Alticrest, Lily, and Muskingum.

Bedrock—Predominantly sandstone and conglomerate with thin strata of siltstone and shale in places.

Depth to bedrock—40 inches or less.

Texture—Sandy loam, fine sandy loam, and loam; occasionally silt loam. Often gravelly, stony, or channery. Coarse fragment content of most soils does not exceed 35 percent in the solum, except Mountainburg and Muskingum soils, which may have as much as 60 percent. Coarse fragment content usually increases with depth.

Soil drainage—Well drained to somewhat excessively drained.

Relative soil water supply—Low.

Soil fertility—Low.

Vegetation—White oak, chestnut oak, scarlet oak, southern red oak, post oak, black oak, Virginia pine, shortleaf pine, blackgum, blackjack oak, and hickories; occasional loblolly pine, eastern white pine, black locust, yellow-poplar, and eastern redcedar. Sassafras, sourwood, dogwood, vacciniums, sumac, persimmon, and buckthorn are common understory species.

Table 8.—*Forest management interpretations for Landtype 4: Narrow Sandstone Ridges and Convex Upper Slopes. Footnotes appear on page 56.*

PRODUCTIVITY				
Species	Site index		Average annual growth cubic feet per acre	
	Natural stands[1]	Old-field plantations[2]	Natural stands[3]	Old-field plantations[4]
E. white pine	70	49	115	126
Shortleaf pine	60	(40)	102	84
Loblolly pine	70	(50)	104	117
Virginia pine	65		70	
E. redcedar	30			
Upland oaks	65		48	

MANAGEMENT PROBLEMS				
Plant competition	Seedling mortality	Equipment limitations	Erosion hazard	Windthrow hazard
Slight to moderate	Moderate to severe	Moderate to severe	Slight to severe	Moderate to severe

SPECIES DESIRABILITY		
Most desirable	Acceptable	Least desirable
E. white pine	Loblolly pine	E. redcedar
Shortleaf pine	Hickories	Blackjack oak
Virginia pine	Post oak	Sassafras
White oak	Chestnut oak	Black locust
Black oak	Scarlet oak	Blackgum
S. red oak	Yellow-poplar	Dogwood
		Sourwood
		Persimmon

Description of Landtype 5:
North Sandstone Slopes

Geographic setting—Shallow to moderately deep, loamy and clayey soils with a wide range of coarse fragments on sloping to very steep north-facing linear to concave midslopes in all subregions. This landtype lies between narrow ridges, broad uplands, or broad ridges and convex upper slopes (Landtypes 1, 2, and 3) and concave footslopes, terraces, and streambottoms (Landtypes 14 and 15). Slope ranges from 6 to 70 percent. Rock fragments are common on the surface.

Dominant soils—Hartsells, Mountainburg, Hector, Townley, and Montevallo are common in Subregion 3; Lily, Alticrest, Dekalb, Gilpin, and Ramsey are more common in Subregions 1 and 2.

Bedrock—Sandstone, conglomerate, sandstone interbedded with thin strata of siltstone and shale, interbedded shale and sandstone, and siltstone interbedded with sandstone and silty shale.

Depth to bedrock—40 inches and less.

Texture—Loam, fine sandy loam, sandy loam, and silt loam; may be stony, gravelly, shaly, channery, or flaggy. Coarse fragment content ranges from 5 to 65 percent in the solum and generally increases with depth.

Soil drainage—Well drained to somewhat excessively drained.

Relative soil water supply—Medium to high. Irrigated by subsurface flow.

Soil fertility—Moderately low to low.

Vegetation—White oak, scarlet oak, black oak, yellow-poplar, hickories, blackgum, southern red oak, red maple, and chestnut oak; occasional northern red oak, American beech, shortleaf pine, Virginia pine, eastern white pine, loblolly pine, black cherry, white ash, sugar maple, eastern redcedar, eastern hemlock, and black locust. Dogwood, sassafras, sourwood, serviceberry, laurel, vacciniums, viburnums, azaleas, sumac, persimmon, American holly, and smilax are common understory species.

Table 9.—*Forest management interpretations for Landtype 5: North Sandstone slopes. Footnotes appear on page 56.*

PRODUCTIVITY				
	Site index		Average annual growth cubic feet per acre	
Species	Natural stands[1]	Old-field plantations[2]	Natural stand[3]	Old-field plantations[4]
E. white pine	75	52	126	145
Shortleaf pine	60	45	102	102
Loblolly pine	70	55	104	133
Virginia pine	65			
E. redcedar	30		70	
White oak	(65)		48–57	
N. red oak	75			
Yellow-poplar	95		98	
Black cherry	85			
White ash	(85)			

MANAGEMENT PROBLEMS				
Plant competition	Seedling mortality	Equipment limitations	Erosion hazard	Windthrow hazard
Slight to moderate	Slight to severe	Slight to severe	Slight to severe	Slight to severe

SPECIES DESIRABILITY		
Most desirable	Acceptable	Least desirable
E. white pine	Hickories	E. hemlock
Shortleaf pine	White oak	E. redcedar
Loblolly pine	Chestnut oak	American beech
Virginia pine	Black oak	Sassafras
N. red oak	S. red oak	Serviceberry
Yellow-poplar	Scarlet oak	Black locust
Black cherry	Sugar maple	American holly
White ash		Red maple
		Blackgum
		Dogwood
		Sourwood
		Persimmon

Description of Landtype 6:
South Sandstone Slopes

Geographic setting—Shallow to moderately deep, loamy and clayey soils with a wide range of coarse fragments on sloping to very steep south-facing linear to concave midslopes in all subregions. This landtype lies between narrow ridges, broad uplands, or broad ridges and convex upper slopes (Landtypes 1, 3, and 4) and concave footslopes, terraces, and streambottoms (Landtypes 14 and 15). Slope ranges from 6 to 70 percent. Rock fragments are common on the surface. South-facing slopes tend to be steeper and have shallower soils with higher contents of coarse fragments than north-facing slopes.

Dominant soils—Hartsells, Mountainburg, Hector, Townley, and Montevallo are more common in Subregion 3; Lily, Alticrest, Dekalb, Gilpin, and Ramsey are more common in Subregion 1 and 2.

Bedrock—Sandstone, conglomerate, sandstone interbedded with thin strata of siltstone and shale, interbedded shale and sandstone, and siltstone interbedded with sandstone and silty shale.

Depth to bedrock—40 inches or less.

Texture—Loam, fine sandy loam, sandy loam, and silt loam; may be stony, gravelly, shaly, channery, or flaggy. Coarse fragment content ranges from 5 to 65 percent in the solum and generally increases with depth.

Soil drainage—Well drained to somewhat excessively drained.

Relative soil water supply—Medium to high. Irrigated by subsurface flow.

Soil fertility—Moderately low to low.

Vegetation—White oak, chestnut oak, scarlet oak, southern red oak, post oak, hickories, blackjack oak, black oak, red maple and blackgum; occasional Virginia pine, shortleaf pine, black locust, eastern redcedar, and loblolly pine. Dogwood, sassafras, sourwood, vacciniums, persimmon, smilax, sumac, and viburnums are common understory species.

Table 10.—*Forest management interpretations for Landtype 6: South Sandstone Slopes. Footnotes appear on page 56.*

PRODUCTIVITY				
	Site index		Average annual growth cubic feet per acre	
Species	Natural stands[1]	Old-field plantations[2]	Natural stands[3]	Old-field plantations[4]
Shortleaf pine	55	(45)	90	102
Loblolly pine	60	55	86	133
Virginia pine	60		53	
E. redcedar	30			
White oak	60		43–48	
N. red oak	65			

MANAGEMENT PROBLEMS				
Plant competition	Seedling mortality	Equipment limitations	Erosion hazard	Windthrow hazard
Slight to moderate	Moderate to severe	Moderate to severe	Moderate to severe	Moderate to severe

SPECIES DESIRABILITY		
Most desirable	Acceptable	Least desirable
Shortleaf pine	Loblolly pine	Blackjack oak
Virginia pine	E. redcedar	Sassafras
White oak	Hickories	Black locust
Black oak	Post oak	Red maple
S. red oak	Chestnut oak	Blackgum
	N. red oak	Dogwood
	Scarlet oak	Sourwood
		Persimmon

Description of Landtype 7:
Sandstone Outcrops and Shallow Soils

Geographic setting—Small to moderately large areas of exposed sandstone and conglomerate and shallow loamy soils formed in residuum and locally in some colluvium or alluvium from sandstone, quartzite, and some shale on nearly level to moderately steep ridgetops, slopes, edges of the Plateau above the nearly vertical cliffs, and along deeply incised streams and rivers in all subregions. Landtype 7 also occurs in sinkholes where the thin sandstone caprock has collapsed into underlying limestone caverns, particularly along the strongly dissected western margin (LTA-C) of Subregion 1. Slope ranges from 2 to 70 percent. The area of exposed rock varies from a few square feet to several acres in narrow strips to broad expanses. Slope of the rock surface usually is 5 percent or less. The very shallow dark brown or gray soils at the margins of exposed rock contain a very high percentage of organic matter. This landtype is associated with Landtypes 1 to 6. Landtype 7 has the lowest productivity of any landtype in the region.

Dominant soils—Hector, Ramsey, Mountainburg, and sandstone outcrops.

Bedrock—Predominantly sandstone and conglomerate with thin strata of shale or siltstone in places.

Depth to bedrock—Less than 20 inches.

Texture—Gravelly, channery, and flaggy sandy loam, fine sandy loam, and loam. Coarse fragment content ranges up to 60 percent in the solum and usually increases with depth.

Soil drainage—Well drained to somewhat excessively drained.

Relative soil water supply—Very low. Seepage is common in wet weather, but the soil dries quickly.

Soil fertility—Very low.

Vegetation—White oak, post oak, chestnut oak, blackjack oak, scarlet oak, southern red oak, and blackgum; occasional Virginia pine, shortleaf pine, hickories, red maple, black locust, and eastern redcedar. Sourwood, dogwood, winged elm, mountain-laurel, vacciniums, lichens, mosses, grasses, and buckthorn are common understory species.

Table 11.—*Forest management interpretations for Landtype 7: Sandstone Outcrops and Shallow Soils. Footnotes appear on page 56.*

PRODUCTIVITY				
Species	Site index		Average annual growth cubic feet per acre	
	Natural stands[1]	Old-field plantations[2]	Natural stands[3]	Old-field plantations[4]
Shortleaf pine	55		90	
Virginia pine	60		53	
E. redcedar	30			
White oak	60		43	

MANAGEMENT PROBLEMS				
Plant competition	Seedling mortality	Equipment limitations	Erosion hazard	Windthrow hazard
Slight	Moderate to severe	Slight to severe	Slight to severe	Severe

SPECIES DESIRABILITY		
Most desirable	Acceptable	Least desirable
Shortleaf pine	E. redcedar	Blackjack oak
Virginia pine	Hickories	Winged elm
	White oak	Black locust
	Post oak	Red maple
	Chestnut oak	Blackgum
	S. red oak	Dogwood
	Scarlet oak	Sourwood

Description of Landtype 8:
Broad Shale Ridges—North Aspect

Geographic setting—Moderatly deep to very deep, loamy and clayey soils on gently sloping to steep north-facing, low, broad hills and ridges above the surrounding undulating plateau top. This landtype extends from the ridge crest down to where the gradient usually increases noticeably. Slope ranges from 3 to 35 percent and is dominantly greater than 6 percent. Soils developed in residuum from shale, and siltstone, and thin strata of sandstone. In places there is a 2- to 3-foot layer of loess over the residuum. This landtype occurs in Subregions 1 and 2 mostly north of highway I-40, where the caprock is shale members of the Crooked Fork group. Landtype 8 occurs above upper shale slopes (Landtype 10).

Dominant soils—Sequoia, Gilpin, Wellston, Whitley, and Tilsit.

Bedrock—Shale and siltstone, and thin strata of sandstone in places.

Depth to bedrock—24 to 60 inches or more. Tilsit soils have a fragipan at depths of 18 to 28 inches.

Texture—Silt loam and loam, occasionally silty clay loam; in places, shaly or channery. Coarse fragment content ranges from 0 to 40 percent in the solum, but is commonly less than 25 percent.

Soil drainage—Well drained except Tilsit soils are moderately well drained.

Relative soil water supply—Medium.

Soil fertility—Moderate to moderately low.

Vegetation—White oak, scarlet oak, hickories, black oak, shortleaf pine, and Virginia pine; occasional southern red oak, yellow-poplar, eastern white pine, red maple, blackgum, loblolly pine, black locust, and black cherry. Dogwood, sourwood, sassafras, persimmon, vacciniums, smilax, azaleas, and viburnums are common understory species.

Table 12—*Forest management interpretations for Landtype 8: Broad Shale Ridges—North Aspect. Footnotes appear on page 56.*

PRODUCTIVITY				
Species	Site index		Average annual growth cubic feet per acre	
	Natural stands[1]	Old-field plantations[2]	Natural stands[3]	Old-field plantations[4]
E. white pine	80	56	136	172
Shortleaf pine	70		125	
Loblolly pine	80		123	
Virginia pine	70		92	
Yellow-poplar	90		90	

MANAGEMENT PROBLEMS				
Plant competition	Seedling mortality	Equipment limitations	Erosion hazard	Windthrow hazard
Moderate	Slight to moderate	Slight to moderate	Slight to moderate	Slight

SPECIES DESIRABILITY		
Most desirable	Acceptable	Least desirable
E. white pine	Hickories	Sassafras
Shortleaf pine	Black oak	Black locust
Loblolly pine	S. red oak	Red maple
Virginia pine	Scarlet oak	Blackgum
White oak		Dogwood
Yellow-poplar		Sourwood
Black cherry		Persimmon

Description of Landtype 9:
Broad Shale Ridges—South Aspect

Geographic setting—Moderately deep to very deep, loamy and clayey soils on gently sloping to steep south-facing, low, broad hills and ridges above the surrounding undulating plateau top. This landtype extends from the ridge crest down to where the gradient usually increases noticeably. Slope ranges from 3 to 35 percent and is dominantly greater than 6 percent. Soils developed in residuum from shale and siltstone, and thin strata of sandstone. In places there is a 2- to 3-foot layer of loess over the residuum. This landtype occurs in Subregions 1 and 2 mostly north of highway I-40, where the caprock is shale members of the Crooked Fork group. Landtype 9 occurs above upper shale slopes (Landtype 11).

Dominant soils—Sequoia, Gilpin, Wellston, Whitley, and Tilsit.

Bedrock—Shale and siltstone, and thin strata of sandstone in places.

Depth to bedrock—24 to 60 inches or more. Tilsit soils have a fragipan at depths of 18 to 28 inches.

Texture—Silt loam, loam, and occasionally silty clay loam; in places, shaly or channery. Volume of coarse fragments ranges from 0 to 40 percent in the solum, but it commonly less than 25 percent.

Soil drainage—Well drained except Tilsit soils are moderately well drained.

Relative soil water supply—Medium.

Soil fertility—Moderate to moderately low.

Vegetation—White oak, chestnut oak, scarlet oak, hickories, black oak, shortleaf pine, and Virginia pine; occasional southern red oak, blackjack oak, post oak, eastern white pine, black locust, red maple, blackgum, yellow-poplar, loblolly pine, and black cherry. Dogwood, sourwood, sassafras, persimmon, azaleas, smilax, and viburnums are common understory species.

Table 13—*Forest management interpretations for Landtype 9: Broad Shale Ridges—South Aspect. Footnotes appear on page 56.*

PRODUCTIVITY				
Species	Site index		Average annual growth cubic feet per acre	
	Natural stands[1]	Old-field plantations[2]	Natural stands[3]	Old-field plantations[4]
E. white pine	(75)	(52)	126	145
Shortleaf pine	(60)		102	
Loblolly pine	(70)		104	
Virginia pine	(65)		70	
Yellow-poplar	80		71	

MANAGEMENT PROBLEMS				
Plant competition	Seedling mortality	Equipment limitations	Erosion hazard	Windthrow hazard
Moderate	Slight to moderate	Slight to moderate	Slight to moderate	Slight

SPECIES DESIRABILITY		
Most desirable	Acceptable	Least desirable
E. white pine	Hickories	Blackjack oak
Shortleaf pine	Post oak	Sassafras
Loblolly pine	Chestnut oak	Red maple
Virginia pine	S. red oak	Blackgum
White oak	Scarlet oak	Dogwood
Black oak	Black locust	Persimmon
Yellow-poplar		Sourwood
Black cherry		

Description of Landtype 10:
Upper Shale Slopes—North Aspect

Geographic setting—Shallow to moderately deep, loamy and shaly soils on moderately steep to very steep, north-facing linear to convex upper slopes. Soils formed in residuum from shale, siltstone, and thin strata of sandstone. Interspersed areas of shale rubble are common. Slope ranges from 10 to 70 percent and is commonly greater than 20 percent. This landtype occurs in Subregions 1 and 2, mostly north of highway I-40, where the caprock is shale members of the Crooked Fork group. Landtype 10 occurs below broad shale ridges (Landtype 8) and above lower shale slopes (Landtype 12).

Dominant soils—Ramsey, Muskingum, Gilpin, and Berks, and shale rubble.

Bedrock—Shale and siltstone; occasionally thin strata of sandstone.

Depth to bedrock—7 to 40 inches.

Texture—Silt loam, loam, and occasionally fine sandy loam; usually shaly or channery. Volume of coarse fragments ranges from 20 to 75 percent in the solum and usually increases in with depth.

Soil drainage—Well drained to somewhat excessively drained.

Relative soil water supply—Medium to low. Irrigated by subsurface flow, but the porous soil drains rapidly.

Soil fertility—Moderate to moderately low.

Vegetation—White oak, scarlet oak, chestnut oak, hickories, yellow-poplar, black oak, red maple, blackgum, and eastern white pine; occasional southern red oak, shortleaf pine, Virginia pine, northern red oak, eastern hemlock, black cherry, white ash, sugar maple, black locust, and loblolly pine. Dogwood, sourwood, sassafras, mountain laurel, persimmon, vacciniums, strawberry bush, devils-walkingstick, striped maple, smilax, azaleas, and viburnums are common understory species.

Table 14.—*Forest management interpretations for Landtype 10: Upper Shale Slopes—North Aspect. Footnotes appear on page 56.*

PRODUCTIVITY				
Species	Site index		Average annual growth cubic feet per acre	
	Natural stands[1]	Old-field plantations[2]	Natural stands[3]	Old-field plantations[4]
E. white pine	80	56	136	172
Shortleaf pine	70		125	
Loblolly pine	75		114	
Virginia pine	70		92	
White oak	60		43–57	
N. Red oak	75			
Black oak	70			
Yellow-poplar	95		98	

MANAGEMENT PROBLEMS				
Plant competition	Seedling mortality	Equipment limitations	Erosion hazard	Windthrow hazard
Slight to moderate	Slight to moderate	Moderate to severe	Slight to severe	Slight to severe

SPECIES DESIRABILITY		
Most desirable	Acceptable	Least desirable
E. white pine	Hickories	E. hemlock
Shortleaf pine	Chestnut oak	Sassafras
Loblolly pine	Black oak	Black locust
Virginia pine	S. red oak	Red maple
White oak	Scarlet oak	Striped maple
N. red oak	Sugar maple	Blackgum
Yellow-poplar	White ash	Dogwood
Black cherry		Sourwood
		Persimmon

Description of Landtype 11:
Upper Shale Slopes—South Aspect

Geographic setting—Shallow to moderately deep, loamy and shaly soils on moderately steep to very steep, south-facing linear to convex upper slopes. Soils formed in residuum from shale, siltstone, and thin strata of sandstone. Areas of shale rubble are common. Slope ranges from 10 to 70 percent and is commonly greater than 20 percent. South-facing slopes tend to be steeper and have shallower soils with higher contents of coarse fragments than north-facing slopes. This landtype occurs in Subregions 1 and 2, mostly north of highway I-40, where the caprock is shale members of the Crooked Fork group. Landtype 11 occurs below broad shale ridges (Landtype 9) and above lower shale slopes (Landtype 13).

Dominant soils—Ramsey, Muskingum, Gilpin, and Berks, and shale rubble.

Bedrock—Shale and siltstone; occasionally thin strata of sandstone.

Depth to bedrock—7 to 40 inches.

Texture—Silt loam, loam, and occasionally fine sandy loam, usually shaly or channery. Volume of coarse fragments ranges from 20 to 75 percent in the solum and usually increases with depth.

Soil drainage—Well drained to somewhat excessively drained.

Relative soil water supply—Medium to low. Irrigated by subsurface flow, but the porous soil drains rapidly.

Soil fertility—Moderate to moderately low.

Vegetation—White oak, scarlet oak, chestnut oak, hickories, Virginia pine, shortleaf pine, black oak, and post oak; occasional southern red oak, blackjack oak, eastern white pine, red maple, black locust, blackgum, and loblolly pine. Dogwood, sourwood, sassafras, laurel, vacciniums, smilax, persimmon, azaleas, and viburnums are common understory species.

Table 15.—*Forest management interpretations for Landtype 11: Upper Shale Slopes—South Aspect. Footnotes appear on page 56.*

PRODUCTIVITY				
Species	Site index		Average annual growth cubic feet per acre	
	Natural stands[1]	Old-field plantations[2]	Natural stands[3]	Old-field plantations[4]
E. white pine	70	49	115	126
Shortleaf pine	60		102	
Loblolly pine	(65)		95	
Virginia pine	60		53	
Black oak	60		43	

MANAGEMENT PROBLEMS				
Plant competition	Seedling mortality	Equipment limitations	Erosion hazard	Windthrow hazard
Slight to moderate	Slight to moderate	Moderate to severe	Slight to severe	Slight to severe

SPECIES DESIRABILITY		
Most desirable	Acceptable	Least desirable
E. white pine	Hickories	Blackjack oak
Shortleaf pine	Post oak	Sassafras
Loblolly pine	Chestnut oak	Black locust
Virginia pine	S. red oak	Red maple
White oak	Scarlet oak	Blackgum
Black oak		Dogwood
		Sourwood
		Persimmon

Description of Landtype 12:
Lower Shale Slopes—North Aspect

Geographic setting—Deep to very deep, shaly or gravelly, loamy soils formed in colluvium from shale, siltstone, and in places, sandstone, and underlain by shale, siltstone, and sandstone. This landtype occupies the moderately steep to very steep, north-facing lower concave clopes. Slope ranges from 5 to 60 percent, but is commonly greater than 20 percent. This landtype occurs in Subregions 1 and 2, mostly north of highway I-40, where the caprock is shale members of the Crooked Fork group. This landtype occurs below upper shale slopes (Landtype 10) and merges with footslopes, terraces, and streambottoms (Landtypes 14 and 15).

Dominant soils—Jefferson and Shelocta.

Bedrock—Shale, siltstone, and some sandstone.

Depth to bedrock—more than 40 inches up to 120 inches.

Texture—Loam and silt loam; sometimes sandy clay loam, and clay loam; usually shaly or channery, sometimes gravelly. Coarse fragment content ranges from 5 to 80 percent in the solum and increases with depth.

Soil drainage—Well drained.

Relative soil water supply—Medium to high. Irrigated by subsurface flow; wet weather seeps are common.

Soil fertility—Moderate to moderately low.

Vegetation—White oak, northern red oak, yellow-poplar, hickories, black oak, eastern white pine, eastern hemlock, blackgum, and red maple; occasional Virginia pine, shortleaf pine, scarlet oak, southern red oak, chestnut oak, black cherry, sugar maple, white ash, black locust, bigleaf magnolia, and loblolly pine. Dogwood, sourwood, sassafras, mountain laurel, rhododendron, witch-hazel, azaleas, viburnums, persimmon, strawberry bush, devils-walkingstick, striped maple, and spicebush are common understory species.

Table 16.—*Forest management interpretations for Landtype 12: Lower Shale Slopes—North Aspect. Footnotes appear on page 56.*

PRODUCTIVITY				
Species	Site index		Average annual growth cubic feet per acre	
	Natural stands[1]	Old-field plantations[2]	Natural stands[3]	Old-field plantations[4]
Shortleaf pine	75		136	
Loblolly pine	85		134	
Virginia pine	75		120	
N. red oak	75		57	
Yellow-poplar	100		107	

MANAGEMENT PROBLEMS				
Plant competition	Seedling mortality	Equipment limitations	Erosion hazard	Windthrow hazard
Moderate	Slight	Moderate to severe	Slight to moderate	Slight

SPECIES DESIRABILITY		
Most desirable	Acceptable	Least desirable
E. white pine	Hickories	E. hemlock
Shortleaf pine	Chestnut oak	Bigleaf magnolia
Loblolly pine	Black oak	Sassafras
Virginia pine	S. red oak	Black locust
White oak	Scarlet oak	Red maple
N. red oak	Sugar maple	Striped maple
Yellow-poplar	White ash	Blackgum
Black cherry		Dogwood
		Sourwood
		Persimmon

Description of Landtype 13:
Lower Shale Slopes—South Aspect

Geographic setting—Deep to very deep, shaly or gravelly, loamy soils formed in colluvium from shale, siltstone, and in places, sandstone, and underlain by shale, siltstone, and sandstone. This landtype occupies the moderately steep to very steep, south-facing lower concave slopes. Slope ranges from 5 to 60 percent, but is commonly greater than 20 percent. South-facing slopes tend to be steeper and have shallower soils with higher contents of coarse fragments than north-facing slopes. This landtype occurs in Subregions 1 and 2, mostly north of highway I-40, where the caprock is shale members of the Crooked Fork group. This landtype occurs below upper shale slopes (Landtype 11) and merges with footslopes, terraces, and streambottoms (Landtypes 14 and 15).

Dominant soils—Jefferson and Shelocta.

Bedrock—Shale, siltstone, and some sandstone.

Depth to bedrock—More than 40 inches up to 120 inches.

Texture—Loam and silt loam; sometimes sandy clay loam, and clay loam; usually shaly or channery, sometimes gravelly. Coarse fragment content ranges from 5 to 80 percent in the solum and increases with depth.

Relative soil water supply—Medium to high. Irrigated by subsurface flow; wet weather seeps are common, but duration is short during the growing season.

Soil fertility—Moderate to moderately low.

Vegetation—White oak, scarlet oak, chestnut oak, hickories, black oak, blackgum, red maple, Virginia pine, and shortleaf pine; occasional southern red oak, eastern white pine, yellow-poplar, northern red oak, post oak, black locust, black cherry, and loblolly pine. Dogwood, sassafras, sourwood, rhododendron, vacciniums, azaleas, strawberry bush, devils-walkingstick, striped maple, and viburnums are common understory species.

Table 17.—*Forest management interpretations for Landtype 13: Lower Shale Slopes—South Aspect. Footnotes appear on page 56.*

PRODUCTIVITY				
	Site index		Average annual growth cubic feet per acre	
Species	Natural stands[1]	Old-field plantations[2]	Natural stands[3]	Old-field plantations[4]
Shortleaf pine	65		113	
Loblolly pine	80		123	
Virginia pine	70		92	
N. red oak	65		48	

MANAGEMENT PROBLEMS				
Plant competition	Seedling mortality	Equipment limitations	Erosion hazard	Windthrow hazard
Moderate	Slight	Moderate to severe	Slight to moderate	Slight

SPECIES DESIRABILITY		
Most desirable	Acceptable	Least desirable
E. white pine	Hickories	Post oak
Shortleaf pine	Chestnut oak	Sassafras
Loblolly pine	Black oak	Black locust
Virginia pine	S. red oak	Red maple
White oak	Scarlet oak	Striped maple
N. red oak	Black cherry	Blackgum
S. red oak		Dogwood
Yellow-poplar		Sourwood

Description of Landtype 14: Footslopes, Terraces, and Streambottoms with Good Drainage

Geographic setting—Deep, loamy soils with good drainage on level to strongly sloping concave footslopes, stream terraces, and heads of hollows on the Plateau surface in all subregions. Slope ranges from 0 to 15 percent. This landtype typically occurs below Landtypes 5, 6, 12, and 13 as narrow strips along intermittent drainages or level bottomland along permanent streams, creeks, and rivers but can also occur below Landtypes 1, 2, 3, 8, and 9 near the heads of streams. When Landtypes 14 and 15 are adjacent, Landtype 14 occupies a higher position on the landscape. In gorges of the Plateau interior, particularly in LTA-C of Subregion 1, this landtype occurs below Landtypes 16 and 17 where streams have not cut through the sandstone caprock, and below Landtypes 18 and 19 where streams have cut through the sandstone caprock into the underlying Pennington and Bangor formations. This landtype is the second most productive one in the region.

Dominant soils—Sewanee, Clifty, Ealy, Cotaco, Barbourville, Pope, and Philo.

Parent material—Alluvium, and in places, colluvium from soils developed in residuum from sandstone, siltstone, and shale, and underlain by sandstone, siltstone, shale, and limestone.

Depth to bedrock—40 inches to 12 feet or more.

Texture—Loam, fine sandy loam, silt loam, and sandy loam; occasionally gravelly. Coarse fragment content ranges from 0 to 35 percent and usually increases with depth.

Soil drainage—Moderately well drained to well drained.

Relative soil water supply—High. Irrigated by subsurface flow. Seeps occur on footslopes in winter and spring. Streambottoms may have seasonal water table for 1 to 3 months.

Soil fertility—Moderate.

Vegetation—White oak, yellow-poplar, red maple, blackgum, sweetgum, black oak, and loblolly pine; occasional southern red oak, scarlet oak, eastern white pine, eastern hemlock, shortleaf pine, Virginia pine, bigleaf magnolia, American sycamore, American elm, American beech, and hackberry. Dogwood, sassafras, sourwood serviceberry, blue-beech, mountain-laurel, viburnums, strawberry bush, devils-walkingstick, striped maple, azaleas, cane, and American holly are common in the understory.

Table 18.—*Forest management interpretations for Landtype 14: Footslopes, Terraces, and Streambottoms with Good Drainage. Footnotes appear on page 56.*

PRODUCTIVITY				
	Site index		Average annual growth cubic feet per acre	
Species	Natural stands[1]	Old-field plantations[2]	Natural stands[3]	Old-field plantations[4]
E. white pine	90	63	154	226
Shortleaf pine	80	(50)	148	117
Loblolly pine	85	60	134	148
Virginia pine	75		120	
Upland oaks	80		62	
Yellow-poplar	100		107	
Sweetgum	90		81	

MANAGEMENT PROBLEMS				
Plant competition	Seedling mortality	Equipment limitations	Erosion hazard	Windthrow hazard
Severe	Slight	Slight to moderate	Slight	Slight

SPECIES DESIRABILITY		
Most desirable	Acceptable	Least desirable
E. white pine	White oak	E. hemlock
Shortleaf pine	Black oak	American hornbeam
Loblolly pine	S. red oak	American beech
Virginia pine	Scarlet oak	Hackberry
Yellow-poplar	American elm	Bigleaf magnolia
Sweetgum		Sassafras
American sycamore		Serviceberry
		American holly
		Red maple
		Striped maple
		Blackgum
		Dogwood
		Sourwood

Description of Landtype 15: Terraces, Streambottoms, and Depressions with Poor Drainage

Geographic setting—Deep, loamy soils with poor drainage on level to gently sloping stream terraces, heads of hollows, and depressions on the Plateau surface in Subregions 1, 2, and 3. Slope ranges from 0 to 3 percent. This landtype typically occurs below Landtypes 5, 6, 12, and 13 as narrow strips along intermittent drainages or level bottomland along permanent streams, creeks, and rivers but can also occur below Landtypes 1, 2, 3, 8, and 9 near the heads of streams. When landtypes 14 and 15 are adjacent, Landtype 14 occupies a higher position on the landscape. In gorges on the Plateau interior, particularly in Subregion 1, this landtype occurs below Landtypes 16 and 17 where streams have not cut through the sandstone caprock, and below Landtype 18 and 19 where streams have cut through the caprock into the underlying Pennington and Bangor formations.

Dominant soils—Bonair, Atkins, and Stokly.

Parent material—Alluvium washed from soils developed in residuum from sandstone, siltstone, and shale, and underlain by sandstone, siltstone, shale, and limestone.

Depth to bedrock—40 inches to 5 feet or more.

Texture—Loam, fine sandy loam, silt loam, and sandy loam; occasionally silty clay loam. Coarse fragment content ranges from 0 to 20 percent in the solum and usually increases with depth.

Soil drainage—Poorly drained to somewhat poorly drained.

Relative soil water supply—High to very high. Irrigated by subsurface flow. Subject to flooding for brief periods and has a water table within a foot or less of the surface from January to May.

Soil fertility—Moderate.

Vegetation—Red maple, sweetgum, blackgum, yellow-poplar, white oak, American sycamore, and loblolly pine; occasional American elm, American beech, cottonwood, water oak, willow oak, black willow, and boxelder. Viburnums, azaleas, mountain-laurel, American holly, cane, sphagnum moss, alder, dogwood, buckthorn, strawberry bush, Virginia-willow, and sedges are common in the understory.

Table 19—*Forest management interpretations for Landtype 15: Terraces, Streambottoms and Depressions with Poor Drainage. Footnotes appear on page 56.*

PRODUCTIVITY				
	Site index		Average annual growth cubic feet per acre	
Species	Natural stands[1]	Old-field plantations[2]	Natural stands[3]	Old-field plantations[4]
Loblolly pine	85	70	134	175
Cottonwood	105			
Bottomland oaks	90			
Yellow-poplar	90		90	
Sweetgum	90		81	

MANAGEMENT PROBLEMS				
Plant competition	Seedling mortality	Equipment limitations	Erosion hazard	Windthrow hazard
Moderate to severe	Moderate to severe	Severe	Slight	Slight to moderate

SPECIES DESIRABILITY		
Most desirable	Acceptable	Least desirable
Cottonwood	Loblolly pine	Black willow
Willow oak	White oak	American beech
Water oak	American elm	American holly
Sweetgum	Yellow-poplar	Red maple
	American sycamore	Boxelder
		Blackgum
		Dogwood

Description of Landtype 16: Plateau Escarpment and Upper Sandstone Slopes and Benches—North Aspect

Geographic setting—Deep to very deep, loamy soils formed in colluvium from sandstone, siltstone, and shale, and underlain by sandstone, siltstone, or shale in all subregions. Occupies the gently sloping to very steep upper one-third to one-half of northerly slopes that extend from the Plateau escarpment to the adjacent limestone valleys. Slope ranges from 5 to 70 percent. Much of the surface is covered with sandstone boulders and fragments. At the Plateau exterior, particularly in the Sequatchie Valley, this landtype may be absent if escarpment development has progressed down to limestone. In gorges of the Plateau interior, primarily in Subregion 1, where stream cutting has not carved through the sandstone caprock, this landtype occurs between the escarpment and larger streams and rivers and Landtype 18 is absent. In narrow gorges the lower one-fourth to one-half of south-facing slopes (Landtype 17) should be included with Landtype 16 because shading mollifies the normal warm microclimate. This landtype is a mesic site and has the highest productivity of any landtype in the region.

Dominant soils—Grimsley, Jefferson, Ramsey, and Zenith. Formerly mapped as sandstone rockland or bouldery colluvial land.

Bedrock—Sandstone, siltstone, and shale.

Depth to bedrock—40 to 60 inches or more.

Texture—Gravelly or cobbly loam, silt loam, sandy clay loam, or clay loam.

Soil drainge—well drained.

Relative soil water supply—Very high to high. Irrigated by subsurface flow and seepage.

Soil fertility—Moderate to moderately low.

Vegetation—White oak, northern red oak, yellow-poplar, chestnut oak, sugar maple, hickories, American beech, black oak, white ash, white basswood, yellow buckeye, and black locust; occasional blackgum, elms, red maple, southern red oak, eastern hemlock, eastern white pine, chinkapin oak, black cherry, black walnut, and cucumbertree. Dogwood, eastern redbud, bigleaf magnolia, specebush, bladdernut, hydrangea, viburnums, azaleas, rhododendrons, sourwood, grape, and pawpaw are common understory species. This landtype also supports a rich herbaceous flora.

Table 20.—*Forest management interpretations for Landtype 16: Plateau Escarpment and Upper Sandstone Slopes and Benches—North Aspect. Footnotes appear on page 56.*

PRODUCTIVITY				
Species	Site index		Average annual growth cubic feet per acre	
	Natural stands[1]	Old-field plantations[2]	Natural stands[3]	Old-field plantations[4]
Black walnut	(90)			
White oak	75			
N. red oak	80		57–62	
S. red oak	75			
Yellow-poplar	100		107	
Black cherry	(90)			
White ash	(90)			

MANAGEMENT PROBLEMS				
Plant competition	Seedling mortality	Equipment limitations	Erosion hazard	Windthrow hazard
Moderate	Slight	Slight to severe	Slight to moderate	Slight

SPECIES DESIRABILITY		
Most desirable	Acceptable	Least desirable
Black walnut	E. white pine	E. hemlock
White oak	Chinkapin oak	American beech
N. red oak	Black oak	E. redbud
Yellow-poplar	S. red oak	Black locust
Black cherry	Elms	Red maple
White ash	Cucumbertree	Blackgum
	Sugar maple	Dogwood
	Yellow buckeye	Sourwood
	White basswood	

Description of Landtype 17: Plateau Escarpment and Upper Sandstone Slopes and Benches—South Aspect

Geographic setting—Deep to very deep, loamy soils formed in colluvium from sandstone, siltstone, and shale, and underlain by sandstone, siltstone, or shale in all subregions. Occupies the gently sloping to very steep upper one-third to one-half of southerly slopes that extend from the Plateau escarpment to the adjacent limestone valleys. Slope ranges from 5 to 70 percent. Much of the surface is covered with sandstone boulders and fragments. At the Plateau exterior, particularly in the Sequatchie Valley, this landtype may be absent if escarpment development has progressed down to limestone. In gorges of the Plateau interior, primarily in Subregion 1, where stream cutting has not carved through the sandstone caprock, this landtype occurs between the escarpment and larger steams and rivers and landtype 19 is absent. In narrow gorges the lower one-fourth to one-half of these slopes should be included in Landtype 16 because shading mollifies the normal warm microclimate. This landtype is not as productive as Landtype 16, and forests lack the preponderance of mesic species found on north aspects.

Dominant soils—Grimsley, Ramsey, Jefferson. Formerly mapped as sandstone rockland or bouldery colluvial land.

Bedrock—Sandstone, siltstone, and shale.

Depth to bedrock—40 to 60 inches or more.

Texture—Gravelly or cobbly loam, silt loam, sandy clay loam, or clay loam.

Soil drainage—Well drained.

Relative soil water supply—Medium to low. Irrigated by subsurface flow and seepage. This landtype is not as moist as Landtype 16.

Soil fertility—Moderately low to low.

Vegetation—White oak, chestnut oak, northern red oak, hickories, black oak, red maple, yellow-poplar, and black locust; occasional blackgum, elms, eastern white pine, white ash, black cherry, black walnut, sugar maple, southern red oak, shortleaf pine, Virginia pine, loblolly pine, and American beech. Dogwood, viburnums, eastern redbud, sourwood, azaleas, and grape are common understory species.

Table 21.—*Forest management interpretations for Landtype 17: Plateau Escarpment and Upper Sandstone Slopes and Benches—South Aspect. Footnotes appear on page 56.*

PRODUCTIVITY				
Species	Site index		Average annual growth cubic feet per acre	
	Natural stands[1]	Old-field plantations[2]	Natural stands[3]	Old-field plantations[4]
Shortleaf pine	65		113	
Loblolly pine	(75)		114	
Virginia pine	70		92	
White oak	(65)			
N. red oak	60		43–48	
S. red oak	(65)			

MANAGEMENT PROBLEMS				
Plant competition	Seedling mortality	Equipment limitations	Erosion hazard	Windthrow hazard
Slight	Moderate	Slight to severe	Slight to moderate	Slight

SPECIES DESIRABILITY		
Most desirable	Acceptable	Least desirable
E. white pine	Black walnut	American beech
Shortleaf pine	Hickories	E. redbud
Loblolly pine	Black locust	Red maple
Virginia pine	N. red oak	Blackgum
White oak	Elms	Dogwood
Chestnut oak	Yellow-poplar	Sourwood
Black oak	Black cherry	
S. red oak	Sugar maple	
	White ash	

Description of Landtype 18:
Lower Limestone Slopes, Benches, and Spur Ridges—North Aspect

Geographic setting—Moderately deep to very deep, loamy and clayey soils formed from limestone residuum and some colluvium from sandstone, siltstone, and shale and underlain by limestone in all subregions. Occupies the gently sloping to very steep lower one-half to two-thirds of northerly slopes that extend from the Plateau escarpment to the adjacent limestone valleys, or the entire northern slopes of narrow spur ridges that extend into the adjacent valleys. Slope ranges from 2 to 75 percent. Sandstone boulders may be present, but up to 40 percent of the surface is covered with outcrops of limestone. Soil material between the rocks is compact, sticky, heavy clay. Coarse fragments in the soil vary from less than 10 percent to 65 percent. This landtype usually occurs downslope from Landtype 16 and is less productive than north upper slopes. Landtype 20 often occurs below this landtype on footslopes dominated by limestone outcrops. Where the escarpment has developed down to limestone, however, this landtype extends from the base of the escarpment down to the adjoining valleys. This landtype is absent in gorges of the Plateau interior where streams have not cut through the sandstone caprock. Where streams have cut through the sandstone caprock into the underlying Pennington and Bangor formations, this landtype occurs below Landtype 16 and above Landtypes 14 and 15. In deeply cut, narrow gorges the lower one-fourth to one-half of south-facing slopes (Landtype 19) should be included with Landtype 18 because shading mollifies the normal warm microclimate.

Dominant soils—Bouldin, Allen, Nella, and Talbott. Formerly mapped as limestone rockland or bouldery colluvial land.

Bedrock—Limestone.

Depth to bedrock—Mostly 60 inches or more but may be 20 to 40 inches where Talbott soils occur.

Texture—Cobbly to stony loam, sandy loam, clay loam, and silt loam.

Soil drainage—Well drained.

Relative soil water supply—Medium to low. Soil water percolates deep into the limestone.

Soil fertility—Moderate to moderately low.

Vegetation—White oak, chestnut oak, northern red oak, black oak, hickories, scarlet oak, southern red oak, and yellow-poplar; occasional blackgum, red maple, sugar maple, eastern white pine, post oak, chinkapin oak, and elms. Dogwood, eastern redbud, winged elm, viburnums, sumac, ironwood, and hawthorns are common in the understory.

Table 22.—*Forest management interpretations for Landtype 18: Lower Limestone Slopes, Benches, and Spur Ridges—North Aspect. Footnotes appear on page 56.*

PRODUCTIVITY				
Species	Site index		Average annual growth cubic feet per acre	
	Natural stands[1]	Old-field plantations[2]	Natural stands[3]	Old-field plantations[4]
White oak	70		43–52	
N. red oak	70			
S. red oak	60			
Yellow-poplar	85		80	

MANAGEMENT PROBLEMS				
Plant competition	Seedling mortality	Equipment limitations	Erosion hazard	Windthrow hazard
Slight to moderate	Slight to moderate	Slight to severe	Slight to moderate	Slight to moderate

SPECIES DESIRABILITY		
Most desirable	Acceptable	Least desirable
White oak	E. white pine	Ironwood
N. red oak	Hickories	Winged elm
Black oak	Post oak	E. redbud
S. red oak	Chestnut oak	Blackgum
Yellow-poplar	Chinkapin oak	Dogwood
	Scarlet oak	
	Elms	
	Sugar maple	

Description of Landtype 19: Lower Limestone Slopes, Benches, and Spur Ridges—South Aspect

Geographic setting—Moderately deep to very deep, loamy and clayey soils formed in colluvium from sandstone, siltstone, and shale and from limestone residuum, and underlain by limestone in all subregions. Occupies the gently sloping to very steep lower one-half to two-thirds of southerly slopes that extend from the Plateau escarpment to the adjacent limestone valleys, or the entire southerly slopes of narrow spur ridges that extend into the adjacent valleys. Slope ranges from 2 to 75 percent. Sandstone boulders may be present, but up to 40 percent of the surface is covered with outcrops of limestone. Soil material between the rocks is compact, sticky, heavy clay. Coarse fragments in the soil vary from less than 10 percent to 65 percent. This landtype usually occurs downslope from Landtype 17 and is less productive than south upper slopes. Landtype 20 often occurs below this landtype on footslopes dominated by limestone outcrops. Where the escarpment has developed down to limestone, however, this landtype extends from the base of the escarpment down to the adjoining valleys. This landtype is absent in gorges of the Plateau interior where streams have not cut through the sandstone caprock. Where streams have cut through the sandstone caprock into the underlying Pennington and Bangor formations, this landtype occurs below Landtype 17 and above Landtypes 14 and 15. In deeply cut, narrow gorges the lower one-fourth to one-half of these slopes should be included in Landtype 18 because shading mollifies the normal warm microclimate.

Dominant soils—Bouldin, Allen, Nella, and Talbott. Formerly mapped as limestone rockland or bouldery colluvial land.

Bedrock—Limestone.

Depth to bedrock—Mostly 60 inches or more but may be 20 to 40 inches where Talbott soils occur.

Texture—Cobbly to stony loam, sandy loam, clay loam, and silt loam.

Soil drainage—Well drained.

Relative soil water supply—Low to very low. Soil water percolates deep into the limestone.

Soil fertility—Moderate to moderately low.

Vegetation—White oak, scarlet oak, chestnut oak, hickories, eastern redcedar, white ash, post oak, southern red oak, black oak, and elms; occasional red maple, blackgum, black locust, chinkapin oak, honeylocust, blue ash, American beech, Virginia pine, shortleaf pine, and loblolly pine. Eastern redbud, dogwood, winged elm, viburnums, ironwood, hawthorns, and sumac are common in the understory.

Table 23.—*Forest management interpretations for Landtype 19: Lower Limestone Slopes, Benches, and Spur Ridges—South Aspect. Footnotes appear on page 56.*

PRODUCTIVITY				
Species	Site index		Average annual growth cubic feet per acre	
	Natural stands[1]	Old-field plantations[2]	Natural stands[3]	Old-field plantations[4]
Shortleaf pine	55		90	
Loblolly pine	(65)		95	
Virginia pine	60		53	
E. redcedar	45			
White oak	50		32–38	
S. red oak	55			

MANAGEMENT PROBLEMS				
Plant competition	Seedling mortality	Equipment limitations	Erosion hazard	Windthrow hazard
Slight	Moderate to severe	Moderate to severe	Slight to moderate	Slight to moderate

SPECIES DESIRABILITY		
Most desirable	Acceptable	Least desirable
Shortleaf pine	E. redcedar	Ironwood
Loblolly pine	Hickories	American beech
Virginia pine	Post oak	Winged elm
White oak	Chestnut oak	E. redbud
S. red oak	Chinkapin oak	Honeylocust
White ash	Black oak	Red maple
	Scarlet oak	Blackgum
	Elms	Dogwood
	Black locust	
	Blue ash	

Description of Landtype 20:
Limestone Outcrops and Shallow Soils

Geographic setting—Small to extensive areas of limestone outcrops interspersed with patches of shallow to moderately deep, clayey soils on gently sloping to steep footslopes in all subregions. This intricate pattern of soil and rock outcrops occurs mostly between Landtypes 18 and 19 and the adjacent limestone valleys but may occur intermingled with Landtypes 18 and 19. Eastern redcedar often dominantes this landtype. Slope ranges from 2 to 40 percent. Soil mass may contain up to 65 percent limestone slabs. More than 50 percent of the surface may be exposed limestone. Where the exposed rock is extensive, it is often terraced but the slope of each terrace is nearly horizontal.

Dominant soils—Barfield, Gladeville, and limestone rockland. Pockets of moderately deep Talbott may occur in this landtype.

Bedrock—Limestone.

Depth to bedrock—Mostly less than 20 inches but ranges up to 40 inches where Talbott soils occur.

Texture—Silty clay loam, silty clay, clay, and silt loam.

Soil drainage—Well drained to excessively drained.

Relative soil water supply—Low. Seepage is common in wet weather, but the soil dries quickly.

Fertility—Moderate.

Vegetation—Eastern redcedar, hickories, hackberry, white ash, and elms; occasional honeylocust, Virginia pine, blackjack oak, blue ash, black wlanut, southern red oak, and osage-orange. Forbs, grasses, sumac, eastern redbud, winged elm, buckthorn, hawthorns, and pricklypear are common in the understory.

Table 24.—*Forest management interpretations for Landtype 20: Limestone Outcrops and Shallow Soils. Footnotes appear on page 56.*

PRODUCTIVITY				
	Site index		Average annual growth cubic feet per acre	
Species	Natural stands[1]	Old-field plantations[2]	Natural stands[3]	Old-field plantations[4]
Virginia pine	(55)		41	
E. redcedar	40			
Upland oaks	(55)		38	

MANAGEMENT PROBLEMS				
Plant competition	Seedling mortality	Equipment limitations	Erosion hazard	Windthrow hazard
Slight	Severe	Moderate to severe	Moderate	Moderate to severe

SPECIES DESIRABILITY		
Most desirable	Acceptable	Least desirable
Virginia pine	Hickories	Blackjack oak
E. redcedar	Elms	Winged elm
Black walnut	White ash	Hackberry
S. red oak	Blue ash	Osage-orange
		E. redbud
		Honeylocust

Footnotes for Tables 5–24

[1] Site indices for each naturally occurring species, except those enclosed in parentheses, are the means of values from soil survey interpretations issued by the SCS for the dominant soils in each landtype, but sometimes adjusted for aspect and slope position (Beck 1962; Broadfoot 1960, 1963; Broadfoot and Krinard 1959; Curtis and Post 1962; Defler 1937; Doolittle and Vimmerstedt 1960; Nelson and others 1961; Schnur 1937; and U.S. Forest Service 1929). Estimated site indices are enclosed in parentheses. Base age is 50 yrs for all naturally grown species except cottonwood, for which it is 30 yrs.

[2] Site indices for old-field plantations of eastern white, loblolly, and shortleaf pines were obtained from Vimmerstedt's (1962) and Smalley and Bower's (1971) site curves. Base age is 25 yrs from seed.

[3] Annual growth of natural stands calculated from published yields at 50 yrs: Eastern white pine—(Doolittle 1956), inside bark volume of total stem, all trees; Shortleaf and loblolly pines—(U.S. Forest Service 1929, Tables 44 and 108), total volume outside bark, trees > 3.5 inches d.b.h.; Virginia pine—(Nelson and others, 1961, Table 4), outside-bark volume to a 4.0-inch o.b. top, trees > 3.5 inches d.b.h.; Upland oaks — (Schnur 1937, Table 2, Column 12), outside bark volume to a 4.0-inch o.b. top, trees > 4.5 inches d.b.h.; Yellow-poplar—(McCarthy 1933, Table 17), inside-bark volume to a 3.0-inch i.b. top, trees > 4.5 inches d.b.h.; Sweetgum—(Winters and Osborne 1935, Table 13), inside-bark volume to a 4.0-inch i.b. top, trees >4.5 inches d.b.h.

[4] Annual growth of eastern white pine plantations calculated from yields at 35 yrs assuming an original spacing of 6 × 7 feet (1,037 trees per ac), outside-bark volume to a 3.0-inch o.b. top, trees > 3.0 inches d.b.h. (Vimmerstedt 1962). Annual growth of loblolly and shortleaf pine plantations calculated from yields at 40 yrs assuming 1,000 seedlings planted per ac., outside-bark volume to a 4.0-inch o.b. top, trees > 4.5 inches d.b.h. (Smalley and Bailey 1974a, 1974b).

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APPENDIX

County Soil Surveys Available for the Mid-Cumberland Plateau[3]

Elder, J. A., E. K. Yates, I. B. Epley, and L. E. Odum.
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*Jackson, G. T., S. R. Bacon, J. F. Brasfield, D. B. Freeman, and I. D. Persinger.
1967. Soil survey of Warren County, Tennessee. U.S. Dep. Agric., Soil Conserv. Serv. 79 p. + maps.
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1959. Soil survey of Coffee County, Tennessee. U.S. Dep. Agric., Soil Conserv. Serv. Series 1956, No. 5, 112 p. + maps.
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1958. Soil survey of Madison County, Alabama. U.S. Dep. Agric., Soil Conserv. Serv. Series 1947, No. 3. 101 p. + maps.

[3]Asterisk denotes survey that contains a section on woodland suitability.

METRIC EQUIVALENTS

1 inch = 2.54 centimeters (exactly)
1 foot = 0.3048 meter (exactly)
1 acre = 0.4047 hectare
1 square foot/acre = 0.2296 square meter/hectare
1 cubic foot/acre = 0.06997 cubic meter/hectare
1 mile = 1.6093 kilometers
1 square mile = 2.5900 square kilometers
°C = (°F − 32)/1.8

SMALLEY, GLENDON W.
1982. Classification and evaluation of forest sites on the Mid-Cumberland Plateau. U.S. Dep. Agric. For. Serv., Gen. Tech. Rep. S0-38. South. For. Exp. Stn., New Orleans, La. 58 p.

Presents a comprehensive forest site classification system for the central portion of the Cumberland Plateau in northeast Alabama, and east-central Tennessee. The system is based on physiography, geology, soils, topography, and vegetation.

Additional keywords: Site index, mean annual increment, soil properties, pines, hardwoods.