

SOIL SURVEY

Union County Georgia

Series 1938, No. 28



Issued June 1950

UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Administration
Bureau of Plant Industry, Soils, and Agricultural Engineering
In cooperation with the
UNIVERSITY OF GEORGIA, COLLEGE OF AGRICULTURE
and the
TENNESSEE VALLEY AUTHORITY

How to Use THE SOIL SURVEY REPORT

FARMERS who have lived in one locality for a long time come to know about the soil differences on their own farms and on those of their immediate neighbors. What they do not know, unless a soil survey has been made, is how nearly their soils are like those at experiment stations or in other localities from which higher yields are reported. They do not know whether these higher yields are from soils like their own or so different that they could not hope to get equally high ones, even if they adopted the practices followed in these other places. These similarities and differences among soils are known only after a map of the soils has been made. Knowing what kind of soil one has and comparing it with soils on which new developments have proved successful will remove some of the risk in trying new methods and varieties.

SOILS OF A PARTICULAR FARM

To find what soils are on any farm or tract of land in the area embraced by this survey, locate it on the soil map, which is in the envelope inside the back cover. This is easily done by locating its boundaries by such landmarks as roads, streams, villages, and other features.

Each kind of soil is marked with a symbol on the map; for example, all soils marked Flh are of the same kind. To find the name of the soil so marked, look at the legend printed near the margin of the map and find Flh. The color where Flh appears in the legend will be the same as where it appears on the map. The Flh means Fannin loam, hilly phase. A section of this report (see table of contents) tells what Fannin loam, hilly phase, is like, for what it is mainly used, and some of the uses to which it is suited.

How productive is Fannin loam, hilly phase? Find this soil name in the left-hand column of table 18, page 113, and note the yields of the different crops opposite it. This table also gives expectable yields for all the other soils mapped, so that the different soils may be compared.

Read in the section on Soil Types and Phases to learn what are good uses and management practices for this soil. Look also at the section headed Use, Management, and Productivity of the Soils. Here soils suited to about the same use and management practices are grouped. Find the group (see tables 12 to 17) that contains Fannin loam, hilly phase. What is said there about rotations, liming, fertilizing, drainage, erosion control, and other management practices applies to this soil.

SOILS OF THE COUNTY AS A WHOLE

If a general idea of the soils of the county is wanted, read the introductory part of the section on Soils. This tells where the principal kinds are found, what they are like, and how they are related to one another. Then study the soil map and notice how the different kinds of soils tend to be arranged in different localities. These patterns are likely to be associated with well-recognized differences in type of farming and land use.

A newcomer who considers purchasing a farm in the county will want to know about the climate as well as the soils; the types and sizes of farms; the principal farm products and how they are marketed; the kinds and conditions of farm tenure; kinds of farm buildings, equipment, and machinery; availability of schools, churches, highways, railroads, telephone and electric services, and water supplies; industries; and cities, villages, and population characteristics. This information will be found in the section on General Nature of the Area.

Students and others interested in how the soils of the county were formed and how they are related to the great soil groups of the world should read the section on Morphology and Genesis of Soils.

This publication on the soil survey of Union County, Ga., is a cooperative contribution from the—

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SOIL SURVEY OF UNION COUNTY, GEORGIA

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¹ The field work for this survey was done while the Division was a part of the Bureau of Chemistry and Soils.

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AGRICULTURE in Union County, Ga., first carried on by the Cherokee Indians and later by white settlers following the discovery of gold on Wards Creek, near Dahlonega, in 1830, centered around three main crops—corn, beans, and potatoes. With the expansion of the county came improved methods of farming, together with a change to a more stabilized system of cropping. A subsistence type of farming is now practiced, consisting principally of corn, rye, hay, potatoes, sweet sorghum for sirup, apples, and livestock. Tobacco and wheat are grown to a less extent, and vegetables chiefly for home consumption. To learn the best agricultural uses of the land a cooperative soil survey of the county was begun in 1938 by the United States Department of Agriculture; the University of Georgia, College of Agriculture; and the Tennessee Valley Authority. The results may be summarized as follows.

SUMMARY OF THE SURVEY

Union County lies in the mountainous part of north Georgia, bordering North Carolina. The surface features range from nearly level narrow first bottoms through a system of three intermediate terraces to rolling and mountainous uplands. The drainage is dendritic in pattern and is effected mainly through the Nottely River. Nottely Dam, built by the Tennessee Valley Authority for controlling stream flow on this river, impounds a reservoir of about 4,290 acres. Agricultural requirements vary from normal conditions of tillage on level or nearly level soil and crop rotation on undulating or gently sloping soil to contour tillage, terracing, or strip cropping on rolling or sloping soil. Soil of the hilly or hill relief is suitable for pasture or forest, and that of steep relief for forest.

The soil series are arranged in groups according to their physiographic position. These groups include (1) soils of the uplands, (2) soils of the colluvial land, (3) soils of the terraces, and (4) soils of the bottom land.

Soils of the uplands include those on mountain and intermountain uplands. On the mountain uplands are soils of the Porters, Balfour, Rabun, Ranger, and Talladega series and on the intermountain uplands are those of the Fannin, Edneyville, Hayesville, and Worsham series. The soils on the mountain uplands are generally less well developed than those on the intermountain uplands, owing largely to the steep slopes of the mountain uplands. Soils of the colluvial land comprise members of the Tusquitee and Tate series. Soils of the terraces include members of the Hiwassee, Altavista, Warne, and State series. Soils of the bottom land belong to the Congaree, Transylvania, Chewacla, Spilo, and Toxaway series.

Studies were made of the characteristics of the soil types, phases, complexes, and miscellaneous land types and of their use suitability, present use, management practices, and management requirements. The soils of the county range widely in color, texture, and consistence. The color of the surface soil and subsoil is red, yellow, brown, or gray or shades of these colors, and in some the subsoil is mottled gray and yellow or gray and brown. The texture is predominantly loam and silt loam, in some places coarser and in others finer. The consistence of the surface soil is generally moderately friable, although in some soils it is loose or crumbly and in others compact or plastic. The consistence of the subsoil ranges from loose to very plastic, but in most of the soils it is moderately friable or crumbly.

All the soils are more or less acid, and most of them are low in content of organic matter, phosphate, and available potash. Tilth is generally good in the coarse-textured soils but rather poor in the fine-textured ones. Most of the soils have medium internal drainage, except on first bottoms and terraces. Soils of 20 series of more than 50 types and phases are mapped.

The use and management of the soils are affected by many soil features, including relief, accelerated erosion, and stoniness. Almost half the land is steep or very steep, having a slope of 30 to 60 percent or more; about a fourth is hilly, slope 15 to 30 percent; and about a fourth is level to rolling or sloping, 0 to 15 percent.

In considering use, management, and productivity, the soils are arranged in five classes according to relative suitability for agriculture—First-, Second-, Third-, Fourth-, and Fifth-class soils.

First-class soils are very good to excellent for the agriculture of the county and constitute good to excellent cropland and very good to excellent pasture land. Second-class soils are good to very good for agriculture and are fair to good cropland and good to very good pasture land. Third-class soils are fair to good soils for agriculture and are poor to fair cropland and fair to good pasture land. Fourth-class soils are poor to fair for agriculture, very poor to poor cropland, and fair to very good pasture land. Fifth-class soils are very poor for the agriculture and are very poor cropland and very poor to poor pasture land; their most feasible use is for forest.

The soils of the five physical land classes are placed in three major groups—soils well suited to tilled crops, soils poorly suited to tilled crops but fairly well suited to pasture, and soils poorly suited to tilled crops and permanent pasture but fairly well suited to forest. These groups are further subdivided according to use suitability, present management, and management requirements.

Estimates of yields and productivity ratings show the relation among the soils of the county in terms of relative productivity for the important crops under three different levels of management.

The control of water on the land where it falls is important to successful agriculture. Such control conserves water useful to plant growth and also reduces soil loss caused by accelerated erosion.

In discussing the factors of soil formation and taxonomic soil classification, the soil series are grouped in higher categories and their morphology described.

GENERAL NATURE OF THE AREA

In Union County, which has no important industries, farming is the principal occupation, and a large part of the products is consumed on the farms where grown. The small sawmills constitute practically all the industrial activities.

A fairly large total acreage that has been farmed at one time has been allowed to reforest, mainly with pine. Most of the merchantable timber has been cut.

All the soils on the uplands and higher terraces of streams have been leached and are low in natural fertility. Over large areas unfavorable slope has restricted the use of the land to pasture or forest.

LOCATION AND EXTENT

Union County is in the northern part of Georgia, bordering North Carolina (fig. 1). Blairsville, the county seat, is 80 miles northeast of Atlanta, 140 miles north of Macon, and 150 miles northwest of Augusta. In general the eastern, southern, and western boundaries are along high mountain ridges. On the east the Wolfpen Ridge forms most of the boundary, and on the south the Blue Ridge, except in the vicinity of Eagle Knob, where the county extends a short distance beyond. Southward from Payne Knob the western boundary is an arbitrary line, but northward it follows the summits of Mull and Hogback Mountains and other mountains. The area of the county is 322 square miles, or 206,080 acres.

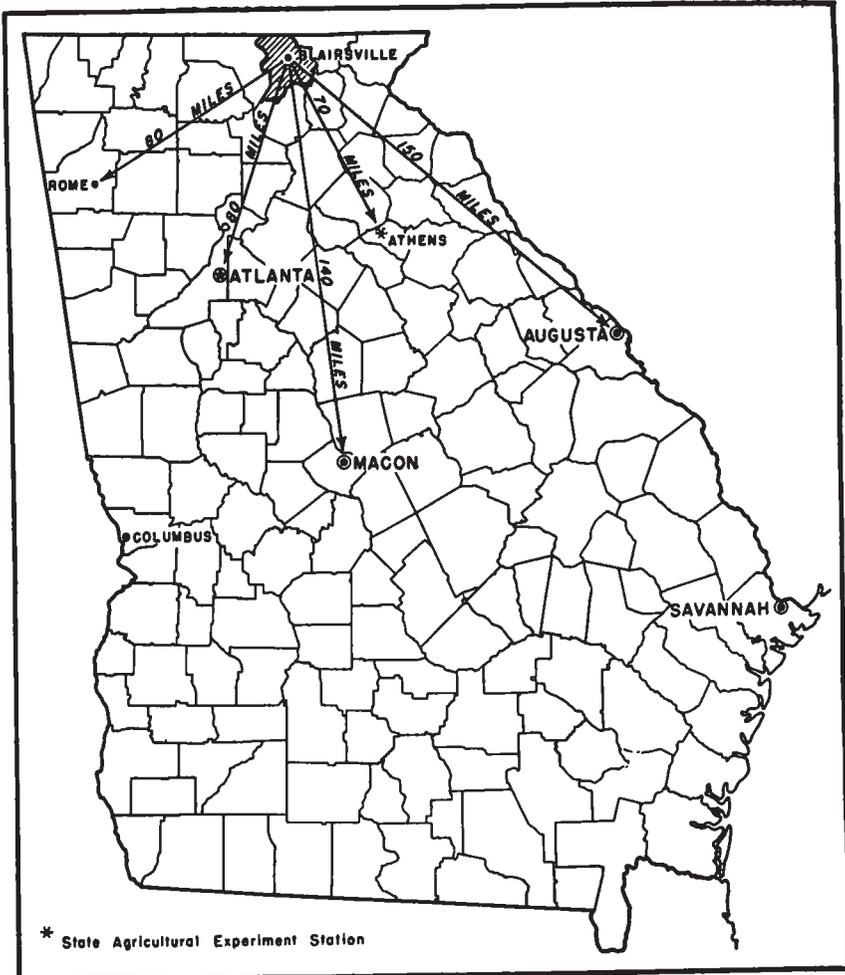


FIGURE 1.—Location of Union County in Georgia.

PHYSIOGRAPHY, RELIEF, DRAINAGE, AND WATER SUPPLY

Union County lies in the Blue Ridge province. The surface features throughout the uplands range from rolling to mountainous. Rolling relief is characteristic of the Hiwassee Plateau. Above an elevation of 2,100 feet (10),² the approximate limit of the plateau, the slopes are steeper and there is very little rolling or gently sloping land. In addition to the nearly level and generally narrow first bottoms, three terrace systems are evident. The most recent terraces are low, in places only slightly elevated above the first bottoms, narrow, nearly level, and subject to frequent overflow. The intermediate ones are gently sloping to sloping and even though higher

² Italic numbers in parentheses refer to Literature Cited, p. 143.

than those of the first bottoms are probably subject to inundation by floods. The highest terraces, apparently much older than the others, are moderately sloping to very strongly sloping near the uplands.

Only meager studies have been made of the geology of this part of the State; consequently, most of the county has been mapped only in reconnaissance surveys. Schist and gneiss of the Carolina series underlie most of the area. In general, granite gneiss underlies the higher ridges, and micaceous schist occurs at lower elevations. Quartz veins are common throughout both formations. Narrow bands of basic rock, such as diorite, pyroxenite, or hornblende gneiss, appear in many places, especially in the southwestern parts. These basic rocks generally have a discontinuous northeast-southwest trend. Black graphitic schist is exposed in the northern part of the county, in places bordering the Nottely River, as are also muscovite-biotite granite, muscovite-biotite pegmatite, and kyanite schist. A narrow belt of Nantahala slate is exposed in the northwestern part (11). Residuum of quartz gravel is found on most of the stream-cut terraces. Some of the kyanite deposits and pegmatites have been worked, but none were being worked in 1939.

Elevations range from 1,600 feet where the Nottely River crosses the Georgia-North Carolina boundary to 4,768 at the top of Brass-town Bald, the highest point in the State. Some of the highest elevations are Gumlog Mountain, 3,743 feet, and Buzzard Roost Ridge, 3,668 feet, in the eastern part, and Blood Mountain, 4,463 feet, Slaughter Mountain, 4,370 feet, Wildcat Knob, 4,018 feet, and Payne Mountain, 3,242 feet, in the southern and western parts. Elevations above sea level at Youngcane, Ivylog, and Blairsville are 1,966, 1,940, and 1,926 feet, respectively. Elevations of most of the land used for cultivated crops are less than 2,200 feet, the most notable exception being in the vicinity of Suches, where the elevation is about 2,500 feet.

Differences in elevation are largely the result of weathering and wearing down of rocks consisting of more or less resistant mineral components and of the position of any particular area in relation to the stream, the reduction of the surface being greatest near the large streams and least around their headwaters. The position of areas near streams is responsible for the plateaus and open valleys near the large rivers and the mountainous character near the divides between them (10).

The drainage pattern is dendritic. There are no swampy places on the uplands, but some poorly drained ones are found in the first bottoms. Most of the drainage is effected through the Nottely River, which rises in the southeastern part of the county, flows northward, and joins the Hiwassee River in North Carolina a few miles beyond the Georgia-North Carolina boundary. Small areas in the northeastern part are drained by small tributaries of the Hiwassee River. Approximately 4 square miles of the southeastern part beyond the Blue Ridge is drained by the Chattahoochee River. Streams in the southwestern part form the headwaters of the Toccoa River.

Extensions of the Hiwassee Plateau border the Nottely River and smaller streams in the northeastern part of the county. The river is entrenched to a depth of 300 to 400 feet and is well graded within this plateau, but beyond its limits the gradient is irregular and small

waterfalls and rapids occur. Power developed by the Nottely River and other streams is utilized by gristmills in various parts of the county.

The water supply from the numerous streams and springs is adequate for the needs of livestock, although it may be low in protracted dry weather. Water for domestic use is obtained from springs, shallow wells, and streams.

CLIMATE

The climate of Union County is continental—it has moderate mid-day summer temperatures with cool pleasant evenings and mild open winters with short erratic periods of cold weather. The county is in the second heaviest rainfall belt in the United States.

Variations in temperature are greater than in other counties in the State where the relief is milder. Although official records of the local variations are not available, lower minimum and average temperatures occur on the mountains than on the Hiwassee Plateau, which lies at a maximum elevation of only 2,100 feet, compared with the 3,300 to 4,768 feet of the surrounding mountains. Convectional currents of cool air from the higher slopes probably account for the cool pleasant summer evenings. The 11-year record of a former United States Weather Bureau station, at Blue Ridge, Fannin County, Ga., shows a mean annual temperature of 57.7° F. and a difference of 30.7° between winter and summer means.

Close correlation also exists between elevation and mean precipitation. Records kept for 3 years by the Tennessee Valley Authority at four widely distributed rain gages in the county at elevations of less than 2,100 feet show an average annual precipitation of 49.92 inches, whereas records of an equal number of rain gages at elevations above 2,100 feet show an average of 16.69 inches heavier, or 66.61 inches.³

On the Hiwassee Plateau there is an average yearly snowfall of about 6 inches, but at higher elevations it is much heavier.

Variations in the lay of the land, including direction of slope, variation in elevation, and proximity and relationship to mountains, affect locally both air drainage and precipitation. Frosts are frequently heavier in the valleys or depressions than on the surrounding higher slopes, and injury to growing vegetation is noticed earlier. Because of cooler temperatures on north-facing slopes, fruit trees remain dormant longer and are less likely to be injured by frost than those on south-facing slopes. For the same reason soils on the north-facing slopes are less intensely oxidized in many places and have a higher content of organic matter. Damage to small grains and other crops by soil heaving and attendant winterkilling is greatest on seepy lower slopes and other places where high humidity prevails. These places, however, may be especially suited to the production in the frost-free season of such leafy truck crops as lettuce and cabbage, provided the soil characteristics are favorable.

The average frost-free season of 184 days—April 19 to October 20—is ample for the maturity of all the important southern crops

³ From unpublished data by James Smallshaw, area engineer, Tennessee Valley Authority, Murphy, N. C.

except cotton. Killing frost has occurred as late as May 10 and as early as October 1. The grazing season extends from about April 15 to December 1.

Although official records show a temperature of -5° F. at the Blue Ridge Weather Bureau station, an unofficial temperature of -18° has been reported for some of the higher mountains. Subzero temperature, however, is very unusual. The brief cold periods are disagreeable chiefly because of the prevailing high humidity. Winters for the most part are sufficiently open to permit outdoor work. Although there is not enough snowfall to provide a deep cover, very little small grain and clover are winterkilled on the better drained soils. The chief winter vegetables ordinarily are turnips and onions.

TABLE 1.—Normal monthly, seasonal, and annual temperature and precipitation at Dahlonega, Lumpkin County, Ga.

(Elevation, 1,519 feet)

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total for the driest year	Total for the wettest year	Average snowfall
	$^{\circ}$ F.	$^{\circ}$ F.	$^{\circ}$ F.	Inches	Inches	Inches	Inches
December.....	42.5	71	1	7.19	5.45	3.06	0.8
January.....	41.5	72	-1	5.51	3.25	6.81	1.6
February.....	43.0	76	-11	5.86	4.43	7.97	1.8
Winter.....	42.3	76	-11	18.56	13.13	17.84	4.2
March.....	50.8	88	0	6.01	3.96	11.54	.6
April.....	58.6	92	23	4.54	2.55	7.19	(¹)
May.....	66.5	95	30	4.89	3.96	9.23	0
Spring.....	58.6	95	0	15.44	10.47	27.96	.6
June.....	73.6	101	39	4.72	1.32	4.31	0
July.....	76.0	101	50	5.63	2.32	3.52	0
August.....	75.1	102	49	5.05	8.76	4.05	0
Summer.....	74.9	102	39	15.40	12.40	11.88	0
September.....	70.5	99	34	4.37	.51	14.49	0
October.....	59.8	89	21	3.89	(¹)	2.84	(¹)
November.....	49.7	79	10	3.62	2.71	11.11	.2
Fall.....	60.0	99	10	11.88	3.22	28.44	.2
Year.....	59.0	² 102	³ -11	61.28	⁴ 39.22	⁵ 86.12	5.0

¹ Trace.

² Aug. 20, 1925.

³ Feb. 13, 1899

⁴ In 1904.

⁵ In 1929.

The rainfall is unusually well distributed and is ample for the moisture requirements of the most exacting crops where other conditions, such as lay of the land, internal soil characteristics, and vegetable cover, are favorable. Crop yields, however, are sometimes materially reduced during periods of light rainfall, especially on clean-cultivated slopes where runoff is excessive or in places where the moisture-holding capacity is limited by shallowness of soil to bedrock or by a tight impervious subsoil or substratum. Variations in rainfall from year to year are so small as to have very little effect on agriculture. Destructive hailstorms, high winds, and tornadoes rarely occur.

On a few farms surface water is used for irrigating home gardens and for small areas of special crops, as lettuce, cabbage, and potatoes, grown for the late summer and fall markets.

Climatic data covering a period of 53 years, compiled from records of the United States Weather Bureau station at Dahlonga, Lumpkin County, Ga., about 36 miles south of Blairsville and 407 feet lower in elevation, are given in table 1. These data may be considered as fairly representative of climatic conditions in Union County.

VEGETATION

Forest on the highland area is classified as chestnut-chestnut oak-yellow-poplar (tuliptree). Although these are the characteristic species that distinguish the forest from that of the hardwood belt to the west, many other kinds of trees also are found. The forest probably contains a larger number of species than any other forest area in North America (13). In the original forest, chestnut was especially conspicuous, yellow-poplar was common in the moister locations, and white pine and hemlock were common at high elevations.

Various species of oak predominate in the present cut-over forest. Most of the original yellow-poplar has been removed, and most of the chestnut not cut for lumber has been killed by blight. Abandoned fields are taken over first by broomsedge, and then smilax and blackberry appear. These, in turn, are crowded out by shortleaf, or Virginia, pine, which is superseded by oak and other deciduous trees.

ORGANIZATION AND POPULATION

Union County was originally a part of the territory belonging to the Cherokee Nation. In 1832 land was ceded by the Cherokee Indians to the United States and was organized into a county that comprised the present Union, Towns, and Fannin Counties (15) and covered about 1,200 square miles. In 1854 the western part was made into Fannin County and in 1856 the eastern part into Towns County (5), leaving Union County with about its present boundaries and an area of 322 square miles.

The early settlers, most of whom came from North Carolina, were mainly of Scotch, English, and Irish descent. Settlement was rapid, and by 1845 the population had grown to 5,812, including 142 Negroes. Blairsville, the county seat, which as early as 1835 had a population of 150, was incorporated in 1847. Other early post offices included Youngcane, Ivylog, Polk, and Shady Grove.

The total population, all classed as rural, increased from 6,340 in 1930 to 7,680 in 1940, with an average density of 24 to the square mile (United States census). Of the total 1940 population 7,668 were native whites, 1 was foreign-born white, and 11 were Negroes. The population is unevenly distributed, and the more densely settled parts of the county are on the rolling uplands of the Hiwassee Plateau and in the narrow valleys in the mountains. Fairly large Forest Service tracts of mountainous country owned by the United States have no habitations.

Blairsville, the only incorporated town in the county, had a population of 358 in 1940. Other small towns are Choestoe, Gaddistown, Baxter, and Suches.

TRANSPORTATION, MARKETS, AND INDUSTRIES

The county does not have the advantage of a railroad. Hard-surfaced Federal highways intersecting at Blairsville connect with Blue Ridge, Gainesville, and Hiawassee, Ga., and Murphy, N. C. A few other roads are improved, but a large total mileage is unimproved. The 1940 census reported 173 farms on hard-surfaced roads; 148 on gravel, shell, or shale roads; 177 on improved dirt roads; and 812 on unimproved dirt roads.

Blairsville is the principal local market and buying center for the rural districts. Many small stores and gristmills conveniently located transact considerable business. Truck crops, such as cabbage, snap beans, lettuce, and potatoes, are transported by motortrucks to markets in Atlanta, Ga., and most of the tobacco is sold in Asheville, N. C.

All industries are of a local nature and are subordinate in importance to agriculture. In 1940 a total of 79 farms reported business with or through cooperatives. The Chattahoochee National Forest and small sawmills furnish seasonal employment.

CULTURAL DEVELOPMENT AND IMPROVEMENT

Grade schools and churches are situated at various points in the county. Advanced students are transported to a central high school in Blairsville.

Part of the county has the advantage of rural electrification. In 1940 (United States census), of 257 farms with electric distribution lines within a quarter mile of the farm dwellings, 121 reported the houses lighted by electricity.

There were 180 automobiles on 177 farms in 1940, 82 motortrucks on 78 farms, and 23 tractors on 22 farms. In the same year 23 farms reported telephones.

Special recreational facilities are afforded by Vogel State Park and Lake Winfield Scott in the mountains in the southern part of the county.

The inherent productivity of the various soils is reflected to a considerable extent by the number and quality of farm improvements and by the living standards of the farmers. Where the farms include largely better soil types, substantial buildings and other improvements are generally found. On farms where the lay of the land or

such soil features as erosion, shallowness to bedrock, tight impervious subsoil, or stoniness are detrimental, the improvements are generally meager and the standard of living is correspondingly low.

AGRICULTURE

The earliest agriculture in the county was carried on by the Cherokee Indians, one of the most advanced of the Indian tribes. They maintained a capital at New Echota, near Calhoun, where a paper was printed in the Cherokee language (?). The Indians lived in semi-permanent homes and had developed a meager type of agriculture. Horses, and later oxen, were used as beasts of burden. Most of the cultivated crops, mainly corn, beans, and potatoes, were grown on the first-bottom lands and terraces. A little tobacco was produced. The small quantity of these crops, together with persimmons, grapes, papaws, mulberries, mayapples, blackberries, strawberries, plums, and other wild fruits, and supplies obtained through hunting and fishing, were ample for the prevailing simple standards of living.

After the discovery of gold in 1830 (?), on Wards Creek on Cherokee land near Dahlonega (Lumpkin County) in the southern Appalachian Mountains, the pressure of white immigration seeking gold became so great that in 1836 the Cherokee Indians were removed and the land opened for settlement. The land was distributed by lottery to the various settlers in 160-acre tracts or 40-acre "gold lots," depending on the pattern of the survey. Settlement and private ownership of land, which began in 1832 (15), was rapid, and as the white settlers were restricted to the land drawn by lottery, many homes were established in remote places and steep mountainsides were cleared for cultivation. Most of the first settlers were interested primarily in gold rather than in agriculture. Like the Indians, they grew principally the crops needed for food. Transportation difficulties, crude farming implements, and steep hillside fields precluded the production of any large quantity of farm products for distant markets. Most of the settlers had limited means, and consequently necessity forced them to attempt the use of the land drawn by lottery even if their particular parcels were not the most desirable.

As a result of the lottery method the early settlement was much more widely distributed over the county than it would have been under a carefully planned program of giving first consideration to the character of the soil and lay of the land. Land abandonment began early—probably before 1845, or within less than 15 years after the first settlement. In 1849 George White (15) wrote that the roads were rough and that in many places bridges were lacking.

Because of remoteness from markets and lack of transportation facilities, timber cutting for commercial use followed rather than preceded agricultural development. The first commercial production of timber began in 1895. White oak and yellow-poplar were cut along the headwaters of Cooper Creek and floated to a local mill. In 1912 part of the county was included in a newly organized national forest, the boundaries of which were later extended to include nearly 80 percent of the county, but much of the land within the national forest boundary is not owned by the Government. Large formerly settled areas were abandoned and now contain no permanent habita-

tions. Most of the land now owned by the Government was culled of yellow-poplar, ash, basswood, cucumbertree, and maple before it was brought into public ownership, but some virgin stands remain. Most of the forested lands are understocked as a result of the blight that killed the chestnut trees, which constituted about 45 percent of the original stand. Stands of shortleaf or Virginia pine cover abandoned home sites in most of the larger coves. With the exception of these, most of the stands contain two or more age classes. Forest products now include hemlock and chestnut bark for tanbark, dogwood for spindles, white oak for staves, yellow-poplar for veneer, locust for posts, and various trees for lumber, much of the timber being cut under contract on Government-owned land. Sample working indicates that about 45 percent of the white oak in need of cutting in the entire Chattahoochee National Forest is suitable for staves.⁴

The present agriculture consists mainly of the production of field crops and livestock. Corn, the most important crop, is grown on nearly every farm. Rye is the leading small-grain crop and is grown on about a third of the farms; wheat is grown much less extensively than rye; and hay is a fairly important crop. A large number of farms produce potatoes and sweetpotatoes. Sweet sorghums for sirup are harvested on about half the farms. Burley tobacco is planted on a fairly large number of farms, but the total acreage is small. Most of the farms grow vegetables for home use, and a fairly large number grow them for sale. Fruits, mainly apples, are produced in small quantities on many farms for home consumption. Forest products are a source of cash income on some farms.

Cattle are kept on nearly all the farms, mainly for a home supply of milk and butter, and hogs are raised on many farms for meat, mainly for domestic use. Chickens are kept on practically every farm for home supply of eggs and fowl. Surplus chickens and eggs are sold by many farmers.

Most of the red and yellow soils of the uplands and terraces suited to cultivated crops are used largely for general farm crops, whereas the better brown and gray soils of the first bottoms are preferred for truck crops. Farms on which most of the cropland is low in productivity are generally of the subsistence type, and less livestock is kept than on farms that contain a larger acreage of the better soils.

The crops commonly grown require different soil conditions for best growth. Corn, the most important crop in total acreage and production, is grown on nearly every soil used for crops, and the yields vary widely. Although it is a hardy crop, easily grown, and free from disease, it is a heavy feeder and for high yields requires soil well supplied with plant nutrients and moisture and in good tilth. It is not especially sensitive to soil acidity, but the pH value should not be lower than 5.0. These conditions are best met by the Congaree and Toxaway soils, which are young soils on first bottoms, and by State silt loam, which is a fairly young soil on low terraces. Some of the more mature soils, however, as Hayesville loam, rolling phase, and Hiwassee and Fannin loams, can be built up to produce

⁴ Data from W. H. Fisher, forest supervisor, Chattahoochee National Forest, Forest Service, U. S. Department of Agriculture.

satisfactory yields. Owing to poor tilth, lack of moisture, and deficiency in plant nutrients, most of the other soils produce relatively low corn yields.

Rye and wheat yields are too low to justify production on a commercial scale. They are valuable as food and cover crops, however, especially on the more sloping cultivated land. They are best adapted to well-drained soils on the terraces and uplands, and Hiwassee, Altavista, and Fannin loams and Hayesville loam, rolling phase, are preferred for their production.

Sorghum is much more exacting in its requirements than corn. It is grown mainly for sirup and makes the heaviest growth on soils high in content of organic matter, but apparently when it is grown on such soils the sirup is dark-colored and low in other qualities. For this reason farmers prefer soils ample in moisture content but low in organic matter and essential plant nutrients. Chewacla silt loam, Chewacla fine sandy loam, Tate-Chewacla silt loams, and Warne-Worsham loams are the favorite soils for this use. Nutrients deficient in the soil are supplied largely through the use of superphosphate, as the sirup made from sorghum grown on land fertilized with manure or nitrate of soda is of inferior quality, which probably is due to the use of such fertilizers.

The leguminous crops grown differ somewhat in soil requirements. Red clover is very sensitive to excess moisture and acidity and requires soil of better than average fertility. It is grown therefore largely on limed areas of Hayesville loam, rolling phase; Hayesville clay loam, rolling phase; Fannin loam; Fannin clay loam, eroded phase; Hiwassee loam; and Hiwassee loam, eroded slope phase. Crimson and white clovers are not so sensitive as red clover and are grown on soils that in places lack drainage. Lime, however, is generally applied before the land is seeded to these crops. Crimson clover is used largely as a green-manure crop preceding corn, especially on Altavista clay loam, eroded phase, and Altavista loam, low-terrace phase. White clover is grown with bluegrass, redtop, orchard grass, and lespedeza for permanent pasture, mainly on Altavista, Warne-Worsham, and Spilo soils. Lespedeza is the most extensively grown legume and is suited to a wide range of soil conditions. Sericea lespedeza will grow on severely eroded soils.

Truck crops vary in soil requirements but, in general, require soils well supplied with moisture, organic matter, and essential plant nutrients. Favorable tilth also is very important, especially if the organic-matter content is low. For some crops, especially potatoes, a loose pervious subsoil is essential. Transylvania, Toxaway, and State silt loams; Congaree silt loam, dark-subsoil phase; and Tusquitee loam are most desirable for truck crops. Congaree silt loam and Congaree fine sandy loam are only slightly less desirable. Other important soils, especially for the production of potatoes and snap beans, are those of the Chewacla series. These soils are not so good for truck crops as Transylvania and Toxaway silt loams and Congaree silt loam, dark-subsoil phase, but their deficiencies may be largely remedied by heavy applications of fertilizer and by other suitable management practices.

CROPS

The acreage and production of the various crops have fluctuated somewhat since 1879 (United States census). The more significant changes in the relative importance and acreage of the crops in the period 1879-1939 are as follows: The virtual elimination of oats for grain, a large decrease in the acreage of wheat, some increase in rye, a large increase in hay, a fairly large increase in potatoes and sweet sorghums harvested for sirup, and some decrease in the acreage of corn, the leading crop.

Corn, rye, and wheat are utilized for household needs or as feed for livestock. On many farms it is necessary to supplement these crops by supplies purchased elsewhere. The maximum corn crop both in acreage and production was in 1899, coinciding with the period of largest population. The corn acreage gradually decreased until 1939, when it was only 11,756 acres, or 2,591 less than in 1879. Average corn yields have shown insignificant variations from a high of 14.4 bushels in 1889 to a low of 12.5 bushels in 1909. The trend, however, seems to be toward slightly lower yields, even though more fertilizer has been used in recent years. The depletion of soil fertility through cropping and erosion probably has more than offset the effects of fertilizer. It is evident that land thrown out of cultivation has been the least productive and that actual loss of soil fertility over much of the county is considerably greater than that reflected by statistical records of crop yields.

A wide diversity exists in the total acreage planted to rye as reported by the Federal census. The smallest acreage, 687, was in 1899 and the highest, 2,507, in 1939, with relatively low average yields of 4.2 and 5.9 bushels, respectively. Approximately half the rye grown is pastured during early stages and plowed under for soil improvement before the grain has matured.

Wheat acreage declined from a maximum of 4,612 acres in 1879 to only 685 in 1939. An increase in acreage, however, was reported for 1919, which was probably due to the stimulus of the high prices following World War I. The maximum acreage in oats, 2,875 acres, was planted in 1889. Since then the acreage has been greatly reduced to only 13 acres in 1939. Only a small part of the acreage of these crops is harvested for grain. The changes in cropping in more recent years is illustrated by a comparison of the total acreage of small grains with that of corn. In 1879 about 60 percent as much land was planted to small grains as to corn. There was a steady decline from this proportion until 1909, when the relative figure was only about 28 percent. A little increase in small-grain acreage was reported for 1919, owing probably to the high prices for harvested grain, but by 1929 only about 19 percent as much land was in small grains as in corn. In 1939, the proportion was about 27 percent, which probably was due largely to crop-control measures and especially to extension-service programs that called for an increase in cover crops and for more diversified farming.

Land in hay crops totaled 1,192 acres in 1939, and the yield averaged about 1.3 tons an acre. Lespedeza, annual legumes, and wild hay

constituted the leading hay crops. Minor hay crops were alfalfa, sweetclover, and small grain. On 3 farms alfalfa was grown on 6 acres and yielded 9 tons of hay. On 6 farms sweetclover was grown on 11 acres and yielded 17 tons of hay. Small-grain hay was reported by only 1 farm. Oats were cut and fed unthreshed from 28 acres on 14 farms. Most of the hay produced is fed to livestock on the farms.

Soybeans for all purposes except plowing under for green manure were reported grown on 192 farms in 1939. They were grown alone on a total of 350 acres and with other crops on 157 acres. Those harvested for beans were planted alone on 8 acres and with other crops on 20 acres. Cowpeas, grown alone on 110 acres and with other crops on 318 acres, were reported by 121 farms. Those harvested for peas were grown alone on 98 acres and with other crops on 43 acres.

Lespedeza seed was harvested from a total of 65 acres on 10 farms in 1939, yielding 15,920 pounds. Two farms reported the production of clover seed.

Tobacco, relatively unimportant in the agriculture of the county, was grown on 43 acres in 1879 and on 41 acres in 1939 (United States census). The greatest acreage in this crop was in 1899, when 236 acres were planted. The number of farms growing tobacco in 1939 was 150, and the total production was 20,987 pounds.

Garden vegetables are grown on nearly every farm in the county. In 1940, 1,233 farms reported that production of garden crops for home use in 1939, excluding potatoes and sweetpotatoes, amounted to \$79,800. In 1939, 1,147 farms reported 562 acres in potatoes, 980 reported 233 acres in sweetpotatoes, and 642 reported 775 acres in sweet sorghums, which are used for making sirup and constitute an important source of cash income for many farms.

A total of 285 farms reported vegetables harvested for sale from 805 acres in 1939, at a value of \$39,003. The main vegetables were beans (snap, string, and wax) and cabbage; the minor ones, lima beans, collards, sweet corn, onions, sweet peppers, squash, tomatoes, beets, green peas, spinach, and turnips. Horticultural specialties were produced on 3 farms.

Fruits are produced solely for home use, as there are no commercial orchards in the county. Apples are the most important fruit. On April 1, 1940, 966 farms reported 18,560 trees of bearing age and 9,631 not of bearing age. Less important fruits are peaches, cherries, pears, and plums. Grapes are the principal small fruit and are grown on a fairly large number of farms. Improved varieties of strawberries are grown for home use on a few farms. Land in bearing and nonbearing fruit orchards, vineyards, and planted nut trees on April 1, 1940, totaled 650 acres, compared with 1,070 acres on April 1, 1930. Wild blackberries and dewberries are abundant, and wild strawberries grow in some places.

The acreages of the principal crops grown in the county for the years 1879 to 1939 (United States census) are given in table 2.

TABLE 2.—*Acres of the principal crops and number of bearing fruit trees and grapevines*¹ in Union County, Ga., in stated years

Crop	1879	1889	1899	1909	1919	1929	1939
	<i>Acres</i>	Acres	Acres	Acres	Acres	Acres	Acres
Corn for grain	14,347	15,508	18,439	15,386	15,094	13,487	11,756
Oats	2,139	2,875	1,282	611	314	10	13
Wheat	4,612	4,335	3,317	1,747	2,814	688	685
Rye	1,934	1,709	687	1,981	2,365	1,855	2,507
Cowpeas				274	251	74	141
Hay, total	140	973	650	1,398	1,335	929	1,192
Clover or timothy, alone or mixed						7	54
Annual legumes for hay					201	134	342
Small grain hay			302	48	136	1	
Lespedeza							428
Other tame hay			284	1,201	387	734	172
Wild hay			64	149	611	53	196
Potatoes		150	103	297	277	315	562
Sweetpotatoes	219	131	119	239	205	137	233
Tobacco	43	25	236	97	62	34	41
Sweet sorghums for syrup		307	208	482	637	361	775
	<i>Number</i>	Number	Number	Number	Number	Number	Number
Apples—trees		25,008	48,860	46,536	34,923	28,944	18,560
Peaches—do.		7,086	5,532	9,176	6,060	5,855	6,122
Pears—do.			129	201	251	175	225
Plums—do.			807	1,552	2,904	880	431
Cherries—do.			280	205		364	764
Grapes—vines			2,443	948	482	905	1,745

¹ The number of fruit trees and grapevines are as of the census years 1900–40.

The values of the crops harvested and forest products sold in the years 1909, 1919, 1929, and 1939 (United States census) are given in table 3.

TABLE 3.—*Values of crops harvested and forest products sold in Union County, Ga., in stated years*

Crops	1909	1919	1929	1939
Cereals	\$201,603	\$427,311	\$237,763	\$160,413
Other grains and seeds	4,130	11,746	1,474	2,432
Hay and forage	15,104	93,973	17,370	22,242
Tobacco			3,284	3,148
All vegetables	50,164	107,010	103,537	170,467
Fruits and nuts	35,690	8,561	16,342	25,133
All other crops	47,205	49,042	27,332	36,165
Forest products sold			21,980	13,694

The total value of all farm products sold, traded, or used by farm households was \$578,643 in 1939 and \$500,504 in 1929 (United States census). The 1939 values of the products by classes are shown in the following tabulation:

Crops sold or traded.....	\$83,984
Field crops ¹	43,588
Vegetables ¹	38,997
Fruits and nuts.....	769
Horticultural specialties.....	630
Forest products sold.....	13,694
Livestock and livestock products sold or traded.....	81,220
Livestock ²	20,914
Livestock products.....	60,306
Dairy products.....	2,445
Poultry and poultry products.....	56,985
Other livestock products.....	876
Farm products used by farm households.....	399,745

¹ Value of potatoes and sweetpotatoes included with field crops.

² Excludes poultry, bees, and fur-bearing animals.

ROTATIONS AND FERTILIZERS

On many farms, especially subsistence farms on soils of the Fannin and Talladega series, no crop rotation is followed, and corn is grown for many years in succession. On other farms, where livestock or livestock products constitute an important part of the farm income, a 2-year rotation of corn and rye is practiced, the rye being plowed under in some years for soil improvement. A 3-year rotation of corn, rye, and lespedeza seeded in the rye, is practiced by some of the more successful farmers and is gaining in use. In some fields snap beans are succeeded by a small-grain crop. In others they follow potatoes, and the fertilizer not assimilated by the potatoes is depended on to supply nutrients for the beans.

Practices vary widely on the large number of farms on which fertilizer is used. A total of 965 farms, or 73.0 percent of the total number in the county, reported the purchase of 1,175 tons of commercial fertilizer in 1939 (1940 census). In addition 150 farms (11.3 percent) purchased 1,635 tons of liming materials.

Complete fertilizer mixtures, as 4-8-4 ⁵ and 3-9-3, or superphosphate are used for corn, sorghum, and small grains at the rate of 50 to 200 pounds an acre at seeding. In some fields the fertilizer is supplemented by a top dressing of nitrate of soda in quantities of 50 to 100 pounds an acre. Cowpeas receive 100 to 200 pounds of superphosphate, and potatoes and beans 400 to 1,600 pounds of 4-8-4 or 3-9-3 fertilizer. Cabbage, spinach, collards, and other truck crops are fertilized with 400 to 1,200 pounds of complete fertilizer, and tobacco with 200 to 300 pounds.

Lime is used mostly on soils of the first bottoms and on soils of the uplands on which legumes are grown. When legumes are fertilized for pasture, $\frac{1}{2}$ to 2 tons an acre of lime and 100 to 200 pounds of superphosphate are applied. Lime is generally used on land for red and crimson clovers. The crimson clover is used largely as a green-manure crop.

⁵ Percentages, respectively, of nitrogen (N), phosphoric acid (P₂O₅), and potash (K₂O).

LIVESTOCK AND LIVESTOCK PRODUCTS

The value of domestic animals, poultry, and bees on farms on April 1, 1940 (1940 census) was \$291,934, and of livestock and livestock products sold and traded in 1939, \$81,220. The livestock consisted of horses, mules, cattle, hogs, chickens, and some sheep, lambs, turkeys, ducks, guineas, and bees. The livestock products were mainly milk, butter, eggs, and chickens. Minor livestock products consisted mainly of whole milk, cream, and butter sold, wool shorn, and honey produced.

The work animals are mainly horses and mules and some oxen. On April 1, 1940, there were 391 horses and colts over 3 months old on 268 farms and 821 mules and mule colts over 3 months old on 550 farms. The better horses are mainly of grade Morgan stock and weigh 1,000 to 1,200 pounds. The mules weigh 800 to 1,000 pounds. On some of the smaller farms, especially those operated by tenants, grade Hereford and Jersey oxen weighing 600 to 900 pounds each are used as work animals instead of horses and mules.

In 1940, 2,849 cattle and calves over 3 months old on April 1 were reported on the 1,209 farms. Cows and heifers milked in 1939 on 1,202 farms totaled 1,645, compared with 1,531 in 1929 on 1,000 farms. Grade Jersey cattle predominate, with some well-blooded Jersey, Hereford, and Shorthorn cattle. The number of cattle and calves on April 1, 1940, constituted an increase of 176 over the number reported on April 1, 1930. The 1920 census showed 4,346 cattle of all ages on January 1, 1920.

On April 1, 1940, there were 1,824 hogs and pigs over 4 months old on farms, compared with 2,573 over 3 months old on April 1, 1930. The total number of all ages in 1930 was 3,388. These numbers constitute a decided decrease since 1920, when 9,392 swine of all ages were reported. The hogs raised, mostly mixed Poland China, Duroc, and Ohio Improved Chester White breeds, are used chiefly to supply the meat requirements of the farm households.

Sheep and lambs over 6 months old numbered 158 on farms on April 1, 1940, or 319 less than on April 1, 1930. The total number of all ages reported on farms was 727 in 1930 and 1,895 in 1920.

Poultry consists almost wholly of chickens, and nearly every farm keeps some. On April 1, 1940, there were 57,295 chickens on 1,256 farms, a considerably larger number than reported in 1920 and 1930. A few turkeys, ducks, and guineas were reported by a relatively small number of farms. Chickens and eggs, in addition to supplying food for home needs, are important items in the cash income of most farms, and in 1939 they furnished the major source of income for 18 of them.

On April 1, 1940, there were 985 beehives on farms, compared with 1,775 in 1930, and the value of honey produced in 1939 was \$1,528, which was much less than in 1929.

The number and value of livestock on farms in 1920, 1930, and 1940, (United States census) are given in table 4.

TABLE 4.—Number and value of livestock on farms in Union County, Ga., in stated years

Livestock	1920		1930		1940	
	Num- ber ¹	Value	Num- ber ²	Value	Num- ber	Value
Horses and colts.....	428	\$47,921	212	\$14,860	³ 391	\$40,424
Mules and mule colts..	1,096	152,948	1,070	95,028	³ 821	114,940
Cattle and calves.....	4,346	128,542	3,140	114,770	³ 2,849	87,885
Hogs and pigs.....	9,392	57,320	3,388	37,023	⁴ 1,824	16,744
Sheep and lambs.....	1,895	8,198	727	3,675	⁵ 158	691
Chickens.....	38,908	24,031	³ 39,481	28,426	⁴ 57,295	29,220
Other poultry.....	1,743		(⁶)	(⁶)	⁴ 499	279
Bees.....hives..	2,365	6,293	1,775	5,680	985	1,724

¹ All ages on Jan. 1.² All ages on Apr. 1, excluding chickens under 3 months old.³ Over 3 months old on Apr. 1.⁴ Over 4 months old on Apr. 1.⁵ Over 6 months old on Apr. 1.⁶ Not available.

The numbers of cattle and calves, hogs and pigs, and sheep and lambs purchased, sold alive, or slaughtered, on farms in the county in 1939 (1940 census) were as follows:

	Sold alive	Slaugh- tered	Pur- chased
Cattle.....	349	13	242
Calves.....	443	10	232
Hogs and pigs.....	1,162	2,149	1,122
Sheep and lambs.....	35	16	(¹)

¹ Not reported.

Livestock products produced, used, or sold by farms in the county in 1929 and 1939 (Federal census) are given in the following tabulation:

	1929	1939
Milk produced.....gallons..	598,660	682,531
Whole milk sold.....do.....	3,800	2,198
Cream sold:		
Sweet cream.....do.....	32	(¹)
Butterfat.....pounds..	4,105	² 5,355
Butter churned.....do.....	164,814	186,109
Butter sold.....do.....	8,150	2,468
Chicken eggs produced.....dozens..	275,491	375,759
Chickens sold alive or dressed.....number..	36,982	29,470
Wool shorn.....pounds..	1,086	401
Honey produced.....do.....	17,234	11,753

¹ Not reported separately.² Includes sweet cream.

The values of livestock products on farms in the county in 1929 and 1939 (Federal census) are given in table 5.

TABLE 5.—*Value of livestock products in Union County, Ga., in stated years*

Livestock products	1929	1939
Whole milk, cream, and butter sold.....	\$5, 553	\$2, 363
Whole milk.....	1, 216	769
Cream ¹	1, 729	1, 125
Butter.....	2, 608	469
Butter churned (exclusive of any sold).....	50, 132	34, 892
Animals butchered on farms.....	(²)	28, 447
Cattle.....	(²)	436
Hogs.....	(²)	27, 937
Sheep.....	(²)	74
Livestock sold alive.....	(²)	24, 989
Cattle and calves.....	(²)	13, 222
Hogs and pigs.....	(²)	11, 620
Sheep and lambs.....	(²)	147
Poultry raised.....	52, 521	29, 766
Chickens.....	48, 933	29, 344
Turkeys.....	2, 954	269
Ducks.....	579	106
Other poultry.....	55	47
Chicken eggs produced.....	85, 402	67, 637
Wool shorn.....	402	100
Honey produced.....	3, 447	1, 528

¹ Both sweet cream and sour cream (butterfat).² Not available.

Although a rather large quantity of feed for livestock is produced, the 1940 census reported that 918 farms, or about 69 percent, purchased feed for domestic animals and poultry in 1939 at a total cost of \$35,713, or an average of \$38.90 each. Most of the feed purchased consisted of concentrates.

TYPES OF FARMS

Farms were classified by the 1940 Federal census according to their major source of income in 1939. Of the 1,325 farms in the county, 1,223 (92.4 percent) were classed as the subsistence type, or farms on which a large part of the products was consumed by the family; 22 (1.6 percent), as deriving their major source of income from vegetables harvested for sale; 18 (1.4 percent), from poultry and poultry products sold or traded, and a like number from field crops sold or traded; 8 (0.6 percent), from forest products sold; and 5 (0.4 percent), from livestock sold or traded. In addition, 21 farms with no farm products sold, traded, or used by farm households represented 1.5 percent of the total; and 10 unclassified farms, 0.7 percent.

LAND USE

In 1939 the land in farms comprised 94,732 acres, or 46.4 percent of the county, and consisted chiefly of cropland and woodland. About 27 percent of the farm land was in cropland; 6 percent in plowable pasture; 61 percent in woodland; and 6 percent in pasture other than plowable or woodland pasture, all wasteland, house yards, barnyards, feed lots, lanes, and roads. The nonfarm land consisted mainly of national forest and other forest land.

The farm land of the county according to use in 1929 and 1939 (Federal census) is shown in table 6.

TABLE 6.—*Farm land according to use in Union County, Ga., in 1929 and 1939*

Land use	1929	1939
	<i>Acres</i>	<i>Acres</i>
Land available for crops.....	30, 843	31, 012
Land used for crops.....	19, 018	19, 891
Cropland harvested.....	18, 704	19, 675
Crop failure ¹	314	216
Cropland, idle or fallow.....	7, 127	5, 722
Plowable pasture.....	4, 698	5, 399
Farm woodland.....	62, 257	57, 760
All other farm land ²	7, 386	5, 960
Total farm land.....	100, 486	94, 732

¹ Represents land in crops that failed because of destruction from any cause or not harvested because of low prices or lack of labor.

² Includes pasture land other than plowable and woodland pasture, all wasteland, house yards, barnyards, feed lots, lanes, and roads.

The Federal census shows an increase in the number of farms between 1880 and 1940, from 986 to 1,325. During the same period, the proportion of land in farms decreased from 77.1 to 46.4 percent, and the average size from 162 to 71.5 acres.

In 1940 the farms ranged in size from less than 10 to more than 900 acres. Of the total number, 377 contained less than 10 to 29 acres; 776, 30 to 139 acres; and 172, 140 to 999 acres. The number and total acreage of farms in 1940 and the acreage of cropland harvested in 1939, in each size range, are given in table 7.

TABLE 7.—*Number of farms, total acreage, and acreage of cropland harvested in each size range of farms in Union County, Ga., in 1939*

Size range of farms (acres)	Farms	Land in farms	Crop-land harvested
	<i>Number</i>	<i>Acres</i>	<i>Acres</i>
Under 10.....	111	676	430
10 to 29.....	266	4, 596	2, 297
30 to 49.....	228	8, 583	2, 823
50 to 69.....	199	11, 430	3, 100
70 to 99.....	213	17, 189	3, 458
100 to 139.....	136	15, 061	2, 721
140 to 179.....	84	13, 028	1, 911
180 to 219.....	45	8, 844	1, 348
220 to 259.....	14	3, 193	535
260 to 379.....	18	5, 522	733
380 to 499.....	6	2, 551	160
500 to 699.....	0	0	0
700 to 999.....	5	4, 059	159
Total.....	1, 325	94, 732	19, 675

FARM TENURE

The Federal census shows that in 1940 the number of farms in the county operated by full owners was 737 (55.6 percent of the total); by part owners, 151 (11.4 percent); and by tenants, 436 (32.9 percent). Only one farm was operated by a manager. The proportion of tenancy showed a decrease of 2.8 percent in the decade 1930-40. The kind and number of tenants in 1940 were as follows: Cash tenants, 88; share-cash tenants, 3; share tenants and croppers, 309; and other tenants, 36.

All land in farms operated by full owners in 1940 was 62,962 acres; and by part owners, 9,147 acres. All land in farms operated by tenants totaled 22,403 acres, of which 5,218 acres were operated by cash tenants, 156 acres by share-cash tenants, 15,952 acres by share tenants and croppers, and 1,077 acres by other tenants.

Cropland harvested in 1939 by full owners totaled 11,390 acres; by part owners, 2,458 acres; and by all tenants, 5,787 acres. Cash tenants harvested 836 acres; share-cash tenants, 55 acres; share tenants and croppers, 4,551 acres; and all other tenants, 345 acres.

Two systems of share rental are practiced. Under one the landlord furnishes the land, work animals, and two-thirds of the seed and fertilizer and receives two-thirds of the crops, including roughage; under the other the tenant furnishes the work animals and half the seed and fertilizer and receives half the crops.

Cash wages paid for hired labor, exclusive of housework and contract construction work, by 163 farms, amounted to \$11,279 in 1939. Of this amount \$878 was for labor hired by the month, \$9,479 for labor hired by the day or week, and \$922 for other hired labor, including piecework and contract labor.

A total of 515 farm operators (38.9 percent) reported work off their farms for pay or income on a total of 52,603 days in 1939, averaging 102 days for each operator. Of this total the number of days on which operators worked on other farms was 6,608, and the number on which they performed nonfarm work was 45,995. Operators who reported no days worked off the farm numbered 770, and those not reporting numbered 40. Of the operators reporting on April 1, 1940, 1,221 resided on the farm operated and 24 did not reside on the farm.

FARM INVESTMENTS AND EXPENDITURES

The value of the farms (land and buildings) in the county was \$1,679,031 in 1940, of which \$545,619 represented the value of buildings on 1,290 farms (Federal census). The average value of all land and buildings per farm was \$1,267, and that of farms of 30 acres and over in size was \$1,471. The average value of land and buildings per acre in 1940 was \$17.72, compared with \$1.94 in 1880. The proportions of value of all property per farm on April 1, 1940, were 81.2 percent in land and buildings, 4.7 percent in implements and machinery, and 14.1 percent in domestic animals, poultry, and bees.

The value of farms (land and buildings) operated by full owners in 1940 was \$1,070,311; by part owners, \$161,345; and by all tenants, \$445,875. The value of buildings on 728 farms operated by full owners amounted to \$368,891; on 145 farms operated by part owners,

\$53,662; and on 416 farms operated by tenants, \$122,066. The value of implements and machinery on 639 farms operated by full owners in 1940 was \$69,220; on 136 farms operated by part owners, \$8,283; and on 343 farms operated by tenants, \$19,102.

Mortgage debt in this county is relatively low. In 1940, of the 888 farms operated by owners and part owners, 709 were reported free from mortgage, 128 were mortgaged, and for 51 there was no mortgage report. The proportion of mortgaged farms in the county was 14.4 percent, compared with 35.9 percent in the State.

Farm expenditures in 1939 for wages, feed, commercial fertilizer, liming material, implements and machinery, motor fuel, and building material amounted to \$115,838. The number and percentage of farms reporting specified items and the amount of expenditures (1940 census) are given in table 8.

TABLE 8.—*Specified items of expenditure by farms in Union County, Ga., in 1939*

Item of expenditure	Farms report- ing		Expenditure	
	Number	Percent	Total	Average per farm
Cash wages paid for hired labor ¹	163	12. 3	\$11, 279	\$69. 20
Feed for domestic animals and poultry....	918	69. 3	35, 713	38. 90
Commercial fertilizer.....	965	72. 8	27, 247	28. 24
Liming materials.....	150	11. 3	4, 665	31 10
Implements and machinery.....	155	11. 7	15, 166	97. 85
Gasoline, distillate, kerosene, and oil....	144	10. 9	4, 041	28. 06
Building materials.....	315	23. 8	17, 727	56. 28

¹ Exclusive of housework and contract construction work.

The average farm is supplied with one-horse or two-horse breaking plows, a walking cultivator, wagon, and sled, and hose and other small tools. More expensive implements, as mowers, hay rakes, binders, and combines, are owned by a few farmers. Many farms are fenced with woven wire, but more fences made of woven wire and barbwire could be used to good advantage. Many fields and pastures are enclosed by rail or brush fences.

SOIL SURVEY METHODS AND DEFINITIONS

In making a soil survey the soils are examined, classified, and mapped in the field and their characteristics recorded, particularly in regard to the growth of various crops, grasses, and trees.

The soils and the underlying formations are examined systematically in many locations. Test pits are dug, borings made, and highway or other cuts and exposures studied. Each exposes a series of distinct soil layers, or horizons, termed collectively the soil profile. Each horizon, as well as the underlying parent material, is studied in detail, and the color, structure, porosity, consistence, texture, and

content of organic matter, roots, gravel, and stone are noted. The chemical reaction of the soil and its content of lime and salts are determined by simple tests.⁶ Reaction refers to the condition of the soil as regards degree of acidity. In a practical sense, the degree of acidity may be thought of as the degree of poverty in lime (available calcium). A neutral soil contains sufficient lime for any crop commonly grown in the county. Other features taken into consideration are the drainage, both internal and external, the relief, or lay of the land, and the interrelations of soil and vegetation.

The soils are classified according to their characteristics, both internal and external, with special emphasis upon the features that influence the adaptation of the land to the production of crop plants, grasses, and trees. On the basis of these characteristics the soils are grouped into classification units, the principal three of which are (1) series, (2) type, and (3) phase. In some places two or more of these principal units may be in such intimate or mixed pattern that they cannot be clearly shown separately on a small-scale map but must be mapped as (4) a complex. Some areas that have no true soil—as Rough stony land (Porters soil material)—are termed (5) miscellaneous land types.

The series is a group of soils having the same genetic horizons, similar in their important characteristics and arrangement in the profile and having the same color, structure, natural drainage, and other important internal characteristics and the same range in relief. The texture of the upper part of the soil, including that commonly plowed, may vary within a series. The series are given geographic names taken from localities near which they were first identified. Hayesville, Fannin, and Congaree are names of important soil series in this county.

Within a soil series are one or more types, defined according to the texture of the upper part of the soil. Thus, the class name of this texture—sand, loamy sand, sandy loam, loam, silt loam, clay loam, silty clay loam, or clay—is added to the series designation to give a complete name to the soil type. Congaree fine sandy loam and Congaree silt loam are soil types within the Congaree series. Except for the texture of the surface soil, these types have approximately the same internal and external characteristics. The soil type is the principal unit of mapping, and because of its specific character it is usually the unit to which agronomic data are definitely related. In comparisons of the type with phases of that type, to avoid repetition of their complete names, the type is sometimes referred to as the normal phase.

⁶ The reaction of the soil is its degree of acidity or alkalinity expressed mathematically as the pH value. A pH value of 7 indicates precise neutrality; higher values, alkalinity; and lower values, acidity. Indicator solutions are used to determine the chemical reaction. The presence of lime is detected by the use of a dilute solution of hydrochloric acid. Terms that refer to reaction and commonly used in this report are defined in the Soil Survey Manual (9, p. 86) as follows:

	<i>pH</i>		<i>pH</i>	
Extremely acid.....	Below	4.5	Neutral.....	6.6-7.3
Very strongly acid.....	4.5-5.0		Mildly alkaline.....	7.4-8.0
Strongly acid.....	5.1-5.5		Strongly alkaline.....	8.1-9.0
Medium acid.....	5.6-6.0		Very strongly alka-	
Slightly acid.....	6.1-6.5		line.....	9.1 and higher

A soil phase specifically named is a subdivision within the type. Phases of a type differ from one another usually in some minor feature, generally external, that may be of special practical significance. For example, within the normal range of relief of a soil type some areas may have slopes permitting the use of machinery and the growth of cultivated crops and others may not. Differences in relief and degree of accelerated erosion may be shown as phases. In such instances the more sloping parts of the soil type may be segregated on the map as a sloping, hilly, or steep phase.

Examples of soil complexes are found in Chewacla-Spilo silt loams, Porters-Balfour loams and their eroded phases, Tate-Chewacla silt loams, and Warne-Worsham loams and their slope phases, in which the soils are so intimately associated that they cannot be separated on a map of the scale used.

The soil surveyor makes a map of the county or area, showing the location of each of the soil types, phases, complexes, and miscellaneous land types in relation to roads, houses, streams, lakes, section and township lines, and other cultural and natural features of the landscape.

Texture refers to the relative quantities of clay, silt, and various grades of sand that make up the soil mass. Coarse-textured soils contain much of the coarser separates (sands), and fine-textured soils contain much clay. Structure refers to the natural arrangement of the soil material into aggregates, or structural particles or masses. Consistence refers to such conditions as friability, plasticity, stickiness, hardness, compactness, toughness, and cementation. Permeability and perviousness connote the ease with which water, air, and roots penetrate the soil. The surface soil ordinarily refers to the coarser textured surface layer, which, in most places, extends to a depth of 6 to 12 inches. The subsoil is the deeper and finer textured layer, which generally is of uniform color in well-drained soils. The substratum is beneath the subsoil and is characteristically splotched or mottled with two or more colors. Bedrock, as used here, is consolidated rock on which the substratum rests.

As used in this report workability refers to the ease with which tillage, harvesting, and other farming operations can be performed; conservability refers to the ease with which the soil can be maintained in good physical condition for crop production.

SOILS

The rocks through weathering provide mineral materials from which soils have formed. Rain and sun have changed them greatly. Of still more importance are those changes caused by the plants and animals on and in the soils. Along with the physical and biological, chemical changes are continually taking place. Thus the soil is made through the influence of physical, chemical, and biological forces. It is especially the biological forces that give a soil those characteristics that are most important to man. Soil is the natural medium for the growth of land plants on the surface of the earth and is composed of organic and mineral materials (14).

In many of the soils the profiles consist of three layers that differ somewhat in thickness, color, texture, and consistence. The first is

the surface layer, which is 6 to 10 inches thick in soils that have been affected very little or not at all by erosion, but in some soils it may be as much as 18 inches thick. The second layer, or subsoil, is usually 15 to 30 inches thick. The third layer, or substratum, ranges in thickness from a few inches to several feet. There is very little textural difference between the surface soil and subsoil of some of the soils on first bottoms and on mountains.

The surface soil and subsoil are red, yellow, brown, or gray, or shades of these colors, although in some soils of the terraces and bottom lands the subsoil is mottled or streaked gray and yellow or gray and brown.

In general, the surface layer consists of loam and silt loam, but in some soils the texture is fine sandy loam, silty clay loam, or clay loam. The consistence of the surface layer of many of the soils is moderately friable, but some are mellow, crumbly, or fluffy, and others are compact or plastic. The texture of the subsoil is generally loam and clay loam, but in some soils it is silty clay loam or clay. The consistence is generally moderately friable; however, in the subsoil of some soils it is loose or crumbly and in others it is stiff, plastic, or almost impervious.

The substratum is composed of soft decomposed rock material and may be more friable than the subsoil. In some places there is no substratum and the subsoil lies on bedrock. In others no subsoil is present and the surface layer passes directly into soft decomposed rock or rests on bedrock.

In forested areas a layer of decayed leaves, twigs, and other vegetable material covers the mineral soil and has stained it brown or dark brown to a depth of 1 to 3 inches.

All the soils of the county are acid, but the acidity varies somewhat in degree. Except Toxaway, Transylvania, and State silt loams; Congaree silt loam, dark-subsoil phase; and Tusquitee loam, the soils are low in organic-matter content. Available supplies of phosphate, potash, and calcium are deficient, especially in the red and yellow soils of the terraces and uplands. Tilt is generally good in soils of loam and fine sandy loam texture but is rather poor in soils of clay loam or silty clay loam texture. Internal drainage is generally good except in some soils of the first bottoms.

In addition to the internal characteristics common to the soils, external features, as stoniness, slope, and accelerated erosion, were considered in the mapping and classification of the soils, as these are closely related to soil use and management.

The use and management of a large proportion of the soils of the county are affected more or less by relief, accelerated erosion, and stoniness, or a combination of two or more of these. Nearly 50 percent of the land is steep and very steep (30 to 60 percent or more), about 25 percent is hilly (15 to 30 percent), and about 25 percent is level to rolling or sloping (0 to 15 percent).

Several types of relief are recognized in mapping the soils of the county. On level or nearly level soil under normal conditions of tillage, accelerated erosion is at a minimum. Insofar as the slope is concerned, there is no resistance to tillage operations. Water flows slowly in sheets and carries away very little soil material. On undulating or gently sloping soil the runoff is moderately slow, but

the water flows in rills rather than sheets and has low but definite transporting capacity. The runoff can be impeded by suitable crop rotations, contour tillage, or terraces.

Rolling or sloping soil is suitable for close-growing and for clean-cultivated crops if good measures of management are practiced. The strong slopes make heavy machinery cumbersome but permit the use of light machinery and farming implements. Water flows in well-defined rills and other small drainageways and has considerable transporting power, runoff being moderately rapid.

Soil of hilly or hill relief is suitable for pasture or forest insofar as slope is concerned but is not suitable for clean-cultivated crops. The slope hinders heavy farm machinery but permits the use of some light machinery or implements. The runoff flows rapidly through well-defined channels and has a high carrying capacity. Where the natural cover has been removed and the soil is erosive, deterioration through resultant sheet and gully erosion is rapid.

Soil of steep relief is best suited to forest insofar as slope is concerned. The steepness of slope precludes the use of farm machinery. The carrying capacity of the runoff is so great that where the soil is void of vegetative cover the removal of soil material is rapid, except from soils very resistant to erosion.

Soil of very steep relief can be best used for forest, although its value for such use may be low. The slopes are so steep that horses and, in places, oxen cannot be used advantageously for removing bulky forest products.

Moderately eroded soil is found on areas that have been eroded to such an extent that the subsoil is within plow depth over half or somewhat more of their extent. Ordinary tillage mixes some of the upper part of the subsoil with the surface soil and somewhat alters its color and texture. In most places the soil has been definitely impaired by sheet erosion, some of it caused by short shallow gullies. Such gullies are usually somewhat more than 100 feet apart. Although a few may be too deep to be effaced by ordinary tillage, none is too deep for ready passage of farm implements. About 50 to 75 percent of the original surface layer has been lost through accelerated erosion.

Severely eroded soil includes areas in which 75 percent or more of the original surface layer and, in places, part of the subsoil have been lost through accelerated erosion. Tillage in these areas would be almost entirely in the subsoil. Erosion has seriously affected the soil in most places, and short gullies may occur at intervals up to 50 feet. As most of the gullies are shallow, farm machinery may be drawn across them, but some are too deep to be effaced by ordinary tillage.

In addition to the eroded soil areas delineated on the soil map, many eroded areas of $2\frac{1}{2}$ acres or less and gullies 300 feet or more in length are indicated by symbols that express the degree of erosion. The meaning of the various erosion symbols is explained in the legend on the margin of the map.

About 30 percent of the land is stony, ranging from stony loam to rough stony land. Stoniness is a condition generally expressed in the soil type designation, but areas of less than $2\frac{1}{2}$ acres that are sufficiently stony to influence cultivation materially are shown by

symbols, as also are small areas so stony as to preclude feasible cultivation. These symbols also are explained on the margin of the map.

SOIL SERIES AND THEIR RELATIONS

Soils of 20 series are mapped in the county. Soils of some series are relatively unimportant in the agriculture because of small extent, unfavorable use suitability, or both. Knowledge of the soil series will be useful in interpreting the results of this survey. It can be acquired more readily by associating the series with prominent land features. Accordingly, the soil series are grouped in relation to such features, as follows: (1) Soils of the uplands, (2) soils of the colluvial land, (3) soils of the terraces, and (4) soils of the bottom land. Uplands are those lands elevated above adjacent lowlands along streams and underlain by weathered rock material. Colluvial land occurs at the foot of slopes on the uplands and comprises soil derived from accumulations of material that washed or sloughed from the higher slopes. The terraces are water-made benches bordering stream bottoms, but occupy higher positions and are not subject to flooding. Bottom land comprises the flood plains of streams and is subject now and then to flooding.

The soil series associated with each of the prominent land features, together with the main characteristics of each series, are given in table 9.

SOILS OF THE UPLANDS

Soils of the uplands belong to the Porters, Balfour, Rabun, Ranger, and Talladega series on mountain uplands and to the Fannin, Edneyville, Hayesville, and Worsham series on intermountain uplands. All have developed from parent material of soft decomposed igneous and metamorphic rocks. They differ greatly in profile characteristics, productivity, and use suitability. The external drainage is slow to very rapid, and internal drainage is medium, except in the Worsham soils, where it is relatively slow. Although climate and vegetation have been important factors in the formation of the various soils, the parent material and relief have been important as well, and differentiation among the soils is due in some measure to the influence of these factors.

The soils on the mountains are dominantly steep and very steep, but areas of some are rolling or hilly. In most places their profiles are poorly or indistinctly developed. In general the Porters and Balfour soils came from weathered material of granite gneiss, the Rabun soils from weathered hornblende gneiss mixed with other rocks, the Ranger soils from weathered phyllite and slate rocks, and the Talladega soils from weathered material of micaceous schist rocks.

Although steep in places, the relief on the intermountain uplands is much milder than on the mountain uplands and has been much more favorable to the formation of deep soils; consequently the profiles are generally better developed. The soils of the Fannin series were derived from weathered micaceous schist rock; those of the Edneyville series from weathered material of schist of high quartz content or schist containing pegmatite or granite gneiss; and the soils of the Hayesville and Worsham series from weathered products of granite gneiss.

TABLE 9.—Principal characteristics and conditions of the soil series of Union County, Ga.

SOILS OF THE UPLANDS

Soil series	Topographic position	Parent material	Dominant relief	Internal drainage	Color of surface soil	Subsoil	
						Color	Consistence
Porters.....	Mountaintops and slopes.	Residuum from the weathering of: Granite gneiss and schist	Steep to very steep.	Medium..	Brown or yellow- ish brown.	Brown, reddish brown, or yel- lowish brown.	Loose, crumbly.
Balfour.....	Mountain and ridge tops and foot slopes.	.....do.....	Gently rolling to rolling.	.....do.....	Brown.....	Brownish yellow, yellowish brown, or light reddish brown.	Friable, crumbly.
Rabun.....	Mountaintops and moun- tainsides.	Hornblende gneiss, mixed in places with biotite schist and granite gneiss.	Rolling to hilly.....	.....do.....	Dark brown to brownish red.	Brownish red in upper part; red in lower.	Crumbly.
Ranger.....	Foothills and foot slopes of mountains.	Phyllite and slate rocks.....	Steep.....	Medium to slow.	Grayish yellow, gray, or brown- ish yellow.	Brownish yellow or yellow.	Dense, slightly compact.
Talladega.....	Mountain slopes and knobs, narrow ridges, and foothills.	Micaceous schist.....	Hilly to steep.....	Medium to rapid.	Reddish brown..	Red.....	Friable, slick (highly micace- ous).
Fannin.....	Intermountain uplands..	.....do.....	Gently rolling to hilly.	.....do.....	Reddish brown or brown.	.....do.....	Dense, moderately plastic.
Edneyville.....	.....do.....	Schist of high quartz content or schist containing pegmatite or granite gneiss.	Gently undulat- ing to rolling.	Medium to slow.	Light gray or gray- ish yellow.	Yellow.....	Moderately stiff, compact.
Hayesville.....	.....do.....	Granite gneiss.....	Hilly.....	Medium..	Reddish brown..	Red.....	Friable.
Worsham.....	.....do.....	Granite gneiss; in places local alluvial and colluvial mate- rials.	Very gently slop- ing to sloping.	Slow to v e r y slow.	Light gray or medium gray.	Yellow or brown- ish yellow.	Do.

SOILS OF THE COLLUVIAL LAND

Tusquittee.....	Colluvial slopes.....	Accumulations of rock waste and soil material that sloughed or washed from Porters and asso- ciated soils.	Very gently slop- ing to moderate- ly sloping.	Medium..	Brown, d a r k brown, or dark grayish brown.	Yellowish brown to brown.	Soft, crumbly.
Tate.....	.....do.....	Colluvial and local alluvial accum- ulations of material washed from Fannin, Talladega, and Hayes- ville soils.	Nearly level to very gently slop- ing.	Medium to slow.	Brown, reddish brown, or red.	Red, brownish red, brownish yellow, or yel- low.	Friable.

TABLE 9.—Principal characteristics and conditions of the soil series of Union County, Ga.—Continued

SOILS OF THE TERRACES

Soil series	Topographic position	Parent material	Dominant relief	Internal drainage	Color of surface soil	Subsoil	
						Color	Consistence
Elwassee.....	High terraces.....	Old alluvium derived from Porters, Hayesville, and associated soils. Alluvium derived from uplands underlain by granite gneiss and schist	Gently sloping to strongly sloping.	Medium..	Dark brown to red	Dark red.....	Crumbly
Altavista.....	Low terraces and second bottoms		Nearly level to very strongly sloping.	Slow to very slow.	Light gray or grayish yellow	Yellow.....	Moderately compact to stiff
Warne.....	do.....		do.....	Very gently sloping to strongly sloping.	do.....	Light gray.....	Light gray streaked with yellow.	Tough, very slowly pervious.
State.....	do.....	Alluvium derived from Porters, Talladega, Hayesville, and associated soils.	Nearly level to very gently sloping	Medium..	Dark grayish brown or brown	Brown to yellowish brown.	Soft, crumbly

SOILS OF THE BOTTOM LAND

Congaree.....	First bottoms, subject to overflow.	Alluvium derived from uplands underlain by granite gneiss, micaceous schist, and to a less extent by basic and sub-basic metamorphic rocks	Level or nearly level	Medium..	Brown.....	Brown to yellowish brown	Friable, crumbly, or loose
Transylvania.....	do.....	Porters and other soils on uplands of high elevation	do.....	Medium to rather slow	Dark grayish brown or dark brown	Dark brown.....	Very crumbly, plastic
Chewacla.....	do.....	Fannin, Talladega, and associated soils derived from micaceous schist rocks	do.....	Slow to very slow	Brown.....	Mottled gray streaked with rust brown	Loose, friable (very micaceous).
Spilo.....	do.....	Soils of the uplands underlain by micaceous schist and granite gneiss	do.....	Very slow	Light gray to medium gray	Light gray streaked or splotted with brown	Compact, slowly pervious
Toxaway.....	do.....	Uncleared areas of Porters and associated soils that occupy high elevations on the uplands	do.....	Slow to very slow	Dark gray to almost black	Dark gray, medium gray, or bluish gray	Highly plastic.

SOILS OF THE COLLUVIAL LAND

Colluvial material that accumulated at the foot of slopes has given rise to soils of the Tusquitee and Tate series. This material includes rock fragments and other rock waste and also soil material that washed and slumped from the higher lying soils. In some places local alluvium is mixed with the colluvial material.

These soils are brown, although in some places the Tate soils are red or reddish brown. The consistence is friable and mellow and the quantity of organic-matter content moderate. Drainage is good, but in some places internal drainage is slow in the lower part. Differences in these soils are due largely to differences in the parent material.

The Tusquitee soil generally occurs at the foot of mountain slopes, whereas the Tate soils are mainly at the base of slopes in the intermountain uplands.

SOILS OF THE TERRACES

The Hiwassee, Altavista, Warne, and State series comprise the soils on the stream terraces. Their parent material consists of alluvium derived from uplands underlain by igneous and metamorphic rocks. Color and drainage are the chief differentiating characteristics. The Hiwassee soils have a dark reddish-brown surface layer, dark-red subsoil, slow to rapid external drainage, and medium internal drainage. The Altavista soils have a light-gray to grayish-yellow surface layer and grayish-yellow to yellow subsoil; external drainage is slow to rapid and internal drainage slow to very slow. The Warne soils have a light-gray surface layer and light-gray, streaked with yellow, subsoil; external drainage is slow to rapid and internal drainage slow to very slow. The State soil has a dark grayish-brown or brown surface layer and brown to yellowish-brown subsoil; external drainage is very slow to medium and internal drainage medium.

SOILS OF THE BOTTOM LAND

The soils of the bottom land belong to the Congaree, Transylvania, Chewacla, Spilo, and Toxaway series. They have formed from alluvium consisting of sand, silt, and clay derived from uplands underlain by igneous and metamorphic rocks and owe their differences largely to the nature of parent material and drainage. Drainage ranges from good in the Congaree soils to poor in the Toxaway soil.

These soils are on first bottoms elevated only a few feet above the streams, and all are flooded by the streams during unusually heavy rains.

SOIL TYPES AND PHASES

The soils of Union County are classified and mapped in 62 units, consisting of 22 soil types,⁷ 31 phases, 4 complexes, 2 complex phases, and 3 miscellaneous land types. The miscellaneous land types are as follows: Alluvial soils, undifferentiated; Rough stony land (Porters soil material); and Stony colluvium (Fannin and Hayesville soil materials). Their location and distribution are shown on the accompanying soil map, and their acreages and proportionate extents are given in table 10.

⁷ When a soil type is subdivided into phases, that part of the type that bears no phase name is referred to as the normal phase.

TABLE 10.—*Acres and proportionate extent of the soils mapped in Union County, Ga.*

Soil type ¹	Acres	Percent
Alluvial soils, undifferentiated.....	294	0.1
Altavista clay loam, eroded phase.....	128	.1
Altavista loam.....	768	.4
Low-terrace phase.....	781	.4
Slope phase.....	198	.1
Balfour loam.....	403	.2
Eroded phase.....	326	.2
Chewacla fine sandy loam.....	250	.1
Chewacla silt loam.....	4,634	2.2
Chewacla-Spilo silt loams.....	1,683	.8
Congaree fine sandy loam.....	403	.2
Congaree silt loam.....	589	.3
Dark-subsoil phase.....	1,056	.5
Edneyville stony fine sandy loam.....	1,274	.6
Undulating phase.....	320	.2
Fannin clay loam:		
Eroded phase.....	8,365	4.0
Eroded hilly phase.....	6,266	3.0
Eroded undulating phase.....	262	.1
Severely eroded hilly phase.....	691	.3
Fannin loam.....	10,400	5.0
Hilly phase.....	15,617	7.6
Undulating phase.....	979	.5
Fannin stony clay loam:		
Eroded phase.....	1,101	.5
Eroded hilly phase.....	794	.4
Fannin stony loam.....	1,267	.6
Hilly phase.....	1,626	.8
Hayesville clay loam:		
Eroded phase.....	1,562	.8
Rolling phase.....	1,222	.6
Severely eroded phase.....	204	.1
Hayesville loam.....	2,867	1.4
Rolling phase.....	397	.2
Steep phase.....	1,715	.8
Undulating phase.....	58	(²)
Hiwassee loam.....	58	(²)
Eroded slope phase.....	179	.1
Porters-Balfour loams.....	5,709	2.8
Eroded phases.....	518	.3
Porters loam.....	21,261	10.3
Eroded phase.....	166	.1
Porters stony loam.....	41,894	20.3
Hill phase.....	6,394	3.1
Rabun clay loam, hill phase.....	179	.1
Ranger slate loam.....	1,184	.6
Rough stony land (Porters soil material).....	16,819	8.2
Spilo silty clay loam.....	614	.3
State silt loam.....	659	.3
Stony colluvium (Fannin and Hayesville soil materials).....	154	.1
Talladega clay loam:		
Eroded phase.....	518	.3
Eroded hilly phase.....	5,786	2.8
Eroded rolling phase.....	1,184	.6
Severely eroded hill phase.....	973	.5

See footnotes at end of table.

TABLE 10.—*Acreage and proportionate extent of the soils mapped in Union County, Ga.—Continued*

Soil type ¹	Acres	Percent
Talladega loam.....	13, 453	6. 5
Hilly phase.....	12, 064	5. 8
Rolling phase.....	1, 075	. 5
Talladega stony loam.....	2, 374	1. 1
Tate-Chewacla silt loams.....	1, 043	. 5
Tate silt loam.....	678	. 3
Toxaway silt loam.....	326	. 2
Transylvania silt loam.....	122	. 1
Tusquitee loam.....	346	. 2
Warne-Worsham loams.....	1, 165	. 6
Slope phases.....	685	. 3
Total.....	206, 080	100. 0

¹ Where data are given for phases only the normal type is not mapped in the county.

² Less than 0.1 percent.

ALLUVIAL SOILS, UNDIFFERENTIATED

Alluvial soils, undifferentiated, constitute a land type of 294 acres in the narrow first bottoms within mountain districts. The materials of this land type are brown sand, sandy loam, or silt loam near the streams and black mucky materials where poor drainage prevails. The color, texture, and drainage of the materials are so variable that the detail cannot be accurately expressed on the soil map. Furthermore, these characteristics are not permanent but are subject to much change by overflow of the streams.

The land is so closely dissected by old stream channels that cultivation is not practical, even with the light implements ordinarily used in mountainous districts. Crop loss caused by high water may be expected in most places.

Use and management.—This land type is not easily accessible to farmsteads, and at least 95 percent of it has never been cleared for agricultural use. It is inherently fertile, however, and most of it is well suited to bluegrass and white clover. If cleared of forest and properly managed the land would produce good to very good pasture.

ALTAVISTA SERIES

Soils of the Altavista series are characterized by a light-gray or grayish-yellow surface layer and yellow stiff heavy-textured clay loam or clay subsoil. Underlying the subsoil is light-gray or mottled light-gray and yellow soil material that rests on rounded quartzite gravel at a depth of 4 to 8 feet. In this county these soils occupy positions on lower terraces than those of the Hiwassee series. Although the soils of both series are developed on terraces and are underlain by rounded quartzite gravel, they have strongly contrasting characteristics. The gray leached surface layer, yellow subsoil, and mottled substratum of the Altavista soils contrast with the reddish-brown,

dark-red, and red corresponding layers of the Hiwassee soils. The dense stiff consistency of the Altavista subsoil also differs from the loose, crumbly Hiwassee subsoil, although the texture may be similar. The Altavista soils are inherently less fertile than the Hiwassee and are rated lower in crop productivity. Their relief ranges from almost level to very strongly sloping, but in most places it is very gently to gently sloping.

The series is represented by Altavista loam and its slope and low-terrace phases, and Altavista clay loam, eroded phase. A large part is used for cultivation and a relatively small part for permanent pasture.

Altavista loam.--This is a gray or grayish-yellow soil with a yellow dense fine-textured subsoil. It has formed from alluvial material consisting of sand, silt, and clay derived from uplands underlain by igneous and metamorphic rocks. It occurs on low terraces and is associated with State soil on the terraces and Congaree and other soils on first bottoms. The relief is very gently to moderately sloping, the gradient ranging from 2 to 10 percent and averaging about 6 percent. External and internal drainage are slow. Most of the soil lies above overflow by streams, and a large part has been cleared for agricultural use.

Areas of this soil border the first bottoms of all the larger streams in the Hiwassee Plateau, and some of the most typical are along Anderson and Youngcane Creeks, west of Blairsville. Most of the individual areas are of less than 20 acres. The aggregate area is 768 acres.

In cultivated fields this soil has the following profile characteristics:

- 0 to 8 inches, medium-gray to slightly grayish-yellow loose gritty loam, light gray when dry, low in organic-matter content, and strongly leached. After rains a large quantity of white coarse sand appears on the surface. Under forested condition the upper 1- to 2-inch layer is moderately high in organic-matter content.
- 8 to 13 inches, grayish-yellow gritty clay loam, stiff and moderately plastic when moist, and moderately compact when dry.
- 13 to 32 inches, yellow stiff fine-textured clay loam, crushing into short ribbons when moist but compact and hard when dry. The lower part of this layer is lighter colored, contains less clay, and is a little more friable. Its denseness restricts somewhat the penetration of roots and the movement of water and air.
- 32 to 50 inches, mottled light-gray and yellow stiff compact sandy clay, slightly micaceous, and containing less clay than the lower part of the overlying layer.
- 50 to 72 inches, light-gray crumbly sandy clay to coarse sandy clay, underlain by white rounded quartzite gravel and larger water-worn rock fragments.

Throughout the extent of this soil the layers vary somewhat in thickness. The profile ranges from medium to strongly acid.

This soil is fair to good cropland and good pasture land. The workability and conservability are very good, and productivity is fair. The soil warms slowly in spring, remains wetter than many of the soils of the uplands, and has a fairly narrow range of moisture conditions for cultivation. It is probably less responsive to fertilization than some of the soils on the uplands. In many of the larger areas open ditches or covered ditches made of pine poles and gravel are used to improve the slow internal drainage.

Use and management.—About 65 percent of Altavista loam is cultivated, 5 percent is idle land, 15 percent is in permanent pasture, 10 percent is in oak or oak and pine forest, and 5 percent is in shortleaf pine (pl. 1, A). The principal crops are corn, rye, and lespedeza, and the minor crops are cowpeas, crimson clover, tobacco, and truck crops, mainly snap beans.

On many farms corn, rye, and lespedeza are grown in rotation. The rye is cut for grain, and the lespedeza is either turned under or pastured. In this rotation corn is fertilized with 100 to 200 pounds an acre of a 2-10-2 or 4-8-4 mixture or superphosphate. The yields range from 18 to 30 bushels. Rye is fertilized with 100 pounds of superphosphate and yields 10 to 13 bushels. On unfertilized land rye yields 5 to 7 bushels. Lespedeza generally is not fertilized, but in many fields the land is treated with 1 to 1½ tons of ground limestone every 5 or 6 years. When harvested for hay, lespedeza produces 1 to 1½ tons. When corn follows two or more leguminous crops that have been turned under and the land has been heavily fertilized, yields of 35 to 40 bushels have been reported. Barnyard manure is applied mostly to cornland and in such quantities as are available. In some rotations cowpeas or crimson clover are grown instead of lespedeza, the crimson clover being turned under for green manure.

A small percentage of this soil is used for snap beans grown as a truck crop. The beans are fertilized with 300 to 500 pounds an acre of 5-7-5 mixture and are generally followed by a small-grain crop or lespedeza. Under this practice of management the beans produce 90 to 165 bushels. Tobacco of good quality is grown in some places, and under common management practices yields are good.

Altavista loam, slope phase.—This phase occupies slopes of 10 to 18 percent, whereas the normal phase of the type occupies slopes of 2 to 10 percent. It is associated with the normal phase on terraces along streams in the Hiwassee Plateau and is not subject to overflow. The small areas are west of Pleasant Grove Church on United States Highway No. 76 and south of Smith Mill. A total of only 198 acres is mapped.

Owing to the sloping relief and to the dense heavy-textured subsoil that restricts internal drainage, erosion is difficult to control on cultivated areas of this soil. In about 50 percent of the cultivated land the surface layer has been considerably eroded, and as a result the plowed layer is heavier textured than the original layer and in most places consists of clay loam.

Use and management.—About 50 percent of Altavista loam, slope phase, is in oak forest, and the rest is mainly cropland. Crops and management are similar to those for the normal phase. Yields are generally slightly lower than on Fannin loam.

Altavista loam, low-terrace phase.—This phase occupies lower positions on terraces than the normal phase of the type, and most of the areas are only slightly higher than soils on the adjoining first bottoms. The relief is level to very gently sloping, the slope ranging up to 5 percent and averaging about 2 percent. The soil is overflowed at times by high water from adjacent streams. External and internal drainage are slow. In most of the cultivated areas either open ditches or drains made of pine poles and gravel and covered with

soil are used to drain the land. Runoff from the nearly level surface is slow, and there is practically no visible damage from erosion.

This soil covers a total of 781 acres, but individual areas are generally of less than 5 acres each. It is associated with soils of the Chewacla and Spilo series, which occur on first bottoms of streams in various parts of the Hiwassee Plateau, especially along Dooly, Youngcane, and Ivylog Creeks.

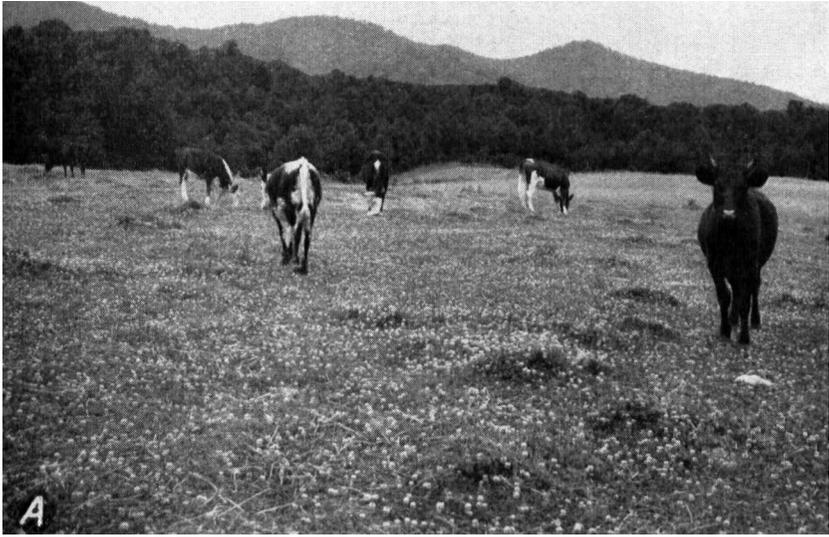
The soil is medium to strongly acid throughout. It differs from the normal phase in several respects. The surface soil is medium gray when wet but lighter gray when dry, and it averages about 10 inches thick compared with about 8 inches in the normal phase. It contains more organic matter and silt and is more porous and permeable to plant roots.

The subsoil is lighter textured throughout, less oxidized, and less compact than that of the normal phase. The upper part to an average depth of 18 inches is light grayish-yellow or pale-yellow slightly compact but plastic clay loam, underlain by yellow dense finer textured clay loam. Below a depth of 24 inches the subsoil is mottled yellow and light-gray stiff plastic clay loam. This layer is lighter textured than the one above and grades at an average depth of 32 inches into light-gray, streaked with yellow, sandy clay, similar to the parent material of the normal phase. This rests at a depth of 4 to 7 feet on stratified deposits of white rounded quartzite gravel and somewhat larger stones. The subsoil is strongly acid. The movement of air and water in the soil is slow but not so restricted as in the normal phase, and root penetration is a little easier.

Use and management.—About 85 percent of Altavista loam, low-terrace phase, is cultivated, 10 percent is in permanent pasture, and the rest is in woodland and other uses.

Corn, rye, and lespedeza in rotation are the principal crops. Corn is fertilized with an average of 150 pounds an acre of 2-10-2 or 4-8-4 mixture, and the yields are 20 to 25 bushels. Under better management practices these yields are increased to as much as 45 bushels. On unfertilized land the acre yields range from 10 to 15 bushels. When rye is fertilized it receives 100 to 125 pounds of superphosphate, and yields 10 to 16 bushels. On unfertilized land the average yield is about 8 bushels. Lespedeza yields are 1¼ to 1¾ tons of hay. Cowpeas or crimson clover are substituted for lespedeza in some fields. These crops are usually seeded at the last cultivation of corn and are turned under for soil improvement. Cowpeas for hay yield 1½ to 2 tons an acre. Soybeans are grown for hay on a few areas, especially in places where the soil has been treated with 1 to 1½ tons of ground limestone. Yields of soybean hay are 2 to 2½ tons.

Altavista clay loam, eroded phase.—This soil has a finer textured plowed layer than Altavista loam; otherwise, the two are similar in physical characteristics. It is associated with Altavista loam and the slope phase of that type. The relief is very gently sloping to gently sloping. External drainage is rapid and internal drainage slow. Streams do not overflow the soil.



A, Pasture of white clover on Altavista loam along Youngcane Creek. Before being seeded, the soil was treated with 3 tons an acre of ground limestone and about 300 pounds of triple superphosphate.

B, Lespedeza hay harvested on Chewacla silt loam. The field was treated with about 300 pounds an acre of triple superphosphate and 3 tons of ground limestone before being seeded.

The total extent of this soil is only 128 acres, and most of the areas cover less than 10 acres. Areas are along the west side of the Nottely River 1 mile south of the Georgia Mountain Branch station and near the headwaters of Akins Creek southeast of Blairsville.

This soil probably has been cultivated for a longer time or more poorly managed than Altavista loam, as it has been materially damaged by accelerated erosion. The plowed layer contains sufficient subsoil material to increase somewhat the clay content and cause the texture to be clay loam. Small spots of yellow fine-textured clay loam subsoil have been exposed by erosion on 5 to 10 percent of the individual soil areas.

Use and management.—Practically all of Altavista clay loam, eroded phase, is used for crops, mainly corn, rye, and lespedeza. Under the same management as for Altavista loam, corn yields 12 to 20 bushels an acre, rye 8 to 10 bushels, and lespedeza $\frac{3}{4}$ to $1\frac{1}{4}$ tons of hay.

With good management, including liberal applications of fertilizer and lime and the turning under of green-manure crops, this soil can be built up to produce 25 to 30 bushels an acre of corn and correspondingly good yields of other crops.

BALFOUR SERIES

Soils of the Balfour series are somewhat similar in profile characteristics to those of the Porters series, but their profiles are generally better developed and deeper to bedrock. They occur on the tops of mountain ridges and on the lower slopes of mountains. The relief is gentler, compared with that of Porters soils, and in this county it is generally rolling.

Balfour soils are less brown than Porters soils, the 7- to 10-inch surface layer being brown when moist and grayish yellow to light brown when dry. The subsoil ranges from 20 to 28 inches thick and is brownish yellow, yellowish brown, or light reddish brown, friable, and permeable. Below the subsoil is reddish-colored weathered bedrock. The granite gneiss bedrock is usually reached at a depth of about 8 feet.

In this county, Balfour loam and its eroded phase are the only soils of this series mapped. Somewhat more than half the total area is in forest. A rather large part that has been cleared is now eroded.

Balfour loam.—This is a brown friable soil occurring in the mountainous districts. It has formed from weathered products of granite gneiss and resembles Porters loam, but has a somewhat better developed profile and is deeper to bedrock. The relief is gently rolling to rolling, in some places undulating. The slope is 7 to 15 percent in the rolling areas and 2 to 7 percent in the undulating. External and internal drainage are medium. Erosion has affected the soil very little in most places.

This soil covers a total of 403 acres on ridge tops and lower slopes of mountains. Areas are at Vogel State Park and in the vicinity of Suches.

In cultivated fields this soil has profile characteristics as follows:

- 0 to 8 inches, brown friable gritty loam; medium to strongly acid. In forested areas the uppermost 1- to 2-inch layer is dark grayish brown, owing to organic matter mixed with the mineral soil.
- 8 to 32 inches, brown or yellowish-brown crumbly clay loam, low in content of organic matter and loose and easily penetrated by water, air, and plant roots. It is medium to strongly acid, and in areas bordering Hayesville soils and on ridge tops it is reddish brown.
- 32 to 48 inches, yellowish-brown loose crumbly clay loam containing many small angular and subangular quartz grains.
- 48 inches +, reddish-colored weathered granite gneiss. The unweathered rock generally occurs at a depth of about 8 feet.

Throughout the extent of this soil the profile layers vary slightly in thickness, color, and consistence.

This soil is fair to good cropland and good pasture land. Its workability and conservability are very good. A moderate to fairly low supply of organic matter and probably a moderate supply of essential plant nutrients are present. The soil can be cultivated over a fairly wide range of moisture conditions, and with proper management practices erosion can be controlled fairly well. The water-holding capacity is good, and the moisture relations for plant growth also are good.

Use and management.—Approximately 60 percent of Balfour loam is in oak-chestnut forest and 10 percent in shortleaf pine; 15 percent is in cultivated land, 10 percent in idle land, and 5 percent in pasture composed largely of bluegrass and white clover. Corn is the main crop, and rye, wheat, red clover, crimson clover, and lespedeza are grown to some extent.

Most of the cultivated land has been terraced, and rotations are of corn, small grain, and lespedeza. Strip cropping is practiced in a few fields. Corn is ordinarily fertilized with 100 to 200 pounds an acre of superphosphate, and wheat and rye with 150 pounds of 4-8-4 mixture. Corn yields 20 to 30 bushels an acre; wheat, 10 to 20 bushels; rye, 10 to 18 bushels; and lespedeza, 1 to 1¼ tons of hay. Average yields of corn are about 25 bushels; wheat, 15 bushels; rye, 14 bushels; and lespedeza, 1¼ tons of hay.

Some areas are treated with 1 to 1½ tons an acre of ground limestone, and crimson clover or red clover is grown instead of lespedeza. Red clover grown in rotation with other crops produces 1 to 2 tons of hay an acre. In some places crimson clover is seeded in cornland after the last cultivation of corn, and in spring the crop is turned under as green manure before corn is planted again.

Balfour loam, eroded phase.—This soil comprises eroded areas of the normal phase on which accelerated erosion has removed 50 to 75 percent, and in places more, of the original surface soil, leaving the subsoil of more than half the mapped area within plow depth. It is otherwise similar to the normal phase and is associated with it on gently rolling to rolling relief (7- to 15-percent slope). External drainage is medium to rapid and internal drainage medium. The aggregate area is 326 acres. All the soil was cleared for agricultural use, although shortleaf pine now occupies some of the land.

This soil is fair to good cropland and good pasture land. It has good workability and fair conservability. The content of organic matter

in this soil is apparently fairly low. The supply of essential plant nutrients probably is moderate. The soil is easily pervious to moisture and air, and plant roots penetrate it freely. The water-holding capacity and moisture relations for plant growth are fairly good.

Use and management.—A small part of Balfour loam, eroded phase, is in shortleaf pine or is lying idle. The rest is used mostly for crops and a small part for pasture. The principal crop is corn, with some rye, wheat, lespedeza, red clover, and crimson clover.

Fertilization is about the same for crops grown on this soil as for those grown on the normal phase, although some of the other management practices for that phase may not be followed. In general, crop yields are slightly lower than on the normal phase. Contour cultivation and terracing, together with strip cropping or seeding to grasses, would in a large measure prevent further serious loss of soil material through accelerated erosion.

CHEWACLA SERIES

Soils of the Chewacla series border small shallow drainageways in the Hiwassee Plateau. Their relief is level or nearly level. The alluvial materials that compose the soils were washed mainly from Fannin, Talladega, and associated soils derived mostly from micaceous schist rocks. These materials have been weathered and are leached and low in organic-matter content.

The uppermost 10- to 12-inch layer is brown and similar in color to Congaree soils. The underlying layers are mottled various shades of gray and streaked with rust brown. Compared with the Congaree soils, whose materials have been washed mainly from soils underlain by granite gneiss, soils of the Chewacla series are more highly micaceous and in places contain as much as 50 percent of finely divided light-colored mica flakes. They are inherently less productive than Congaree soils, owing partly to differences in mineralogical composition, a lower supply of essential plant nutrients and organic matter, less favorable structure, and waterlogged subsoil in wet seasons. Silt loam and fine sandy loam are the dominant textures of soils of this series.

In this county soils of this series are mapped as Chewacla silt loam and fine sandy loam and Chewacla-Spilo silt loams. A large part of the two types is used for cultivated crops, but the complex is used largely for hay and permanent pasture.

Chewacla silt loam.—This brown friable soil occurs on first bottoms. It has formed from alluvial material derived chiefly from Fannin and Talladega soils, which have formed from micaceous schist rocks. A high content of finely divided mica flakes in the profile characterizes this type. The relief is level or nearly level, and external and internal drainage are slow.

This is the most extensive soil on the first bottoms of the county. It occurs along all the smaller streams in the Hiwassee Plateau, where the associated soils of the uplands are members of the Fannin and Talladega series. A large part of the aggregate area of 4,634 acres has been cleared for agricultural use.

In areas that have never been cultivated this soil shows the following profile characteristics:

- 0 to 2 inches, gray loose silt loam containing a fairly large supply of organic matter. The organic-matter content is highest in this layer.
- 2 to 18 inches, brown loose very micaceous silt loam.
- 18 to 30 inches, dull-brown, mottled with various shades of gray, loose highly micaceous silt loam. Under natural conditions this layer is saturated with water during wet seasons.
- 30 to 78 inches, mottled poorly oxidized very micaceous silt loam or sandy loam, which is waterlogged all the time.
- 78 inches +, quartz gravel.

The layers of the profile of this soil vary somewhat from place to place in thickness, color, and in other characteristics. The profile is medium to strongly acid. Although it is friable and loose throughout, conditions are less favorable to the penetration of roots in the lower part of the profile than in the lower part of the profile of Congaree silt loam. The moisture relations are generally favorable to plant growth. In cultivated fields the surface layer to an average depth of 8 inches is grayish-brown loose fluffy silt loam containing a large quantity of small mica flakes.

This soil is fair to good cropland and good pasture land. Its workability is good and its conservability excellent, but its inherent fertility is not so high as that of Congaree silt loam.

With proper management, including heavy fertilization, this soil is capable of producing excellent yields of crops.

Many small bodies of Chewacla fine sandy loam and Tate-Chewacla silt loams are included with this soil as mapped.

Mapped with this soil also are areas in which the soil is waterlogged most of the time. Materials that make up the included soil were washed from Fannin and other highly micaceous soils. The surface soil is light-gray to dark-gray loose micaceous silt loam. In places mottled colors contrast to the brown better oxidized surface soil of the normal soil, and the mottled coloration may be due to poor drainage, organic matter, or dark-colored graphitic materials. Below an average depth of 12 inches the soil is coarsely mottled with various shades of gray and streaked with dull brown. Both the surface soil and the underlying material contain a high percentage of mica flakes. Below a depth of 36 inches the material is light-gray or bluish-gray micaceous loamy sand. The profile is strongly acid throughout.

Owing to the loose friable consistence, this included soil can be easily drained artificially. Its organic-matter content is higher than in the normal soil, and with a little artificial drainage it is better suited to the production of potatoes, snap beans, and leafy truck crops. This superiority is due chiefly to the higher content of organic matter. Compared with Toxaway silt loam, which occupies a similar topographic position and has similar natural drainage, this soil has a much lower inherent fertility.

Approximately 800 acres of this included soil is mapped. The larger bodies are along Ivylog and Youngcane Creeks in the northern and western parts of the county. Other bodies are in the vicinity of Town Creek southeast of Blairsville.

Use and management.—A mixed forest of deciduous trees occupies about 10 percent of Chewacla silt loam; corn, 45 percent; small grains,

10 percent; lespedeza, 10 percent; snap beans, 10 percent; potatoes, 5 percent; cabbage, 1 percent; and permanent pasture and miscellaneous crops, 9 percent (pl. 1, B).

Corn is ordinarily fertilized with 150 to 200 pounds an acre of 4-8-4 or 2-10-2 mixture or superphosphate, but in a few places it is given a top dressing of 50 to 150 pounds of nitrate of soda. About 25 percent of the soil has received 1 to 1½ tons of ground limestone an acre. Wide variations are reported in yields. Where corn has been planted in rotations that include one or more leguminous crops turned under for soil improvement, heavily fertilized, and the land recently limed, the yields range from 35 to 50 bushels an acre. On unlimed areas planted mainly to corn and small grains and treated with 100 to 150 pounds of fertilizer an acre, average yields of 25 bushels an acre may be expected. On land exclusively cropped to corn, without the use of fertilizer, yields of 15 to 20 bushels an acre are obtained.

Small grains grown on this soil include rye, wheat, and occasionally oats. About 10 percent of the rye is turned under for soil improvement. Harvested rye gives yields of 10 to 16 bushels an acre. Wheat yields range from 10 to 15 bushels an acre, although yields as high as 20 bushels have been reported. About two-thirds of the small-grain acreage is fertilized, most commonly with 100 to 150 pounds an acre of superphosphate.

Snap beans are generally grown on land treated with 1 to 1½ tons of ground limestone. The land is fertilized with 200 to 400 pounds an acre of 4-8-4 mixture, and in places 150 pounds an acre of nitrate of soda is added. Bean yields range from 100 to 200 bushels an acre and average about 120. Potatoes are fertilized with 600 to 800 pounds an acre of 5-7-5 or 4-8-6 mixture, and yields range from 100 to 160 bushels an acre and average about 125. Cabbage is fertilized with an average of 500 pounds of 4-8-4 mixture an acre, and yields average about 8 tons an acre.

Lespedeza is not ordinarily fertilized where it is grown in rotation with fertilized crops. The average yield of lespedeza hay is about 1¼ tons an acre. Soybeans are grown in places, and the average yield of the hay is about the same as for lespedeza.

About 40 percent of the included soil is used for corn; 5 percent for small grains, mainly rye; 15 percent for truck crops; 30 percent for permanent pasture; 5 percent for miscellaneous crops; and 5 percent for forest. The soil is fertilized similarly to the normal soil, but it requires some artificial drainage before it can be used for crops. Cleared land too poorly drained for crop production supports a dense sod of water-tolerant sedges and brush. In places where the management is similar, corn and rye yields are about 20 percent lower than on the normal soil, but the yields of potatoes, cabbage, and snap beans are about 10 percent higher.

Chewacla fine sandy loam.—This soil differs from Chewacla silt loam mainly in having a coarser texture. It has formed from micaceous alluvium, and finely divided mica flakes are characteristic of the profile. External drainage is slow to very slow and internal drainage moderately slow. Practically all of the soil is used for agriculture.

The aggregate area is small (250 acres) compared with the silt loam. It occupies level or nearly level positions in first bottoms along various small streams in the Hiwassee Plateau. Some of the larger individual areas are along Ivylog Creek north of Blairsville and Butternut Creek southwest of Blairsville.

In cultivated fields this soil has the following profile characteristics:

- 0 to 10 inches, brown, or grayish-brown loose fine sandy loam containing many small mica flakes. It is low in organic-matter content and medium to strongly acid. In many places the soil is slightly reddish on the surface, due to recent overwash from red soils of the uplands.
- 10 to 20 inches, brown friable micaceous fine sandy loam; medium to strongly acid.
- 20 inches +, mottled gray and dull-brown micaceous silt loam or fine sandy loam. It is waterlogged and medium to strongly acid.

In uncultivated places there is an accumulation of decomposed organic matter in the upper 2-inch layer; otherwise, the profile is practically the same as in cultivated areas. Throughout the extent of this soil the profile layers vary somewhat in thickness and other characteristics from those described above.

This soil is considered fair to good cropland and good pasture land. Its workability and conservability are good, and it is moderately productive of crops commonly grown. The moisture relations for plant growth are good, and the soil can be cultivated over a little broader range of moisture conditions than Chewacla silt loam. The supply of organic matter is apparently fairly low, and that of essential plant nutrients probably moderate.

Use and management—Chewacla fine sandy loam is used mainly for corn, small grains, and lespedeza, and a small part for truck crops and pasture. Its management and crop yields are about the same as for the silt loam. With heavy fertilization and other suitable management practices it can be built up to produce very good yields.

Chewacla-Spilo silt loams.—This complex is an intricate mixture of small areas of Chewacla, Spilo, and Toxaway silt loams. It occurs in relatively small areas on first bottoms along many of the streams in the Hiwassee Plateau. The relief is level or nearly level, and external and internal drainage are slow to very slow. There is considerable variation, however, in the natural drainage of each soil area, but on the whole the soil is imperfectly drained. The complex covers an aggregate area of 1,683 acres.

Spilo silt loam is characterized by a light-gray rather compact silt loam surface soil about 8 inches thick and a light-gray or mottled light-gray and yellowish-brown tough clay subsoil, which is almost impervious. This is the predominant soil of the complex; the Chewacla and Toxaway soils cover less than an acre in most places.

The complex is very poor to poor cropland but fair to good pasture land. It can be best utilized for pasture, hay, and forage. Workability of the soil is rather poor, as old stream channels here and there render cultivation impracticable in most places. Conservability is very good and productivity fair. The supply of organic matter ranges from low in the Spilo soil to high in the Toxaway soil. The content of essential plant nutrients is probably low to moderately high.

Use and management.—About 25 percent of Chewacla-Spilo silt loams is in forest consisting of deciduous trees; nearly all the rest is

used for hay crops and permanent pasture. In most places hay crops and pasture consist of lespedeza and native grasses mixed. The hay yield ordinarily averages about $\frac{3}{4}$ ton an acre, but on limed land it is as much as $1\frac{1}{2}$ tons.

Management requirements for the production of permanent pasture include such practices as liming, fertilization with superphosphate, and the use of properly selected pasture mixtures.

CONGAREE SERIES

Soils of the Congaree series occupy well-drained situations in first bottoms on level or nearly level relief. In most places they are subject to overflow by adjacent streams. They are derived from alluvial materials washed from soils on uplands underlain by granite, granite-gneiss, micaceous schist, and to a less extent by basic and sub-basic metamorphic rocks. They are most typical on plateaus that lie at lower elevations than the mountains from which a minor part of the parent alluvial material has come. The alluvial materials were washed mainly from well-developed soils on the plateaus. The upper layers of Congaree soils have a reddish color in many places, caused by materials washed very recently from red soils on the slopes.

In undisturbed Congaree soil the upper 4- or 5-inch layer may be grayish brown, because of the presence of a small content of organic matter. In such soil slight lamination is evident. In cultivated fields the uppermost 8- to 10-inch layer is brown and is loose, friable, or somewhat firm. The underlying layer to an average depth of 30 inches is brown to yellowish brown and friable. Apparently, there has been no transfer of fine materials from the upper part of the profile to the lower. Below an average depth of 30 inches gray and mottled colors prevail. Congaree soils are low in organic-matter content and are moderately micaceous but are relatively fertile. The loose to somewhat firm consistence permits easy penetration by roots and free movement of air and water. Tillage operations are possible under a wide range in moisture conditions. Reaction is slightly to moderately acid throughout.

These soils are well suited to a wide variety of crops, but damage to crops by stream overflow may be expected from time to time. Most of the total area is cleared and used almost wholly for crops. Corn is the principal crop. Truck crops are grown in some places.

In this county fine sandy loam and silt loam are the dominant textures in this series. The soils mapped are Congaree fine sandy loam; Congaree silt loam; and Congaree silt loam, dark-subsoil phase.

Congaree fine sandy loam.—This brown friable soil occurs in first bottoms and is subject to stream overflow. It is derived from alluvial material of mixed origin, coming from soils on the uplands underlain by micaceous schist and granite gneiss. The relief is level or nearly level, the slope generally being not more than 2 percent. External drainage is slow, and internal drainage medium. The soil covers a total of 403 acres, mostly in the bottom lands along the Nottely River. It is well suited to general crops and truck crops. Practically all of it is cleared and in agricultural use.

The profile of this soil in cultivated fields shows the following characteristics:

- 0 to 10 inches, grayish-brown friable fine sandy loam of low organic-matter content. It is loose, easily penetrated by roots, and medium to strongly acid. In wooded places it contains slightly more organic matter than in cultivated fields.
- 10 to 36 inches, brown or yellowish-brown friable loose fine sandy loam containing less organic matter than the layer above. It is medium to strongly acid, and it is penetrated freely by air, moisture, and roots.
- 36 inches +, mottled dull-brown and gray friable fine sandy loam underlain at a variable depth by crumbly silt loam or well-rounded channel gravel.

The layers of the profile vary somewhat in thickness from place to place. In a number of small areas bordering the Nottely River the upper layer consists of loamy fine sand or loamy sand overwash. Such soil is less productive for most crops than the normal soil. The areas are shown on the soil map by symbols indicating sand spots.

This soil is good to very good cropland and good to very good pasture land. It has excellent workability, very good conservability, and good productivity. It is practically free from stones and is easily tilled. It can be cultivated over a wide range of moisture conditions. The moisture relations are fairly good for plant growth, and the soil warms fairly early in spring. The supply of organic matter is apparently fairly low, but that of most essential plant nutrients is probably rather high. Both soil material and plant nutrients can be easily conserved.

Use and management.—Nearly all of Congaree fine sandy loam is used for crops, mainly corn, rye, wheat, crimson clover, red clover, lespedeza, vegetables, and sweet sorghum. The well-drained condition, favorable texture, and large supply of available plant nutrients make it well suited to corn, the principal crop. In many areas rye is seeded in cornland just before the last cultivation of the corn, and the rye is plowed under in spring to maintain the organic content of the soil. Some farmers substitute crimson clover for rye, which increases the nitrogen content of the soil as well as the organic-matter content. On land where a small-grain crop is desired, a 3-year rotation of corn, wheat or rye, and red clover is followed. Where this rotation is used, 1 ton of ground limestone an acre is generally applied to decrease the acidity of the soil.

Corn is fertilized with 150 to 200 pounds an acre of 2-10-2 or 4-8-4 mixture. Corn yields range from 25 to 40 bushels an acre in typical areas, but where the soil has been covered with recent overwash of sand the yields are much lower and average about 20 bushels an acre. Because of flood hazards rye and wheat are rarely kept on the land until harvested for grain, but when harvested for grain the average yield is 12 and 15 bushels an acre, respectively. In better than ordinary crop years, yields of wheat are as much as 20 bushels an acre and those of rye as much as 18 bushels. Red clover and lespedeza yields are about 1¼ to 1½ tons of hay an acre. Sweet sorghum produces an average of about 150 gallons an acre of good quality sirup.

The soil is well suited to tomatoes, peas, potatoes, sweetpotatoes, lettuce, cabbage, carrots, and snap beans. Lettuce, tomatoes, peas, and cabbage need light applications of lime, but other truck crops

do not seem to need lime. Of the truck crops, sweetpotatoes are probably best suited to the sandy overwash areas.

Congaree silt loam.—This brown mellow well-drained soil is in first bottoms near streams. It has formed from alluvial material derived from uplands underlain by micaceous schist and granite gneiss. It occupies low positions along streams and is subject to overflow during heavy rains. The relief is level or nearly level, and external drainage is slow and internal drainage medium. This soil differs from Congaree fine sandy loam mainly in having a finer texture and slightly less friable consistence. It is also better supplied with plant nutrients and dries out somewhat more slowly during the growing season than that soil. Nearly all of it is cleared and in agricultural use.

This soil has an aggregate area of 589 acres, and most of it occurs in the bottom lands along the Nottely River. Some areas are along the Toccoa River, mainly near Pleasant Valley School, Gaddistown, and Cavender Bridge.

In cultivated fields this soil has profile characteristics as follows:

- 0 to 8 inches, grayish-brown loose fluffy silt loam containing a little more organic matter than Congaree fine sandy loam but much less than Transylvania silt loam. This layer is medium to strongly acid and is easily pervious to moisture, air, and roots.
- 8 to 30 inches, brown crumbly silt loam, easily penetrated by moisture, air, and roots, and ranging from medium to strongly acid.
- 30 inches +, mottled gray and brown crumbly silt loam or fine sandy loam. It is easily pervious to moisture and air and admits easy penetration by roots. It is medium to strongly acid.

The profile layers vary somewhat in thickness throughout the extent of the soil. In some places, especially in areas bordering the Congaree fine sandy loam, the texture of the surface soil is loam.

This soil is good to very good cropland and very good pasture land. It is especially well suited to the production of corn. Workability and conservability are excellent, and productivity is rather high. The soil contains a fair supply of organic matter, which apparently is loosely incorporated with the mineral material of the surface soil. There is probably a relatively high content of essential plant nutrients. Tillage is comparatively easy, and good productivity may be fairly easily maintained. Erosion offers practically no problem of control. The moisture relations for plant growth are good. Although the soil has a wide range of moisture conditions for tillage, it warms somewhat less rapidly in spring than does Congaree fine sandy loam.

Use and management.—Most of Congaree silt loam is used for crops. At least 80 percent of it is planted to corn each year. Of the rest, about 5 percent is used for permanent pasture, 10 percent for truck crops and miscellaneous crops, and 5 percent for forest. Crop rotations and other management practices are similar to those for Congaree fine sandy loam, but about 50 percent more ground limestone is required for the best yield of red clover. Corn yields are a little higher than on Congaree fine sandy loam, ranging from 35 to 50 bushels an acre. Wheat and rye are about as well suited to Congaree silt loam as to Congaree fine sandy loam. When grown on Congaree silt loam, however, such crops are likely to be winterkilled or flooded. The average yields of truck crops are a little higher on this soil, partly

because of better moisture conditions and the slightly higher content of organic matter.

Congaree silt loam, dark-subsoil phase.—Associated with Transylvania and Toxaway silt loams in the first bottoms, this soil is intermediate in drainage between them. Like Transylvania silt loam, it is best developed where the parent alluvial material has been derived from wooded Porters and associated soils that occur at high elevations. The relief is level or nearly level, and external and internal drainage are medium to moderately slow.

This soil occurs in first bottoms near the headwaters of the Nottely River and along tributaries of that stream. It is also along Stink Creek in the vicinity of Choestoe and along Suches Creek near the junction of Baker Branch. The aggregate area is 1,056 acres.

The upper layer of the soil to an average depth of 15 inches is dark grayish-brown or dark-brown loose but very crumbly and plastic silt loam. It is high in content of finely disintegrated or decomposed organic matter that tends to separate from the mineral material when the soil is pressed between the fingers. The underlying layer to an average depth of 25 inches is friable silt loam, mottled medium gray and dark gray or black, which is due to poor oxidation, high organic-matter content, or a combination of these. Beneath this layer is friable silt loam, mottled with various shades of gray, but in a few places where channel gravel is close below, the color is dull brown. The soil is medium to strongly acid throughout.

This soil is good to very good cropland and very good pasture land. It is well suited to general crops and to such truck crops as potatoes, cabbage, lettuce, spinach, peas, and carrots. Artificial drainage is required in some places for best results from cereal and truck crops. The soil has good workability and excellent conservability and has a higher content of essential plant nutrients, especially nitrogen, than does Congaree fine sandy loam. The range of moisture conditions for cultivation is slightly narrower than that of Congaree fine sandy loam.

In some places the surface soil consists of brown friable gravelly silt loam. Areas of this variation occur north of New Pleasant Valley School, south of Gaddistown, and along the upper Nottely River at the junction of Helton Creek, and comprise nearly 10 percent of the aggregate area. Owing to the presence of gravel and some cobblestones, this gravelly soil is slightly inferior to the nongravelly soil for agricultural use.

Use and management.—At least 60 percent of Congaree silt loam, dark-subsoil phase, is used for corn; 10 percent for rye, which is harvested for grain; 2 percent for truck crops; 10 percent for permanent pasture; and 18 percent for miscellaneous purposes. About twice as much rye, however, is seeded in cornland for green manure as is harvested for grain. The rye turned under for green manure is followed either by corn or truck crops. Corn is fertilized with 150 to 200 pounds an acre of 4-8-4 mixture on most farms, but on a few it is fertilized with 200 to 300 pounds of superphosphate and later with a top dressing of 100 pounds an acre of nitrate of soda. Increased corn yields are obtained on land that has received 1 to 2 tons an acre of ground limestone, where legumes are in the rotation. Under this

practice corn yields 40 to 60 bushels an acre, but when very little fertilizer is used and no lime is applied only about 35 bushels are obtained.

Rye is not ordinarily fertilized. The yields range from 10 to 18 bushels an acre. Soil-improving crops include crimson clover, lespedeza, and cowpeas. Permanent pastures consist largely of bluegrass and white clover. Corn, bluegrass, white clover, and some of the other crops are benefited materially by applications of 1 to 2 tons an acre of ground limestone.

Cabbage is fertilized with 800 to 1,200 pounds an acre of 4-8-4 mixture. The yields range from 8 to 15 tons an acre when the crop is not damaged by stream overflow. Snap beans yield 150 to 200 bushels an acre when fertilized with 250 to 300 pounds an acre of 4-8-4. Many other truck crops adapted to this soil are not grown at present. Occasionally, crops are lost when the land is flooded.

EDNEYVILLE SERIES

Soils of the Edneyville series are associated with those of the Fannin series. The surface layer is light gray or grayish yellow and the subsoil yellow in contrast to the reddish-brown surface layer and the red subsoil of the Fannin soils. Also the subsoil is slightly heavier textured and more compact. Edneyville soils in this county are underlain by schist high in quartz content or are cut in many places by granite gneiss. They are apparently more highly leached and less productive than Fannin soils having comparable slope and eroded condition.

This series is represented by the stony fine sandy loam and its undulating phase. The aggregate area of these two soils is comparatively fairly small. The relief is undulating to rolling and the slope 2 to 15 percent. A large part of the total acreage is in forest. The cleared land is used for field crops and permanent pasture, although some areas are lying idle.

Edneyville stony fine sandy loam.—This light-colored and light-textured soil developed on uplands from weathered products of schist and other rocks. The relief is gently rolling to rolling, but is rolling in most places. The slopes range from 7 to 15 percent and average about 12. External drainage is medium to rapid, and internal drainage medium to slow. A fairly large part of the soil has been materially damaged by erosion and about a third is too stony for feasible cultivation.

This soil occurs in relatively small bodies, mainly in the northwestern part of the county. Representative areas are north of Youngcane, at Hemptown Gap on United States Highway No. 76, southwest of Lows Mill, 3 miles west of Blairsville, at Pleasant Hill Church in the western part of the county, and south of Ebenezer in the northeastern part. The aggregate area is 1,274 acres.

In cultivated fields this soil has the following profile characteristics:

0 to 8 inches, light grayish-yellow friable fine sandy loam apparently containing only a small quantity of organic matter. Angular quartz stones, up to 6 inches in diameter, are on the surface and in the soil. This layer is strongly acid and is easily penetrated by moisture, air, and roots. Under forested conditions the uppermost 2-inch layer is dark gray and moderately high in organic-matter content. The rest of the layer is light grayish-

yellow friable fine sandy loam, which is highly leached and impoverished. 8 to 13 inches, yellow crumbly strongly acid clay loam, easily pervious to moisture, air, and roots.

13 to 36 inches, yellow to brownish-yellow moderately stiff compact clay of massive structure. When dry, it is hard and difficult to crush, and when moist may be pressed fairly easily into short gritty ribbons. A few quartz fragments, up to 6 inches in size, are present. This layer is strongly acid. Moisture and air slowly permeate the material, and roots penetrate less freely than in the upper part of the profile.

36 to 50 inches, brownish-yellow to reddish-yellow crumbly clay loam.

50 to 78 inches, mottled yellow and red gritty clay loam.

78 inches +, weathered schist rock, containing quartz and granite gneiss.

The thickness of the different layers of the profile varies somewhat from place to place.

This soil is poor to fair cropland and fair pasture land. Workability is fair and conservability very good. The soil apparently has a fairly low supply of organic matter and of most essential plant nutrients. It has good water-holding capacity. It warms earlier in spring than some soils of heavier texture and can be cultivated over a fairly wide range of moisture conditions.

Use and management.—Approximately 70 percent of Edneyville stony fine sandy loam has never been cleared for cultivation. Small oaks are the predominant trees. About 10 percent of the soil once farmed is now covered with shortleaf pine, 10 percent is lying idle, and the rest is cultivated or in permanent pasture.

The management in most places includes some form of crop rotation and fertilization. The most common rotation consists of corn, rye, and lespedeza, which are the main crops. The rye is cut for grain, and the lespedeza is either turned under in fall and followed by corn in spring or is pastured. On land treated with 100 to 200 pounds an acre of 2-10-2 or 4-8-4 fertilizer or the same quantity of superphosphate, corn yields 16 to 28 bushels an acre. When fertilized with 100 pounds an acre of superphosphate rye yields 10 to 12 bushels an acre, but when not fertilized it yields 6 to 8 bushels. Lespedeza is not ordinarily fertilized, but the land is treated with 1 to 1½ tons of ground limestone every 5 or 6 years. When harvested for hay, lespedeza yields ¾ to 1½ tons an acre.

Under careful management, including liberal applications of fertilizer and long crop rotations in which mainly cover crops of legumes and small grains are grown, satisfactory yields can be obtained and erosion controlled. When corn and other clean-cultivated crops are grown, strip cropping where feasible should prove beneficial.

Edneyville stony fine sandy loam, undulating phase.—This phase is similar to the normal phase of the type, except that it occurs on smoother relief (2- to 7-percent slopes). It is on ridge tops in association with the normal phase and Fannin loam. External drainage is medium to rapid and internal drainage medium to rather slow. Erosion is slight or moderate in some places.

This soil has an aggregate area of 320 acres. Areas are south of Ebenezer in the northeastern part of the county, south of Pleasant Hill Church in the northwestern part, and south of Dillard Chapel along Youngcane Creek. Most of the areas are less than 5 acres in size.

The soil is fair to good cropland and good pasture land. Workability is good, conservability very good, and productivity fair.

Use and management.—About 80 percent of the soil is forested with small oak trees, 5 percent is cultivated, 5 percent is lying idle, and 5 percent is in permanent pasture. The rest is in miscellaneous uses. The crops are mainly corn, rye, and lespedeza. The soil is managed similarly to the normal phase, but crop yields average about 15 percent more. Tobacco is grown in some places. It is fertilized with 250 to 400 pounds an acre of 4-8-4 mixture, and the average yield is about 600 pounds an acre.

There are possibilities for the use of more of the less stony soil for cultivated crops.

FANNIN SERIES

Soils of the Fannin series have a reddish-brown or brown surface layer and red subsoil. They are underlain by micaceous schist rock at a depth of 3 to 5 feet, and differ from soils of the Talladega series in having better developed and thinner subsoils and greater depth to weathered rock. The underlying rocks are generally less micaceous. The relief ranges from undulating to hilly, but is predominantly rolling and hilly. Fannin loam, typical of the series in this county, occupies slopes of 7 to 15 percent, whereas Talladega loam occupies slopes of 30 to 60 percent. Fannin soils rarely occur on slopes steeper than 30 percent, and Talladega soils almost never occur on slopes of less than 15 percent. Fannin soils that have favorable slopes and have not been severely depleted are good cropland. Talladega soils, however, dry out easily and are considered generally very poorly suited to crops.

All the virgin areas of the Fannin soils have loam or stony loam surface layers. The clay loams and stony clay loams are the result of soil losses caused by accelerated erosion.

The Fannin series consists of Fannin loam and its undulating and hilly phases; Fannin stony loam and its hilly phase; the eroded, eroded undulating, eroded hilly, and severely eroded hilly phases of Fannin clay loam; and the eroded and eroded hilly phases of Fannin stony clay loam. About 61 percent of this area is uneroded or slightly eroded, about 37 percent moderately eroded, and the rest severely eroded.

About 43 percent of the area of these soils is in forest, 31 percent in cultivation, 23 percent idle, and the rest in permanent pasture.

Fannin loam.—This light-brown mellow soil, with red micaceous subsoil, is one of the most extensive cropping soils in the county. It occurs on the Hiwassee Plateau in association with the hilly phase of Fannin loam, the eroded hilly and severely eroded hilly phases of Fannin clay loam, and various phases of the Talladega soils. The rock that has given rise to it consists of mica schist, which has contributed many small mica flakes to the profile. The soil generally occupies broad gently rolling to rolling ridge tops having a 7- to 15-percent slope. External and internal drainage are medium, although the runoff is rapid in some places.

The aggregate area of 10,400 acres is in the northern and north-western parts of the county, and the individual areas are usually 5 to 20 acres in size.

Oak and many kinds of less important trees made up the native forest on this soil, and different species of oak are now the predominant trees on areas that have never been cleared. On land that has been cleared and cultivated but has reverted to forest, shortleaf pine comprises the principal growth.

In cultivated fields this soil has the following profile characteristics:

0 to 7 inches, grayish-brown friable mellow loam. It is low in content of organic matter; medium to strongly acid; easily permeable to moisture and air; and roots penetrate it freely. In wooded areas this layer is stained dark grayish brown by organic matter to a depth of 2 or 3 inches.

7 to 12 inches, reddish-brown crumbly fine-textured clay loam.

12 to 34 inches, red highly micaceous clay loam, breaking readily into small irregularly shaped aggregates that may be pressed fairly easily when moist into short smooth ribbons. It is moderately dense, moderately friable, and has a slick greasy feel. The layer is not sufficiently dense to prevent root penetration but roots are fewer than in the two layers above. The material is porous enough to permit free movement of air and is strongly acid. The uniformly red coloration indicates a highly oxidized condition of iron compounds and a general absence of waterlogging.

34 to 48 inches, red soft highly micaceous clay loam of noticeably lighter texture than that of the layer above. Only a few of the larger roots of trees penetrate this material.

48 inches +, dark greenish-red or red weathered micaceous schist rock.

Where this soil adjoins Edneyville stony fine sandy loam the surface layer is yellowish brown. At numerous other places variations in color may be observed, but they are of minor importance.

This soil is fair to good cropland and good pasture land. It has good workability, fair conservability, and is moderately productive of the crops commonly grown. The content of organic matter and essential plant nutrients is lower than in such soils as Porters, Balfour, and Rabun, which occur on the mountains. The soil is susceptible to erosion, and precautions are necessary to conserve water. Moisture relations are fairly good for plant growth, and the land can be cultivated over a relatively wide range in moisture.

A few areas of Talladega loam, rolling phase, up to half an acre in size, are included with this soil as mapped.

Use and management.—Approximately 40 percent of Fannin loam is in oak forest and 10 percent in shortleaf pine, 30 percent is cultivated, 10 percent is in permanent pasture, and 10 percent is lying idle or is in miscellaneous uses. The principal crops are corn, rye, and lespedeza. Some cowpeas and crimson clover are grown. Truck crops, especially snap beans, are produced on a relatively small acreage.

A rotation of corn, rye, and lespedeza is practiced on many farms. Corn is followed by rye, which is seeded in the cornland and the crop harvested for grain. Lespedeza follows the rye and is either superseeded by corn or used for pasture. In the rotation as practiced by some, crimson clover or cowpeas is grown in place of lespedeza, and the crimson clover is turned under for green manure before corn is again planted on the land.

In this rotation corn, when fertilized with 100 to 200 pounds an acre of 2-10-2 or 4-8-4 mixture or superphosphate, yields 20 to 40 bushels an acre. Rye yields 10 to 15 bushels an acre when fertilized with 100 pounds of superphosphate, and 8 to 10 bushels when no fertilizer is used. Land for lespedeza is not given applications of

fertilizer in most places, but in many fields the land is treated with 1 to 1½ tons of ground limestone at 5- or 6-year intervals, and the yields of hay range from ¼ to 1½ tons an acre. On land where two or more crops of legumes have been turned under and the fertilization has been heavy, corn yields 55 bushels or somewhat more an acre. When available, barnyard manure is applied, preferably to cornland.

Snap beans for truck crops are fertilized with 300 to 500 pounds an acre of 5-7-5 mixture and in most places are followed by a small-grain or lespedeza crop. Under this management, the beans yield 100 to 175 bushels an acre.

The management requirements of this soil include liberal fertilization and long rotations consisting mainly of grasses and leguminous and small-grain cover crops. Under such practice the water is well used and satisfactory crop yields are obtained. When corn or other clean-cultivated crops are grown, strip cropping or terracing should be considered.

Fannin loam, undulating phase.—This phase differs from the normal phase of the type mainly in having milder relief, which is gently undulating to undulating (2- to 7-percent slopes) instead of gently rolling to rolling. It has medium external and internal drainage. Erosion has affected the soil only slightly. About half the total area has been cleared for crop use.

A total of 979 acres is mapped. The individual areas generally are 5 to 10 acres in size, and the larger ones are on smooth ridge tops in the northwestern part of the county. Some of the best examples of this soil are west of Kelley Mountain and southwest of Confidence School.

In general the surface soil and subsoil are slightly thicker than in the normal phase. In cultivated fields the surface soil is grayish-brown friable mellow loam about 8 inches thick. In forested areas to a depth of 1 or 2 inches it is dark grayish brown, owing to the accumulation of organic matter derived from decayed leaves and other decayed vegetation. The 18- to 32-inch subsoil is red highly micaceous and moderately friable clay loam having a slick greasy feel. It is underlain by the parent material consisting of red soft clay loam of high mica content and of noticeably lighter texture than the subsoil. Rock fragments of various sizes are on the surface and in the soil but in most places are not sufficient to hinder tillage. The surface soil is medium to strongly acid and the subsoil strongly acid.

This soil is fair to good cropland and good pasture land. It has very good workability, good conservability, and is moderately productive of the crops commonly grown. Favorable tilth and generally good conditions for plant growth prevail. Both the surface soil and subsoil are relatively low in content of organic matter and probably fairly low in essential plant nutrients. The moisture relations are favorable to the production of the crops ordinarily grown. Resistance of the soil to drought is relatively high, especially in comparison with some of the more sloping or severely eroded soils of the county. The soil is easily pervious to moisture and air, and plant roots penetrate it freely. The water-holding capacity is good.

Mapped with areas of this soil are about 50 acres of soil that would be mapped as Fannin stony loam, undulating phase, if it were of

sufficient extent. Such soil is regarded of lower agricultural value because of its stony character, although the two soils have similar cropping possibilities.

Use and management.—About 50 percent of Fannin loam, undulating phase, is in oak and mixed forest, 20 percent in shortleaf pine, 10 percent under cultivation, 10 percent in permanent pasture, and 10 percent in idle land or miscellaneous uses. Corn is the principal crop. Rye and lespedeza are important. Cowpeas and crimson clover are less important, and some snap beans are grown as truck crops.

Crop yields vary widely depending not only on the inherent fertility of the soil but to a greater degree on the management, including the use of amendments. On a majority of fields the rotation consists of corn superseded by rye sown in the corn, followed by lespedeza seeded in the rye. The rye is cut for grain. The lespedeza either is turned under in fall and followed by corn in spring or it is pastured and permitted to reseed the land the following spring and is turned under in fall.

Where crop rotations are practiced and the land receives 100 to 200 pounds an acre of 2-10-2 or 4-8-4 fertilizer or superphosphate, corn yields 20 to 35 bushels an acre. The rye grown in rotation and fertilized with an average of 100 pounds an acre of superphosphate yields 10 to 15 bushels an acre, but on unfertilized land it yields about 8 bushels. Lespedeza is not ordinarily fertilized, but in many fields the land receives 1 to 1½ tons an acre of ground limestone at 5- or 6-year intervals. The lespedeza yields ¾ to 1¼ tons of hay an acre. Where corn follows 2 or more consecutive leguminous crops that have been plowed under and the land heavily fertilized, yields of 50 to 66 bushels an acre have been obtained. Barnyard manure, when available, is generally applied to cornland.

On a few farms some of the soil is used for truck crops, especially snap beans. The beans are fertilized with 300 to 500 pounds an acre of 5-7-5 mixture and are generally superseded by small grain or lespedeza. When this practice is followed, bean yields of 100 to 175 bushels an acre may be expected.

Some farmers grow cowpeas or crimson clover instead of lespedeza in the crop rotations, and the crimson clover is turned under for green manure before corn is planted.

Fannin loam, hilly phase.—This phase is similar in profile characteristics to the normal phase of the type and differs mainly in being hilly, its slope ranging from 15 to 30 percent instead of 7 to 15 percent. It is best developed on the Hiwassee Plateau in the northern part of the county, occurring on the stronger slopes in association with the normal phase and Fannin clay loam, eroded phase, on the ridge tops. It has medium to rapid external drainage and medium internal drainage. Its aggregate area is 15,617 acres, and individual areas of 50 acres or larger are of common occurrence.

The surface layer of this phase, being only about 6 inches thick, is not quite so thick in places as that of the normal phase. In some places the subsoil is not very well developed. Where this phase is mapped adjoining areas of the hilly phase of Talladega loam, the boundary lines are drawn arbitrarily in many places, as the two soils

differ but little in profile development and depth to the underlying rocks.

This phase has poor workability and conservability but fair productivity.

A few small areas of Talladega loam, hilly phase, are included with this soil as mapped.

Use and management.—About 60 percent of Fannin loam, hilly phase, is in oak and mixed forest, 20 percent in shortleaf pine, 15 percent under cultivation, and 5 percent in idle land.

Although the present use is largely for forest, the soil constitutes an important reserve which, if needed, could be cleared and planted to legumes and pasture grasses. It is too susceptible to erosion for feasible use as cropland, but erosion can be held in check by properly managed pasture, especially if the soil is used for pasture without intervening clean-cultivated crops.

Some of this soil, particularly on north-facing slopes, would probably be desirable for commercial apple and peach orchards and possibly vineyards. Results from such fruits in farm orchards indicate that they do well on this soil.

Fannin stony loam.—The profile of this soil is similar to Fannin loam and differs mainly in having a large number of rock fragments up to 6 inches in diameter on the surface and in the profile. The relief is gently rolling to rolling, and external and internal drainage are medium. The soil covers a total area of 1,267 acres in the northern and northwestern parts of the county. It is confined mainly to ridge tops, and the individual areas are relatively small. A large part is in forest.

This soil is fair cropland and good pasture land. Workability is fair, conservability good, and productivity fair for the crops commonly grown. The soil is considered less desirable than Fannin loam for cropland chiefly because of its stony character. In most places the rock fragments strewn over the surface and mixed with the soil are numerous enough to interfere somewhat with tillage, but in only a few places preclude cultivation.

Use and management.—About 60 percent of Fannin stony loam is in oak or mixed forest, 10 percent in shortleaf pine, 20 percent in cultivated land, and 10 percent in idle land. The main crops are corn, rye, and lespedeza. A small acreage is planted to cowpeas and crimson clover. With the addition of stone picking, the management practices and crop yields are about the same as for Fannin loam.

Fannin stony loam, hilly phase.—This phase differs from the normal phase of the type mainly in having a stronger relief (15- to 30-percent slopes). Many stones similar to those on and in the normal phase are characteristic of this phase. External drainage is medium to rapid and internal drainage medium. The soil is associated with other Fannin soils and with Talladega soils. The aggregate area is 1,626 acres, and most individual areas contain 50 acres or more. The larger areas are in the western part of the county near Dillard Chapel west of Youngcane and in the northwestern part south of Cook Mill. A large part of the soil has never been cleared for agricultural use.

This soil is very poor to poor cropland and fair pasture land. It has poor workability and fair to poor conservability. The hilly relief

and stoniness render it poorly suited to cultivated crops. Although its productivity for pasture is about the same as that of Fannin loam, the stones and steeper slopes make it a little less desirable for that use.

Mapped with this soil are about 70 acres of a soil that would be mapped as Edneyville stony fine sandy loam, hilly phase, if it were sufficiently extensive. This inclusion is made because of the limited extent of the Edneyville soil, the manner in which it grades into the Fannin soils, and the close similarity in the use suitability of the two soils. The included soil has a grayish-yellow fine sandy loam surface layer and a yellow stiff sandy clay subsoil, which is less plastic than that of the Fannin soil. It is stony on the surface and throughout the profile. A representative area is a half mile south of Dillard Chapel southwest of Youngcane. All this included soil is in forest consisting generally of small oak trees.

Use and management.—About 80 percent of Fannin stony loam, hilly phase, is in oak or mixed forest, 10 percent in cultivated land, 5 percent in pasture land, and 5 percent in idle land. Owing to the unfavorable characteristics of the soil for crops, cleared areas can be used as cropland for only a few years. The soil, however, may be considered as a reserve for pasture, when more pasture land is desired.

Fannin clay loam, eroded phase.—Originally this soil had a loam surface layer similar to that of Fannin loam. Except for the texture of the plowed layers, the two soils have nearly identical profiles. They occur on gently rolling to rolling relief, in which the slope ranges from 7 to 15 percent. External drainage is medium to rapid and internal drainage medium. The principal differences between the two soils are due to their use and management in the past. Much of Fannin loam has remained in forest, and the cleared land either has been carefully managed or has not been cleared long enough to be affected seriously by erosion. On the contrary, this soil is cultivated or in pasture, although some cleared land has grown up in shortleaf pine. The eroded condition apparently resulted from cultivating the soil without taking precautions to hold erosion in check.

The aggregate area of this soil is 8,365 acres, all of which is cleared land. It is in the northern and northwestern parts of the county and is associated mainly with other Fannin soils.

The 5- to 6-inch plowed layer consists of a mixture of surface soil and subsoil materials, to which the subsoil material has imparted a reddish color. This layer contains enough clay to have a somewhat dense but crumbly consistence rather than a loose friable mellow consistence characteristic of the plowed layer of Fannin loam.

This eroded phase is poor to fair cropland and fair pasture land. It has good workability, poor conservability, and fair productivity. Tillage and other conditions favorable to plant growth are not so good as in Fannin loam.

Use and management.—About 60 percent of Fannin clay loam, eroded phase, is in cultivation, 10 percent in permanent pasture, and 30 percent in idle land or other uses. Corn is the principal crop grown; other crops are mainly rye, wheat, and lespedeza.

Cropping practices on much of this soil have not been beneficial. Corn has been planted year after year without the use of fertilizer or the growing of cover crops. Under such practice, rapid depletion of

the soil soon resulted, and now corn yields average less than 10 bushels an acre in many fields. Accelerated erosion is very active, causing much loss of water and soil materials and unfavorably affecting the physical and chemical qualities of the soil.

It was not unusual to crop areas of this soil until the fertility was almost gone, and then allow them to remain idle or to grow up in shortleaf pine. Many such areas have again been cleared and cultivated. In a few places this cycle has been repeated a number of times.

In the past some farmers have alternated corn and rye in farming this soil. At present some are using crop rotations that include legumes and small grains. The rotations are similar to those practiced on Fannin loam. Although strip cropping for protection against erosion is practiced on only a small part of the soil, a fairly large part is protected by terraces. Under better management practices the average corn yield is about 12 bushels an acre, but yields of as much as 30 bushels are obtained. Rye and wheat yield 6 to 10 bushels an acre, but yields of both crops could be substantially increased. Lespedeza yields $\frac{1}{2}$ to $\frac{3}{4}$ ton of hay an acre.

This soil can be built up gradually to a moderately productive condition by the judicious use of lime, fertilizer, and green manure. Green manure is especially helpful in improving the tilth. Continued precautions, however, are necessary to hold erosion in check.

It is interesting to note the development of terracing and other measures for controlling water, as practiced on this and similar soils in the county. Contour ditches were used in some of the early attempts to control water on the land. No records are available as to the date on which such ditches were first employed, but many were dug about 1900. These ditches deepened rapidly, and many are now narrow gullies and some are 10 feet or more deep. They are a handicap to the use of the land, even for pasture, as they are hazardous to livestock. Later, shallow terraces were constructed. Many of the more recent terraces have been carefully built and some have suitable outlets for controlling excess rain water.

Fannin clay loam, eroded undulating phase.—This soil differs from Fannin loam, undulating phase, mainly in the texture of the surface soil. Originally the two soils were identical. In general this soil has been cultivated longer than either Fannin loam or its undulating phase. During much of its use history, it has been planted to clean-cultivated crops, mainly corn. The soil has been cultivated without being protected with cover crops, especially in winter, and no special efforts have been made to build it up either with legumes or commercial fertilizers. Soil depletion through erosion has been rapid; consequently, only a relatively shallow surface soil, 6 inches or less thick in most places, remains. In many places subsoil material is mixed with the plowed layer, giving much of that layer a bright-red or brownish-red color.

The relief of this phase is gently undulating to undulating and its slope is 2 to 7 percent. External drainage is medium to rapid and internal drainage medium. The aggregate area is 262 acres. The larger areas are on ridge tops in the Hiwassee Plateau, especially in the northwestern part of the county. All the soil has at one time or

another been in agricultural use, although a considerable acreage is now in second-growth trees.

This soil is fair to good cropland and good pasture land. Workability is very good, conservability fair, and productivity is fair for the crops commonly grown. Tilth conditions are poorer than in Fannin loam, undulating phase, and more power is required for ordinary tillage and the preparation of good seedbeds. The soil must be tilled under a narrower range of moisture conditions. Root penetration is more difficult in the plowed layer; and when there is a shortage of rainfall, the soil is likely to dry out more quickly. Because of these conditions this soil is considered slightly inferior to Fannin loam, undulating phase.

Mapped with this soil are about 35 acres of a soil that would be mapped as Fannin stony clay loam, eroded undulating phase, if it were sufficiently extensive.

Use and management.—About 60 percent of Fannin clay loam, eroded undulating phase, is under cultivation, 10 percent in permanent pasture, 10 percent in idle land, and 20 percent in shortleaf pine. Corn, rye, and lespedeza are the main crops grown (pl. 2, A).

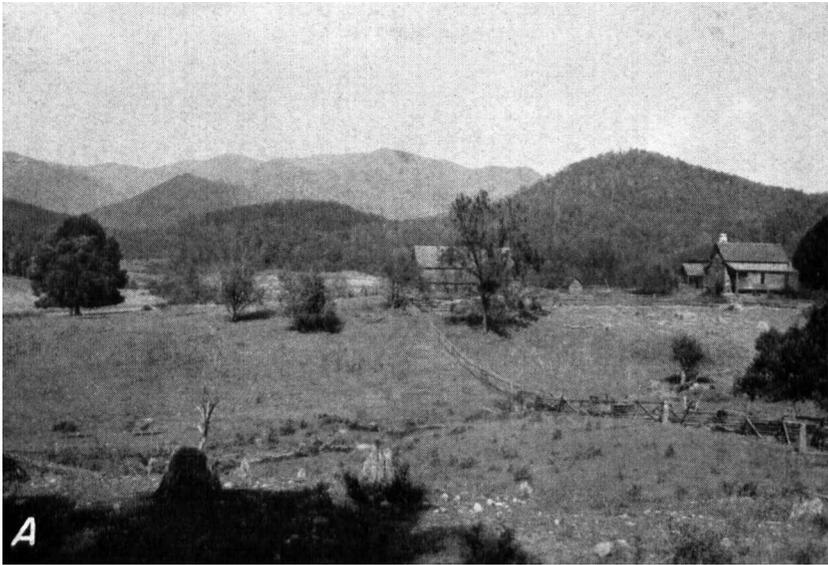
This soil is managed similarly to Fannin loam, undulating phase, but lower crop yields are obtained. Corn yields are 15 to 25 bushels an acre, rye yields 6 to 12 bushels, and lespedeza $\frac{3}{4}$ to $1\frac{1}{4}$ tons of hay. Truck crops are not ordinarily grown on this soil.

With good management, including liberal applications of lime and fertilizer and the use of green manure to improve the tilth, this soil can be built up so as to produce 30 to 40 bushels of corn an acre and correspondingly good yields of other crops ordinarily grown.

Fannin clay loam, eroded hilly phase.—This soil differs from Fannin clay loam, eroded phase, mainly in slope, which is stronger, ranging from 15 to 30 percent. Its external drainage is rapid and internal drainage medium. It is associated with other Fannin soils in the northern and northwestern parts of the county. It is much less extensive than Fannin loam, hilly phase, and covers a total area of 6,266 acres. Originally, these two soils were the same in profile characteristics. The present differences, principally in thickness and texture of the surface soil, are largely the result of loss of material through accelerated erosion. The surface soil of this eroded hilly phase is 3 to 6 inches thick and includes some subsoil material that has been brought up by the plow.

All this soil has been used for clean-cultivated crops for long periods, and owing to the rather steep slope, which causes rapid runoff, the loss of soil material through accelerated erosion has been rather severe. In many places gullies have cut far into the parent material. These deep gullies are shown on the soil map by symbols.

This soil is very poor to poor cropland and fair pasture land. Workability, conservability, and productivity are poor for the crops commonly grown. The hilly relief and poor tilth have caused much loss of water through runoff where clean cultivation is practiced. Water soaks in this eroded soil more slowly than in Fannin loam, hilly phase, which is practically uneroded; consequently, less moisture is stored, and during dry periods the soil soon dries out. The hilly relief and erosion greatly increase the task and cost of tilling the soil.



A, Farmstead on Fannin clay loam, eroded undulating phase, in the southeastern part of the county. In the immediate foreground is a narrow strip of Chewacla silt loam along the drainageway and a narrow area of Fannin clay loam, eroded hilly phase. Forest in background is on Porters soils and Rough stony land (Porters soil material).

B, Dates-of-planting test conducted by the Georgia Mountain Branch Station with the Bliss Triumph variety of potatoes on State silt loam. Rate of fertilization, 1,000 pounds an acre of 4-8-6. The 4 rows on the right planted May 10; the next 4 rows, May 5; those at left, May 1.



- A, Grape-variety test on Talladega clay loam, severely eroded hill phase. Good results are obtained at the Georgia Mountain Experiment Station with a number of varieties of grapes on this soil and other members of the Talladega series. The Talladega soils, however, are too shallow for the successful production of apples and peaches on a commercial basis.
- B, Cabbage-spacing test conducted on Tate silt loam by the Georgia Mountain Experiment Station. This crop of Marion Market variety was planted April 4, 1938, and harvested July 12. Fertilization consisted of 2,000 pounds an acre of 5-10-7. In this test, 8- to 10-inch spacing produced the largest number of marketable heads, most of which weighed 3 to 4 pounds each.

Use and management.—About 50 percent of Fannin clay loam, eroded hilly phase, is lying idle, 20 percent is cultivated, 5 percent is in pasture, and 25 percent once cultivated is now covered with shortleaf pine.

On many farms where there is not enough of the better soils for crop production, areas of this soil have been cropped year after year to corn without the use of cover crops or fertilizer. This practice has resulted in rapid depletion of soil fertility. Corn yields are relatively low, ranging from 5 to 8 bushels an acre. The large percentage of this soil lying idle and the rather large percentage of formerly cultivated land now covered with shortleaf pine indicate that the use and management of the soil in the past were not properly adjusted to its requirements.

A few farmers, nevertheless, are making good use of this eroded soil, especially for the production of lespedeza and pasture grasses. Practically all of the soil would provide excellent pasture if given liberal applications of lime and superphosphate and seeded to mixed pasture plants. In many places erosion is held in check by terraces or contour plowing. In places where a durable leguminous cover is required, sericea lespedeza should prove satisfactory. Two or three cuttings of hay, totaling $\frac{3}{4}$ to $1\frac{1}{4}$ tons an acre, may be obtained from this crop in a single season.

Fannin clay loam, severely eroded hilly phase.—This phase consists of severely eroded areas of what was Fannin loam, hilly phase, and Fannin stony loam, hilly phase. The slope ranges from 15 to 30 percent, and external drainage is very rapid and internal drainage medium. In most areas nearly all the original surface layer has been removed by accelerated erosion, and the plowed layer consists of fine-textured material of the red clay subsoil. In many places gullies have cut into the subsoil. These gullies can be plowed across, but plowing will not completely efface them. Some deep gullies occur here and there.

The soil extends over a total of 691 acres, of which about 60 acres are stony. Areas are in the northern part of the county, representative ones being east of Ivylog, west of Lance Mill, and southeast of Smith Bridge.

The workability of this phase is poor and the conservability and productivity very poor.

Included with this phase as mapped is a total of about 25 acres of rough gullied land consisting of areas of Fannin and Porters soils that have lost their surface soil and a large part of their subsoil through accelerated erosion. In some places no subsoil remains, and the parent material, consisting of soft weathered rock, is exposed. The slope ranges from 7 to 25 percent. One of the largest areas of this inclusion is mapped one-fourth mile north of Suches.

Use and management.—Owing to the extent of accelerated erosion and to the hilly relief, Fannin clay loam, severely eroded hilly phase, is very poorly suited to crops and pasture. It is suitable, however, for forest. The trees must be adequately protected from fires and other good management practiced in order to obtain the best stands of forest.

Fannin stony clay loam, eroded phase.—Except for the presence of stones on the surface and in the plowed layer, this soil is the same as Fannin clay loam, eroded phase. The plowed layer consists of subsoil and surface soil materials mixed and is brownish red where the subsoil material predominates. Angular and subangular quartz and other rock fragments, up to 6 inches in diameter, are scattered over the surface and throughout the plowed layer in sufficient numbers to retard tillage somewhat. Although the subsoil is similar to that of Fannin loam, its depth to unweathered rock is a little greater, ranging from 4 to 5 feet.

The relief of this soil is gently rolling to rolling, the slope being 7 to 15 percent. External drainage is rapid and internal drainage medium to rapid. Most of the 1,101 acres is in the northwestern part of the county in the vicinity of Kelley Mountain. The areas are generally 5 to 20 acres in size and are associated mainly with Fannin stony loam.

This soil is poor to fair cropland and fair pasture land. It has poor workability and fair conservability and productivity for the crops commonly grown.

Mapped with this soil are about 120 acres of a severely eroded phase of Fannin clay loam, which occurs in tracts of 10 acres or less in different parts of the Hiwassee Plateau. Representative areas are southwest of Thomas Mill in the northwestern part of the county and northwest of Queens Gap west of Blairsville. About 50 acres of a severely eroded phase of Fannin stony clay loam also are included because of its small total area and similar use suitability for the production of pasture plants.

This included severely eroded phase of Fannin clay loam differs from the eroded phase in degree of erosion. The original surface layer has been almost wholly removed by accelerated erosion, and red heavy-textured clay loam subsoil material is exposed over more than 75 percent of the area of the soil. Good tilth is difficult to maintain, and roots penetrate this soil more slowly than they penetrate Fannin clay loam, eroded phase. Shallow gullies that are plowable but not completely obliterated by tillage are characteristic of this severely eroded phase. Deep gullies and small areas mutilated by accelerated erosion occur in many places and are indicated on the soil map by symbols.

Use and management.—Like the eroded phase of Fannin clay loam, the eroded phase of Fannin stony clay loam has been affected considerably by accelerated erosion. The past and present management practices also are similar to those of that soil. About 65 percent of it is cultivated, 10 percent is lying idle, 5 percent is in permanent pasture, and 20 percent is in shortleaf pine. Crop yields are relatively low. Corn yields 8 to 20 bushels an acre, wheat and rye 5 to 10 bushels, and lespedeza about $\frac{1}{4}$ ton of hay, but under careful management better yields are obtained.

About 80 percent of the included severely eroded phase of Fannin clay loam is lying idle, and the rest is in shortleaf pine. This soil would respond to good management and could be used as pasture land. *Sericea lespedeza* and kudzu should prove satisfactory for water control and rebuilding the soil.

Fannin stony clay loam, eroded hilly phase.—This soil is similar to Fannin stony loam, hilly phase, except in color and texture of the surface soil. The slopes range from 15 to 30 percent. External drainage is rapid to very rapid and internal drainage medium to rapid. The aggregate area is 794 acres. Small areas generally occur in various places on the Hiwassee Plateau. One of the larger areas borders the Nottely River south of Blairsville.

All the soil has been cultivated, and the present texture of the plowed layer is the result of loss through accelerated erosion of a large part of the original loam surface layer and the mixing by tillage of subsoil material with the small quantity of loam that was left.

This soil is very poor to poor cropland and fair pasture land. Workability is very poor, conservability fair, and productivity poor for the crops commonly grown.

Use and management.—About 20 percent of Fannin stony clay loam, eroded hilly phase, is cultivated, 10 percent is in pasture and miscellaneous uses, 40 percent is lying idle, and 30 percent is in shortleaf pine. Corn and lespedeza are the principal crops. Under common management, corn yields 5 to 9 bushels an acre and lespedeza $\frac{1}{2}$ to 1 ton of hay. With proper management better yields of these crops may be expected. Ordinarily, the carrying capacity of pasture is about 5 acres to 1 cow, but with good management, including erosion-control measures, 2 acres of pasture would probably sustain 1 cow.

HAYESVILLE SERIES

The soils of the Hayesville series have a reddish-brown surface layer and red subsoil similar to the soils of the Fannin series. The depth of the profile to bedrock, however, is greater than in the Fannin soils. It ranges from 5 to 8 feet, whereas in the Fannin soils it is less than 5 feet. The subsoil is more porous and crumbly than that of the Fannin soils. The Hayesville soils have formed from weathered granite gneiss and the Fannin soils from weathered micaceous schist rock; hence the Hayesville soils are less micaceous than the Fannin. In places where the relief and erosion of Hayesville soils are similar to those of Fannin soils, the Hayesville are somewhat more productive.

Soils of this series mapped in this county are Hayesville loam and its undulating, rolling, and steep phases; and the eroded, severely eroded, and rolling phases of Hayesville clay loam. These soils are mainly in the vicinity of Choestoe and in the southeastern part of the county.

A fairly large acreage of these soils has been cleared for crop use, a considerably large acreage is lying idle, and some has never been cleared of forest. Erosion has affected the use and management of a large total acreage.

Hayesville loam.—A brown friable surface soil and a red clay loam subsoil are characteristics of this soil. It has formed from weathered material of granite gneiss and has a comparatively deep profile. The soil is less micaceous than Fannin loam, which is a red soil formed from weathered products of highly micaceous rocks. The relief is hilly and slopes range from 15 to 30 percent. External drainage is medium to rapid and internal drainage medium. The soil is extensive in the southeastern and southwestern parts of the county, and it covers a

total of 2,867 acres. Only a small acreage has been cleared for crop or pasture use.

The characteristics of the profile of this soil in cultivated fields are as follows:

- 0 to 7 inches, grayish-brown to light-brown friable loose loam, somewhat gritty, and moderately high in content of organic matter; medium to strongly acid. Moisture, air, and roots easily penetrate the layer. Under virgin conditions, a relatively thin layer of partly decomposed leaves, twigs, and other vegetable matter covers the soil. The mineral soil of the topmost 1- to 2-inch layer is dark grayish-brown or dark-brown friable gritty loam. In general, it contains more organic matter than the plowed layer, and it contains many small roots and also other organic material.
- 7 to 11 inches, brownish-red crumbly light-textured soft clay loam of low organic-matter content. It has coarse crumb structure in contrast to the granular structure of the above layer; is medium to strongly acid; and moisture, air, and roots penetrate it easily.
- 11 to 32 inches, red slightly micaceous fine-textured clay loam of soft blocky structure. It is low in content of organic matter. Small dark-gray and grayish-green concretions are in the material. The uniformly red color indicates good oxidation. The pore space is ample for the movement of moisture and air, and the larger roots easily penetrate the layer. The material is medium to strongly acid.
- 32 inches +, light-red soft moderately friable clay loam. It is lighter textured, more micaceous, and less oxidized than the above layer, and small concretions are more numerous. It is underlain at a variable depth by soft decomposed granite gneiss.

Throughout the extent of this soil the profile layers vary somewhat in thickness, and other minor variations occur from place to place.

This soil is poor cropland and fair to good pasture land. It has poor workability and conservability and fair productivity. The rather steep slope renders tillage and the control of runoff more difficult than on many soils of milder relief. The soil is probably fairly well supplied with most essential plant nutrients. Its water-holding capacity is fairly good, and with proper management runoff can be controlled fairly well.

Use and management.—Less than 10 percent of Hayesville loam is used for crops and permanent pasture; the rest is in oak and mixed forest. The forested soil, however, may be a reserve to be cleared and used for pasture consisting of bluegrass, white clover, and lespedeza. When the pasture has become well established and lime and superphosphate have been applied, 4 acres should sustain 1 cow.

The small acreage cropped is planted mainly to corn, which produces comparatively low yields under common management.

Hayesville loam, undulating phase.—This phase differs from the normal phase of the type mainly in being gently undulating to undulating rather than hilly. It occurs on ridge tops in association with other Hayesville soils and has slow to medium external drainage and medium internal drainage. Erosion is moderate in some places, but in most places it is slight or has not occurred at all. A large part of the soil has been cleared for agricultural use.

The aggregate area of this soil is only 58 acres, and most of the individual areas are less than 5 acres in size. Representative areas are in the southwestern part of the county near Harmony Church and east of Cynthia Knob.

This phase is fair to good cropland and good pasture land. Workability and conservability are very good, and productivity is good for

the crops commonly grown. Moisture and air permeate the soil easily, and roots penetrate it freely. The moisture relations are favorable to plant growth. The surface soil and subsoil are medium to strongly acid. In general the content of essential plant nutrients is fair.

Mapped with this soil are about 40 acres that if sufficiently extensive would be mapped as Hayesville clay loam, undulating phase. It was included with this phase chiefly because of its small extent and similar use suitability. The plowed layer is heavier, owing to the loss of some of the original loam through erosion and to clay loam of the subsoil brought up by the plow.

Use and management.—Most of Hayesville loam, undulating phase, is used as cropland. The main crops are corn, wheat, rye, and lespe-deza. Some crimson clover and red clover are grown. The management practices are similar to those for Hayesville loam, rolling phase, but crop yields are slightly higher. The control of erosion, however, is somewhat easier because of the milder relief.

This soil is one of the more fertile soils of the uplands. Under proper management it can be maintained in a fairly high state of productivity.

Hayesville loam, rolling phase.—This phase differs from the normal phase of the type mainly in having a milder relief, which is gently rolling to rolling rather than hilly. The slopes range from 7 to 15 percent, and external and internal drainage are medium. The soil occurs on ridge tops in the vicinity of Choestoe and in the southwestern part of the county. Its aggregate area is 397 acres, about one-third of which is in crop and pasture use.

In cultivated land the surface soil is grayish-brown to light-brown loose friable gritty loam 7 or 8 inches thick. The content of organic matter is fairly high. In forested land the surface soil is dark grayish-brown or dark-brown friable gritty loam containing more organic matter than the plowed layer. A 2- to 5-inch subsurface layer of brownish-red crumbly clay loam intervenes between the surface soil and subsoil. The subsoil is red slightly micaceous fine-textured clay loam containing some small dark-gray and grayish-green concretions. At a depth of about 32 inches it passes into light-red parent material consisting of soft clay loam. In many places this material contains more mica and concretions than the subsoil. Both the surface soil and subsoil are medium to strongly acid, but the subsoil in most places is a little more acid than the surface soil.

This soil is fair to good cropland and good pasture land. It has good workability, conservability, and productivity for the crops commonly grown. Pore space is sufficient for the movement of air and moisture, and the deep soil profile holds an ample supply of moisture.

Use and management.—About 30 percent of Hayesville loam, rolling phase, is used for cultivated crops, 50 percent is in oak and mixed forest, 10 percent is in shortleaf pine, 5 percent is in permanent pasture, and 5 percent is lying idle.

This soil is somewhat more productive than Fannin loam. Careful management, however, is required to control water. The soil has been terraced in most places, and rotations of corn, wheat or rye, and lespe-deza are followed. Strip cropping is practiced in a few places.

Corn is ordinarily fertilized with 100 to 200 pounds an acre of 20-percent superphosphate, and wheat and rye with 150 pounds of 4-8-4 mixture.

Corn yields 18 to 35 bushels an acre; wheat, 9 to 18 bushels; rye, 9 to 15 bushels; and lespedeza, 1 to 1¼ tons of hay. Corn yields average about 22 bushels an acre; wheat, about 12 bushels; and lespedeza, about 1¼ tons of hay. Some areas of the soil are treated with 1 to 1½ tons an acre of ground limestone, and on these crimson clover or red clover are grown instead of lespedeza. Under a high level of management red clover grown in the rotation yields 1 to 1¼ tons an acre of hay. Some farmers seed crimson clover in cornland after the last cultivation of the corn and in the following spring it is turned under for soil improvement before corn is planted again on the land.

Hayesville loam, steep phase.—This soil is similar in profile characteristics to the normal phase of the type, but it has a steeper slope—30 to 60 percent rather than 15 to 30 percent. External drainage is rapid to very rapid and internal drainage medium. In cleared areas accelerated erosion is moderate to severe. A large part of the soil, however, has never been cleared for agricultural use.

Most of this soil is along the upper reaches of the Nottely River and in the vicinity of Suches. Individual areas are relatively large, most of them containing 50 to 100 acres. A total of 1,715 acres is mapped.

This soil is regarded as very poor cropland and very poor to poor pasture land, but it is well suited to forest. Workability is fair and conservability poor. Productivity is poor for the crops commonly grown. The control of runoff is an important problem in the management of the soil when cleared and used for crops and pasture.

Use and management.—About 85 percent of Hayesville loam, steep phase, is in oak-chestnut forest, 5 percent is idle land, 5 percent is in permanent pasture, and 5 percent is cultivated in conjunction with less steep Hayesville soils. Corn is the principal crop. Under the common management practices the yields of corn and the carrying capacity of the permanent pastures are relatively low.

As the soil is best suited to forest, the management requirements are those of forest production rather than crop and pasture production.

Hayesville clay loam, eroded phase.—The profile characteristics of this soil are similar to those of Hayesville clay loam, rolling phase. The soil is hilly, however, and its slopes range from 15 to 30 percent. It has medium to rapid external drainage and medium internal drainage. It occurs in association with other Hayesville soils and covers an aggregate area of 1,562 acres.

Originally, this soil was Hayesville loam, but accelerated erosion has removed most of the virgin loam, and the present plowed layer consists mainly of clay loam subsoil material. In most places the surface soil is 3 to 6 inches thick. It is reddish brown where some of the original surface layer remains and red where it consists mainly of subsoil material.

This soil is very poor to poor cropland and fair to good pasture land. Workability and conservability are poor. Productivity for the crops

generally grown also is poor. The control of runoff is highly important in maintaining or improving productivity.

Use and management.—At some time all of Hayesville clay loam, eroded phase, has been used for cultivated crops. In many fields corn has been grown for several years in succession without the use of cover crops, adequate fertilization, and other practices to sustain productivity. In these areas the soil has been depleted.

Approximately 40 percent of the soil is in idle land, 30 percent in shortleaf pine, 20 percent in cultivated land, and 10 percent in pasture. On many farms where better land is scarce, areas of this soil are used for crops. Where corn is planted for several years in succession, yields are relatively low, ranging from 6 to 9 bushels an acre; but where the corn is rotated with a small-grain crop and legumes and is fertilized, yields as high as 14 bushels an acre are obtained. When fertilizers are used, they are similar in kind and quantity to those used on Hayesville loam, rolling phase. Rye and wheat yield 5 to 8 bushels an acre and lespedeza $\frac{3}{4}$ to $1\frac{1}{4}$ tons of hay.

The high percentage of this soil in idle land and in shortleaf pine is the result of the generally unfavorable returns obtained in the management commonly practiced. Red clover and also bluegrass and white clover mixed, however, respond readily when the soil is treated with 1 to $1\frac{1}{2}$ tons of ground limestone and heavy quantities of superphosphate.

Areas of this soil on north-facing slopes offer possibilities for orchard sites, providing erosion has not been too severe. The unfavorable tilth could be improved by green manure consisting of leguminous crops. Heavy applications of lime and superphosphate should prove beneficial in increasing the vegetative growth to be plowed under.

Hayesville clay loam, severely eroded phase.—This phase represents areas of Hayesville loam from which practically all the original surface soil has been removed by accelerated erosion. In many places gullies have cut into the upper part of the subsoil. The plowed layer is composed almost entirely of subsoil material consisting of brownish-red or red friable clay loam. Aside from the eroded condition of this soil, the profile is similar to that of Hayesville loam.

The relief of this phase is hilly and the slopes range from 15 to 30 percent. External drainage is very rapid and internal drainage medium. The soil is associated mainly with Hayesville clay loam, eroded phase, and covers a total area of 204 acres.

This soil is poor cropland and fair pasture land. Workability and conservability are poor, and the supply of essential plant nutrients is probably low.

Use and management.—All of Hayesville clay loam, severely eroded phase, has been in crop or pasture use at some time, but accelerated erosion has been so detrimental to cropping that much of the cleared land either is lying idle or has been allowed to grow up in shortleaf pine. Some of the soil is used as pasture land.

Pasture is an alternative use for this soil, although the best use for some areas may be forest. Control of water on the land is one of the most important problems in the management of the soil. Among the requirements for the production of pasture are rather heavy applications of ground limestone and heavy applications of superphosphate.

Hayesville clay loam, rolling phase.—This soil differs from Hayesville loam, rolling phase, chiefly in the texture of the surface soil. Originally, it was similar to that soil, but it has been cleared longer or has been more severely misused. The slope ranges from 7 to 15 percent, and external drainage is medium to rapid and internal drainage medium.

An aggregate area of 1,222 acres is mapped, and most of the individual areas cover less than 10 acres, chiefly on sloping ridge tops, surrounded by steeper Hayesville soils.

Such clean-cultivated crops as corn have been grown for many years in succession without proper cover crops, especially in winter; consequently, the loss of soil material from accelerated erosion has been rather heavy, leaving a surface soil 6 inches thick or less. An admixture of subsoil material makes it reddish brown. In small spots the original surface soil has been completely removed, and the red heavy clay loam subsoil is exposed.

This soil is fair to good cropland and good pasture land and is fairly productive. Workability and conservability are fair, but tilth is poorer than in Hayesville loam, rolling phase, which has lost very little through erosion. The surface soil is more difficult for plant roots to penetrate and in dry periods dries out more readily.

Use and management.—Corn, rye, and wheat are the main crops on Hayesville clay loam, rolling phase. Most of the cultivated land has been terraced. Strip cropping is practiced in a few places. Some farmers practice a crop rotation of corn followed by a small grain, and this in turn by lespedeza, crimson clover, or red clover. With this rotation, a cover can be kept on the land throughout most of the year. Fertilizer practices are similar to those on Hayesville loam, rolling phase, but the crop yields average about 10 percent less.

HIWASSEE SERIES

Soils of the Hiwassee series occur on comparatively high and apparently very old stream terraces. They are characterized by well-developed red profiles. The surface layers range from dark brown to red and are mellow or friable. The subsoil is red to dark-red crumbly clay loam. In the normal profile a thick layer of red crumbly clay loam beneath the subsoil is underlain by stratified deposits of well-rounded quartzite gravel and cobbles.

This series is represented by Hiwassee loam and its eroded slope phase. Their aggregate area is comparatively small. A large proportion of each soil has been slightly to moderately eroded. The soils are used principally for cultivated crops.

Hiwassee loam.—A dark reddish-brown surface layer and dark-red subsoil characterizes this soil, which occurs on high terraces near streams. Farmers call it "push land" because it will not turn easily from the moldboard. It has formed from old alluvium, consisting largely of sand, silt, clay, and pebbles and larger water-worn rock fragments. The relief is very gently sloping to gently sloping and in some places moderately sloping. The slope ranges from 2 to 10 percent. External drainage is slow to medium. The original vegetation consisted largely of oak trees. Nearly all of the soil has been cleared for agricultural use.

The aggregate area of this soil is only 58 acres, and most of the individual areas cover less than 10 acres. The soil occurs in small areas bordering the Nottely River but is well above overflow even during unusually heavy rainfall. One of the larger areas is south of Nottely River along State Highways Nos. 19 and 129 southeast of Blairsville.

In cultivated fields the profile of this soil has characteristics as follows:

- 0 to 9 inches, dark reddish-brown soft crumbly loam containing a relatively large quantity of organic matter. The material is slightly to medium acid and is easily pervious to moisture, air, and roots. In wooded areas this layer to a depth of about 2 inches is dark grayish brown and has a high content of organic matter.
- 9 to 40 inches, dark-red crumbly soft massive clay loam containing a few dark-gray manganese concretions. Moisture and air permeate the material easily, and roots penetrate it freely. It is slightly to medium acid. The organic-matter content is much lower than in the above layer.
- 40 to 90 inches, red highly micaceous soft clay loam.
- 90 inches +, yellow or greenish-yellow micaceous sandy loam mixed with quartzite pebbles.

The depth, texture, color, and consistence of the profile layers are remarkably uniform compared with those of other soils, but there are minor variations. In a few small areas where surface drainage is slow the surface layer is nearly black, owing to an unusually high content of organic matter. Where the soil borders Altavista loam and in areas where internal drainage is a little slower than usual, the subsoil is reddish brown or brown.

This type is good to very good cropland and very good pasture land. Workability and conservability are very good, and productivity is good for the crops commonly grown. Compared with the Fannin and Hayesville soils, this soil is generally less acid, and it is generally better supplied with available plant nutrients. Owing to the loose crumbly consistence throughout the profile, roots easily penetrate deeply into the parent material, and air and moisture move freely through the soil. The water-holding capacity is ample.

Included with this soil as mapped are about 25 acres of a soil that would be mapped as Hiwassee loam, eroded phase, if sufficiently extensive. The surface soil of this inclusion is lower in organic-matter content and has less depth than that of the normal phase of the type, but the use suitability of each soil is practically the same.

Use and management.—About 70 percent of Hiwassee loam is cultivated, 20 percent is in permanent pasture and miscellaneous uses, and 10 percent is in forest.

Management practices, including fertilization, are similar to those for Fannin loam, undulating phase, but this soil is considered better for the production of most crops. Corn yields 25 to 50 bushels an acre; wheat, 10 to 25 bushels; rye, 10 to 23 bushels; lespedeza, 1½ to 2 tons; and red clover, 1¼ to 2 tons. This soil is also well suited to snap beans, potatoes, and cabbage. Sweet sorghum yields about 150 gallons of sirup an acre.

Hiwassee loam, eroded slope phase.—This phase differs from the normal phase of the type mainly in having a thinner surface soil, a stronger slope, and a lower content of organic matter. The relief

ranges from gently sloping to strongly sloping but is very strongly sloping in some places. The slopes range from 5 to 18 percent, averaging about 12 percent. External drainage is medium to rapid and internal drainage medium. The aggregate area is 179 acres. The soil occurs on high terraces bordering the Nottely River in close association with the normal phase and with Fannin, Talladega, and Hayesville soils.

The reddish-brown to red surface soil is 4 to 6 inches thick, depending on the erosion that has taken place. Considerable variation exists in the depth of the soil profile. In a few places quartzite gravel underlies the profile at a depth of about 18 inches. Some of this shallow soil is stony and is indicated on the soil map by symbols.

This soil is fair to good cropland and good pasture land. It has good workability and conservability, and the crops commonly grown yield well. Owing to the rather strong slope, erosion is more difficult to control than on the normal phase. Most of the cultivated soil has been materially damaged by accelerated erosion.

Use and management.—About 60 percent of Hiwassee loam, eroded slope phase, is under cultivation, 15 percent is in permanent pasture, 20 percent is in forest consisting mainly of deciduous trees, and 5 percent is lying idle. Corn, wheat, rye, lespedeza, and red clover are the principal crops. The management practices are about the same as for Fannin loam. Crop yields are about 10 percent less than for similar crops grown on the normal phase.

PORTERS SERIES

Soils of the Porters series are characterized by brown surface layers, which are moderately high in organic-matter content. The subsoil is brown, reddish-brown, or yellowish-brown loose crumbly loam or clay loam. This layer is underlain by yellowish-brown loose crumbly but gritty loam or clay loam. Weathered granite gneiss is ordinarily reached at a depth of 20 to 60 inches. In a few places fine-textured schist, quartz mica schist, or more nearly basic metamorphic rock underlie the profile.

Porters soils are generally at high elevations on mountains and in most places occupy positions on steep and very steep slopes. Large areas are characterized by loose stones on and in the profile.

This series is represented by Porters loam and its eroded phase, Porters stony loam and its hill phase, and Porters-Balfour loams complex and its eroded phases. This is the most extensive series in the county. A large part of it is in forest. Some areas, especially those of less steep slope, are used as cropland and pasture land.

Porters loam.—A brown friable mellow soil occurring on mountains in association with other Porters and other soils. It is rather extensive, although a relatively small acreage is used for crops or pasture. The slope is prevailing steep, ranging from 30 to 60 percent. External drainage is medium to rapid, and internal drainage is medium.

This soil occurs in extensive areas in the southern part of the county where it covers an aggregate area of 21,261 acres. Except in the more moist places, the original forest was classified as oak-chestnut forest. The present forest consists chiefly of oak and a scattering of other deciduous trees and also coniferous trees, especially white pine and

hemlock, which occur at the higher elevations. Tuliptree, red maple, and ash are the common trees in the more moist locations.

In forested areas this soil has profile characteristics as follows:

- 0 to 2 inches, dark grayish-brown fluffy loam, the dark color being caused by a relatively large supply of decomposed organic matter mixed with the mineral material.
- 2 to 7 inches, dark-brown to brown fluffy loam containing considerable grit. It is medium to strongly acid and is easily pervious to moisture, air, and roots.
- 7 to 28 inches, brown or yellowish-brown crumbly clay loam or fine-textured loam. It is low in content of organic matter and is medium to strongly acid. Moisture, air, and roots easily penetrate this layer.
- 28 to 40 inches, yellowish-brown crumbly clay loam or loam containing many small angular and subangular grains of quartz.
- 40 inches +, reddish-colored weathered granite gneiss. The unweathered rock lies at a depth of 5 feet or more.

The profile characteristics of this soil are similar to those of Balfour loam, but this soil has a stronger relief. Such internal characteristics as a slightly thinner surface soil, less well-developed subsoil, and more frequent variations in the thickness of the soil layers constitute the main differences between these two soils.

This soil is poor cropland and fair to good pasture land. Workability and conservability are poor and productivity is fair. The soil apparently contains a moderate quantity of organic matter and is probably fairly well supplied with essential plant nutrients.

Use and management.—At present Porters loam is largely in forest. It seems to be fairly well suited to pasture, although on many farms the best use for the steeper areas apparently is forest.

Porters loam, eroded phase.—This phase differs from the normal phase of the type only in the upper part of the profile, which has been altered by accelerated erosion to the extent that the texture and color have been altered. The slopes are steep and range from 40 to 60 percent. External drainage is rapid to very rapid and internal drainage medium. The soil extends over a total of 166 acres, and most of it is in the southern part of the county. Representative areas are along Cooper Creek $2\frac{1}{2}$ miles southwest of Wolfpen Gap and $\frac{1}{2}$ mile north of Buzzard Roost Ridge. A severely eroded area is one-fourth mile south of Sarah.

The soil is very poor cropland and very poor to poor pasture land. It has poor workability and conservability and fair productivity.

Use and management.—All of Porters loam, eroded phase, was cleared of forest and used at some time for pasture and cultivated crops. As it has been materially damaged by erosion it is now suited mainly to forest. Approximately 80 percent of it is in pine forest. Most of the rest is lying idle, and growths of broomsedge, blackberry, and other small wild plants cover the land.

Porters stony loam.—A large number of angular rock fragments strewn over the surface and embedded in the profile are characteristic of this soil, which occurs on steep and very steep mountain slopes. Compared with Porters loam, this soil, aside from the stony character of the profile, is more variable in profile development, and its depth to bedrock is shallower—20 to 36 inches rather than 36 to 60 inches. The slope ranges from 30 to more than 60 percent, and external drainage is rapid to very rapid and internal drainage medium.

This is the most extensive soil in the county. It occurs in large areas in the mountainous districts and occupies a total of 41,894 acres. Nearly all of it was originally covered with oak-chestnut forest, but the present forest, which covers most of the soil, is composed largely of oak.

In forested areas this soil has the following profile characteristics:

- 0 to 1 inch, dark grayish-brown fluffy loam containing a large quantity of well-decomposed organic matter and held together by a mass of small roots and other organic matter.
- 1 to 7 inches, brown or yellowish-brown fluffy loam containing some small rock fragments. Also, rock fragments up to large boulders in size are scattered over the surface of the land. This layer is medium to strongly acid and is easily permeable to moisture, air, and roots.
- 7 to 24 inches, brown or yellowish-brown crumbly loam or clay loam containing many fragments of granite gneiss, which are more numerous in the lower part of the layer than in the upper. The layer is relatively low in content of organic matter and is medium to strongly acid. It is easily pervious to moisture, air, and roots.
- 24 to 28 inches, soft weathered rock.
- 28 inches +, bedrock consisting of granite gneiss.

In many places the soil is shallow, and granite gneiss is reached at a depth of 20 inches or less. In some places the subsoil is well developed to a depth of 36 inches or more.

This soil is very poor cropland and very poor to poor pasture land. It has very poor workability and poor conservability and is fairly well supplied with organic matter and probably contains a moderate quantity of essential plant nutrients. Stoniness and steepness prevent in most places its feasible use for other than the growth of forests.

A number of variations are included with this soil as mapped. These inclusions were necessary because of the steep mountainous relief, dense forest cover, and generally limited agricultural use of the soil. On the Wolfpen Gap Road east of Wolfpen Gap the surface soil is reddish-brown crumbly stony clay loam to an average depth of 8 inches. It is underlain by a brownish-red or light-red crumbly clay loam subsoil that grades at a depth of 20 to 30 inches into weathered granite gneiss, high in content of orthoclase feldspar and interbedded with thin layers of biotite schist rock. In some other counties soils of such profile characteristics have been classified as members of the Clifton series.

In other locations, especially southwest of Suches, a number of narrow areas of Rabun clay loam, steep phase, are included with this soil. The Rabun soil has a red or deep-red subsoil.

About 350 acres of Porters stony clay loam also are included with Porters stony loam. The finer texture is the result of accelerated erosion. All this inclusion was cleared and cultivated, but owing to the steep slope, which hindered tillage and made the problem of controlling runoff difficult, cultivation has been discontinued on most of the land. The soil is now largely covered with a dense growth of shortleaf pine, pitch pine, or Virginia pine or with broomsedge and blackberry.

Also included are areas of Porters stony loam, very steep phase. This soil is similar to the normal phase of the type but has a steeper slope, or one exceeding 60 percent. Its aggregate area is about 1,500 acres. The principal areas are in the vicinity of Vogel State Park and

Lake Winfield Scott. Although this soil produces trees satisfactory for timber, logging is difficult because of the steep slope.

Use and management.—Nearly all of Porters stony loam is in forest, and the soil seems to be best suited to this use. Management requirements, therefore, are for the production of forest rather than crops and pasture. Some of the less stony and less steep areas could possibly be used for crops or pasture.

Porters stony loam, hill phase.—This soil is similar to the normal phase of the type in profile characteristics, but its slope is 15 to 30 percent rather than 30 to more than 60 percent. The relief is very strongly sloping or hilly, and external drainage is medium to rapid and internal drainage medium. The soil area of 6,394 acres occurs on mountaintops and lower slopes of mountains.

Nearly all of this soil is in forest. On many of the higher lying areas the forest consists of white pine, constituting somewhat more than 15 percent of the stand, and hardwood trees, which are mainly oak. Tuliptree is common on some of the lower lying areas.

This soil is poor cropland and fair pasture land. It has poor workability and fair conservability and productivity. It apparently has a moderate supply of organic matter and probably is moderately well supplied with essential plant nutrients.

Mapped with this soil are areas of Porters stony loam, slope phase, the slope of which ranges from 7 to 15 percent. This included soil is similar to Balfour loam, but there are more stones on the surface and throughout the profile. The surface soil and subsoil are shallower and vary more in development than the corresponding layers of Balfour loam. The depth to the underlying granite gneiss ranges from 20 to 36 inches, whereas in Balfour loam the depth is much greater and there is generally a rather thick parent-material layer before the granite gneiss is reached.

This inclusion covers a total of about 250 acres. The individual areas are relatively small and occur near streams and on narrow ridge tops. Representative areas are near the headwaters of the Nottely River, west of Wide Gap, southwest of Lake Trahlyta, and south of Wilson Mountain along the west branch of Wolf Creek.

Probably 75 percent of this soil is too far from homesteads to be used as pasture land. The stony character of the soil precludes its feasible use for cultivation, but the soil is well suited to pasture plants. At least 90 percent of it is in forest or deciduous trees, mainly oak on the ridge tops and tuliptree, red maple, and ash along small drainage-ways. Most of the rest is lying idle or has grown up to shortleaf pine.

Also mapped with Porters stony loam, hill phase, are areas of the eroded hilly phase of this type. These two soils are similar except as the surface soil of the eroded phase has been affected by erosion. The inclusion affected by accelerated erosion has a surface soil a little lighter in color and perhaps a little finer in texture as compared with Porters stony loam, hill phase.

This included soil occupies a total of approximately 350 acres. Representative areas are at the junction of Helton and Hatchet Creeks south of Jacks Mountain, along Akins Creek west of Harmony Grove School, and southeast of Woody Lake. All the soil has at some time been cleared and used for crops and pasture. It has been materially

damaged by accelerated erosion through the loss of both mineral material and organic matter. Approximately 80 percent is now in shortleaf pine. Nearly all the rest is lying idle or is covered with broomsedge, blackberry, and other small wild plants. Owing to stoniness, erosion, and unfavorable slope, the eroded inclusion may be used for forest on many farms.

Use and management.—Although most of Porters stony loam, hill phase, is in forest, some areas if properly managed offer possibilities for the production of pasture if more pasture land is desired.

Porters-Balfour loams.—A complex of Porters and Balfour soils in which the individual areas are too small and intricately associated to be separated on the soil map. The relief is hilly or very strongly sloping, the gradient ranging from 15 to 40 percent and averaging about 22 percent. External drainage is medium to rapid and internal drainage medium. The complex occurs in extensive areas throughout the mountainous districts, and it is most extensive on lower slopes, where it adjoins areas of the Hayesville soils. It has an aggregate area of 5,709 acres. Only a relatively small part has been cleared for agricultural use. The original forest consisted mainly of oak and chestnut. Cove hardwoods, however, occupied the more moist places and included mainly yellow-poplar, ash, red maple, white oak, and Northern red oak. Oaks predominate in the present forest, but there are a large number of other deciduous trees and also pines, mainly shortleaf pines.

The surface soil of the Porters soil is dark-brown or brown friable mellow loam, about 8 inches thick. The subsoil is brown or yellowish-brown crumbly clay loam or loam to a depth of about 28 inches, where it passes into yellowish-brown crumbly clay loam or loam containing a large number of quartz grains. The bedrock, consisting of granite gneiss, is reached at a depth of 5 feet or more. The surface soil of the Balfour soil is brown friable gritty loam, about 8 inches deep. The subsoil is brown or yellowish-brown crumbly clay loam to a depth of about 32 inches, where it gives way to yellowish-brown loose clay loam containing many small quartz grains. At a depth of 8 feet or more the soil is underlain by granite gneiss. In this complex the main difference between the two soils is that the Balfour soil has a better developed and deeper profile than the Porters soil.

This complex is poor cropland and fair to good pasture land. The workability, conservability, and productivity are good. The Porters soil is moderately well supplied with organic matter and the Balfour soil apparently has a moderate to fairly low supply. Both soils probably contain a moderate quantity of essential plant nutrients. Moisture, air, and roots penetrate the soils easily. The water-holding capacity is good, and moisture relations are favorable to plant growth.

Use and management.—About 85 percent of the complex is in forest. Nearly all the cleared acreage is used for pasture. The internal characteristics make most of the complex suited to bluegrass and white clover, but about 40 percent of it is inaccessible for pasture use.

Porters-Balfour loams, eroded phases.—The physical characteristics of this soil differ from those of the normal phase of the complex only in the upper part of the soil, which is lighter colored and a little

finer textured. The relief is hilly, and the slope ranges from 15 to 40 percent. External drainage is rapid to very rapid and internal drainage medium. Practically all the soil has been cleared for crop and pasture use, but a large part of the cleared land has grown up to trees, mainly pines.

This soil covers a total area of 518 acres, mostly on lower slopes of mountains in the southern part of the county. Representative areas are south of Lake Woody near Wards Gap, east of Gooch Mill, west of Woody Lake, and southwest of Pilot Mountain.

This soil is poor cropland and fair to good pasture land. Workability is good, and conservability and productivity are fair. The supply of organic matter is relatively low, although the quantity of essential plant nutrients is probably fair. The control of water on the land is one of the main problems of management.

Use and management.—Approximately 70 percent of Porters-Balfour loams, eroded phases, is in shortleaf pine, pitch pine, or Virginia pine; 25 percent is lying idle; and 5 percent is used as pasture land or is cultivated. Probably 50 percent of the soil is too far from other areas of land suitable for pasture or for cultivated crops to be used as pasture land. Insofar as the soil characteristics are concerned, this soil is well suited to bluegrass, white clover, and other pasture plants. More care, however, is required to establish pastures than on the normal phase of the complex, because of erosion and a low supply of organic matter in the upper part of the soil.

RABUN SERIES

The soil of the Rabun series is fairly well to well developed and well drained and has formed from weathered products of dark-colored basic igneous rocks. It occurs on rolling to steep relief in mountainous country and is associated with Porters soils. A dark-brown to brownish-red friable surface soil and brownish-red to red friable crumbly silty clay or clay loam subsoil characterizes this soil. The red color probably is due to the basic character of the parent rock.

Rabun clay loam, hill phase, is the only representative of this series mapped in this county. Its aggregate area is small, and nearly all of it is in forest.

Rabun clay loam, hill phase.—This red soil occurs on mountains, generally in association with soils of the Porters series. It has formed from weathered dark-colored basic rocks and is characterized by a comparatively deep friable crumbly profile. The relief is rolling, hilly, or very strongly sloping, the slope ranging from 10 to 30 percent. External drainage is medium to rapid and internal drainage medium. The aggregate area of the soil is 179 acres. Areas are near Cavender Bridge and Spencer Knob. Very little of it has been cleared for agricultural use.

In forested areas this soil has the following profile characteristics:

- 0 to 2 inches, dark-brown or dark grayish-brown fluffy silt loam containing a large quantity of well-decomposed organic matter and numerous small roots.
- 2 to 8 inches, brownish-red very crumbly clay loam, smooth and plastic when moist. This layer has a low content of organic matter, is medium acid, and is easily pervious to moisture, air, and roots.

8 to 15 inches, brownish-red crumbly clay loam of slightly finer texture than the above layer; medium acid. Moisture, air, and roots easily penetrate this layer.

15 to 34 inches, red crumbly clay loam. The material has a soft blocky structure, breaking readily into small crumblike aggregates, and is medium acid. It is easily permeable to moisture, air, and roots.

34 to 52 inches, red soft crumbly clay loam, lighter in color and texture than the overlying layer.

52 inches +, green and purplish-red weathered hornblende gneiss.

The profile layers vary in thickness from place to place.

This soil is poor cropland and fair to good pasture land. It has poor workability and conservability and good productivity. It is fairly well supplied with plant nutrients. The water-holding capacity is good. Insofar as the relief and internal characteristics are concerned, the soil is well suited to pasture.

Use and management.—Except about 15 acres used for pasture, Rabun clay loam, hill phase, is in forest, consisting mainly of oaks. Most of the soil is too remote from present farmsteads to be used for other purposes than forest.

RANGER SERIES

The soil of the Ranger series is characterized by a grayish-yellow, gray, or brownish-yellow surface soil and brownish-yellow or yellow subsoil. The parent material consists of dull-yellow clay loam that grades at a depth of 3 to 5 feet into weathered phyllite or slate rock. In many respects the Ranger soil is similar to Talladega soils. Soils of both series are typically developed on slopes of 30 to 60 percent. Small rock fragments, consisting of platy pieces of weathered phyllite or slate in the Ranger soil and of small pieces of weathered mica schist in the Talladega soils, occur on the surface and throughout the soil. Only shallow subsoils are found even in the most typical soils of both series. The chief differences between the two series are in the color of the subsoil and in the character of the parent material. The subsoil of the Ranger soil is yellow or shades of yellow and is underlain by weathered slaty rock, whereas that of Talladega soils is red and is underlain by weathered micaceous schist rock.

Ranger slate loam is the only member of the Ranger series mapped in this county. It has a fairly small aggregate area, and a large part of it is in forest.

Ranger slate loam.—This is a slaty soil occurring on the lower slopes of mountains. It lies above the upper limits of the Hiwassee Plateau at elevations of 2,100 to 2,500 feet above sea level. The relief is steep, the slope ranging from 30 to 60 percent. External drainage is rapid to very rapid and internal drainage medium to slow.

This soil has an aggregate area of 1,184 acres. Individual areas are comparatively large, the largest being in the northwestern part of the county near Jonica Gap. One area is along the Georgia-North Carolina boundary line near the northwestern corner of the county.

Under forested conditions this soil shows the following profile characteristics:

0 to 1 inch, dark-gray gritty silt loam containing a large quantity of organic matter and a mass of small roots.

1 to 6 inches, brownish-yellow loose fluffy loam or silt loam, with which is mixed a large quantity of small platy fragments of phyllite. When the

soil is moist, sharp particles of grit are evident, and the color is yellowish brown. The original organic matter soon disappears from the cultivated soil, and the mixing by cultivation of the remaining materials gives rise to a dull brownish-yellow slate loam.

6 to 22 inches, dull-yellow dense slightly compact loam containing many slaty fragments.

22 to 28 inches, yellow slaty loam, less compact and lighter textured than the above layer.

28 inches +, light-gray weathered slate or phyllite rock.

The profile layers vary considerably in thickness. In many places there is no true subsoil, and the surface soil passes directly into the parent material. In practically no place is there a sharp transition from the surface soil to the subsoil and from the subsoil to the parent material.

This soil has poor workability and conservability and very poor productivity. The reaction varies from medium to strongly acid. Owing to the rather compact subsoil and parent material and to platy fragments of weathered rocks throughout the soil mass, root penetration is not so easy as in Talladega loam. Also the soil is not so well oxidized, and movements of air and moisture in the soil are more difficult.

Steepness, erodibility, shallowness to bedrock, and generally low productivity preclude the use of this soil either for cropland or pasture land. The best use for it is forest.

Mapped with this soil are about 80 acres of moderately eroded and severely eroded soil. In some of the eroded areas the surface soil is lighter colored and finer textured, otherwise the soil does not differ materially from the slate loam. Where the soil has been cleared and cultivated for a number of years, severe erosion has occurred.

Also included with Ranger slate loam is a total area of about 175 acres of Ranger slate loam, hill phase, but the individual areas are less than 10 acres in size. This soil occurs on milder relief than the normal phase of the type, the slope ranging from 15 to 30 percent and averaging about 25 percent. External drainage is rapid and internal drainage medium to slow. The soil is medium to strongly acid. Its surface soil is similar to that of the normal phase, but the subsoil is better developed and consists of dull-yellow moderately compact clay loam to a depth of 26 to 36 inches. It contains platy fragments of phyllite throughout and is only moderately well oxidized. These platy fragments and the dense compact subsoil hinder somewhat the penetration of roots and movement of air and moisture. The parent material is similar to that of the normal phase, but the depth to the underlying rocks ranges from 3 to 5 feet compared with a depth of generally less than 3 feet. This increased depth gives the hill phase greater water-holding capacity than the normal phase.

Use and management.—About 95 percent of Ranger slate loam is in oak and mixed forest, and nearly all the rest is idle.

About 30 percent of the included hill phase is in oak and mixed forest, 30 percent was cultivated but is now in pine forest, 20 percent is idle, 15 percent is cultivated, and 5 percent is in permanent pasture. Corn is the main crop. The yields range from 5 to 15 bushels an acre and average less than 10. The better yields are obtained where corn is rotated with rye and lespedeza, but nearly everywhere the yields are too low for profitable production. The platy fragments of weathered

rock on the surface and in the soil greatly affect the use of the soil for pasture. Also the dense compact subsoil retards internal movement of moisture, so that the soil is more easily damaged by the trampling of livestock during periods of wet weather than some of the soils with more open subsoils. Practically every cleared area of this soil has been materially damaged by accelerated erosion. The steep slopes, erodibility of the soil, and general lack of plant nutrients virtually prevent the use of most of this soil for cropland.

ROUGH STONY LAND (PORTERS SOIL MATERIAL)

Rough stony land (Porters soil material) has very steep slopes (60 percent or more). Its aggregate area is 16,819 acres. Many large boulders and smaller stones are on the surface and in the soil, and numerous outcrops of bedrock are present. Porters soil material fills the spaces between the stones. It is grayish-brown or brown loam or clay loam to a depth of less than 20 inches in most places. The boulders, rock outcrops, smaller rock fragments of the soil mass, and the underlying rock are generally granite and gneiss but in some places are quartz schist, mica schist, quartzite, and hornblende gneiss.

The forest on this land type is inferior to that on Porters stony loam, although good timber is produced in many places. The forest consists of small oak, white pine, and hemlock, together with a mixture of other trees. The understory is mainly rhododendron and mountain-laurel. The land is too steep and is otherwise unsuitable for cropping or grazing of any importance.

SPILO SERIES

The soil of the Spilo series is associated in first bottoms near streams with those of the Chewacla series. It differs from those soils in being more poorly drained and more compact, especially in the subsoil. It is swampy in places and unless artificially drained is too wet for tilled crops.

The Spilo soil has a light-gray to medium-gray compact surface layer, 7 to 9 inches thick, and a light-gray streaked or splotched with brown compact slowly pervious subsoil, 12 to 20 inches thick. Underlying the subsoil is a light-gray to bluish-gray tough clay or silty clay layer, which may be splotched with yellow or rust brown and is 18 inches thick or more.

The Spilo series is represented in the county by only one type—Spilo silty clay loam. It has a rather small total area, and its use is restricted by slow drainage. Another member of the series occurs in complex with soil of the Chewacla series and is classified and mapped as Chewacla-Spilo silt loams (p. 42).

Spilo silty clay loam.—This type occurs on imperfectly drained first bottoms near streams, in association mainly with Chewacla soils. Where typically developed it has a light-gray fine-textured surface soil and light-gray or mottled dense tough clay subsoil and parent material. The soil is level or nearly level and has very slow external and internal drainage. Under natural conditions it is swampy nearly all the time. The natural vegetation consists of water sedges and other water-tolerant plants.

A total of 614 acres is mapped, mostly in the northern part of the county along Youngcane and Ivylog Creeks.

This soil has the following profile characteristics:

- 0 to 8 inches, light-gray or medium-gray compact strongly acid silty clay loam.
- 8 to 25 inches, light-gray, streaked or mottled with dull yellowish brown, tough massive slowly pervious clay. It is strongly acid.
- 25 inches +, bluish-gray tough somewhat plastic massive strongly acid clay, underlain in some places by angular pieces of quartz at a depth of 48 inches or more.

The profile layers vary somewhat in thickness from place to place. Much variation exists in the color of the surface soil, depending on the content of organic matter. In places, to a depth of 3 or 4 inches the surface soil is nearly black, in contrast to light gray or medium gray in areas where the supply of organic matter is lower.

This soil is poor cropland and fair pasture land. Workability is fair, conservability very good, and productivity fair. Drained areas can be worked under only a very limited range of moisture conditions. The soil remains soggy for some time after adjoining soils are dry enough to be tilled. It warms slowly in spring. More power is required to work it than any of the associated soils because of the heavier textured surface soil. The tight clay subsoil and a large quantity of mica flakes mixed through the profile cause the poor porosity and generally unfavorable conditions for the growth of plants.

Use and management.—A small part of Spilo silty clay loam is used for crops and a small part for pasture. Corn, rye, oats, sorghum, and lespedeza are the main crops. In drained and limed areas corn averages about 12 bushels an acre; rye, about 10 bushels; sorghum, about 75 gallons of sirup; and lespedeza, $\frac{3}{4}$ to 1 ton of hay. Artificially drained areas that have been heavily limed are well suited to bluegrass and white clover for pasture.

Artificial drainage, liming, and proper fertilization are the main requirements of this soil for the production of crops.

STATE SERIES

The soil of the State series occurs on level to very gently sloping relief on stream terraces, but the terraces are lower than those on which soils of the Hiwassee series are found. The soil is younger in degree of development than Hiwassee soils and differs mainly in the color of the surface soil and subsoil. The surface soil is dark grayish brown or brown, loose, friable, and 8 to 12 inches thick; the subsoil is brown to yellowish brown and 15 to 32 inches thick underlain by light-brown sandy clay or gritty light-textured clay loam containing mica flakes. At variable depths this layer is underlain by coarse sand or gravel, mainly quartz. In contrast, the Hiwassee soils have a dark-brown to red surface soil and dark-red subsoil.

State silt loam is the only member of the State series mapped in this county, and its total area is fairly small. Practically all of it is cultivated.

State silt loam.—This brown mellow well-drained soil on low terraces near streams is associated with Transylvania and Toxaway silt loams and Congaree silt loam, dark-subsoil phase, on first bottoms, and

with Hiwassee and Altavista soils on terraces. The relief is nearly level to very gently sloping, the slope averaging about 2½ percent. External drainage is very slow to medium and internal drainage medium. The soil is high in inherent fertility and is well adapted to general farm crops and to such truck crops as potatoes, cabbage, lettuce, spinach, and carrots. Almost all of it is in agricultural use.

This soil is most typically developed on terraces only a few feet higher than the adjoining first bottoms but at elevations near or above the upper limits of the intermountain plateaus. Because the parent material has been transported from higher elevations where the processes of weathering are slower than at the lower elevations on the intermountain plateaus, the soil has higher inherent fertility than Hiwassee or Altavista soils. The surface soil is better supplied with organic matter, which is partly due to the slower rate of decay of organic materials in the lower temperatures of the higher elevations. In some local areas materials high in organic-matter content are removed by floodwaters, in others such materials are washed onto the soil from adjoining Porters soils.

The larger areas of this soil are along the Toccoa River and the upper Nottely River. Small isolated areas are along Youngcane Creek, north of Youngcane, northwest of Clements Mill, and southeast of Confidence School. Most of the areas are less than 10 acres in size. The aggregate area is 659 acres.

The characteristics of the profile are as follows:

- 0 to 10 inches, dark grayish-brown loose fluffy silt loam, high in organic-matter content and strongly acid. It is easily pervious to moisture, air, and roots.
- 10 to 15 inches, dark-brown crumbly silt loam containing much less organic matter than the overlying layer but more than the underlying layer. It is strongly acid. Moisture and air permeate the material easily, and roots penetrate it freely.
- 15 to 36 inches, brown soft crumbly strongly acid clay loam. It is sufficiently porous throughout to permit free movement of moisture and air and easy penetration by roots.
- 36 to 72 inches, light-brown micaceous sandy clay or gritty clay loam.
- 72 inches +, coarse quartz sand or gravelly material composed largely of quartz.

Throughout the extent of this soil the profile layers differ slightly in thickness. The thickness of the surface layer is 1 to 3 inches greater than in Altavista loam on comparable relief.

This soil differs from Hiwassee loam, which occupies high terraces, in having a dark grayish-brown rather than reddish-brown surface soil and a brown rather than dark-red subsoil. It also contrasts to Altavista soils, which are on low terraces and have grayish-yellow surface soils and yellow stiff clay loam subsoils. It has a higher organic-matter content in the surface soil than is typical of Altavista or Hiwassee loams. Its surface soil is smoother and more plastic than that of Altavista loam. From the standpoint of age it is younger than the Hiwassee and Altavista soils.

This soil is good to very good cropland and very good pasture land. It has excellent workability and very good conservability and productivity. It is practically free from stones, and cultivation is relatively easy. It is fairly well supplied with organic matter and probably is well supplied with essential plant nutrients. The moisture-holding

capacity is good. The soil material and plant-nutrient supply can be conserved by few intensive management practices.

Use and management.—Nearly all of State silt loam is cultivated. About 50 percent of it is used for corn; 10 percent for rye, which is harvested for grain; 5 percent for wheat; 10 percent for permanent pasture; 10 percent for snap beans; 5 percent for cabbage; 5 percent for potatoes; and about 5 percent is in miscellaneous use. With a few minor exceptions, the crops are fertilized and rotated similarly to the same crops grown on Congaree fine sandy loam. Most of the areas of the State soil, however, are rarely, if ever, damaged by stream overflow. Inasmuch as this soil lies higher than the Congaree soils, it is better suited to wheat.

Corn yields range from 25 to 60 bushels an acre. Wheat yields are about 18 bushels an acre, but under careful management they may be increased to as much as 25. Potatoes fertilized with 800 to 1,600 pounds an acre of 9–10–15 yield 125 to 275 bushels an acre; cabbage fertilized with 1,000 to 1,500 pounds of 3–9–5 yields 10 to 21 tons; and snap beans fertilized with 300 to 600 pounds of 4–8–4 yield about 150 bushels (pl. 2, B).

STONY COLLUVIUM (FANNIN AND HAYESVILLE SOIL MATERIALS)

Stony colluvium (Fannin and Hayesville soil materials) occurs at the foot of slopes and in first bottoms, its slopes ranging from 2 to 10 percent. Internal drainage is medium to rapid. In representative situations it consists of a mass of stones with which a small quantity of soil is mixed. The stones are mainly gravel, boulders, and fragments of quartzite, and the soil is dark-gray or grayish-brown loam or clay loam containing varying quantities of organic matter. The many stones present prevent feasible use of the land for cultivated crops.

The total area of this land type is 154 acres, and the individual areas are generally less than 15 acres in size. Representative areas are at and north of Youngcane.

Use and management.—Approximately 30 percent of Stony colluvium (Fannin and Hayesville soil materials) is used for permanent pasture; the rest is in deciduous trees, mainly oak. Areas in which the stones are not so numerous are suitable for bluegrass and white clover, but at least 50 percent of the land is too far from farmsteads to be of any use except for forest.

TALLADEGA SERIES

The Talladega series includes red highly micaceous soils that are relatively shallow to bedrock. There is very little subsoil, and in many places the surface soil grades directly into parent material. Weathered micaceous schist rock is generally reached within a depth of 20 inches and rarely at a greater depth than 36 inches. The surface layer of these soils is reddish brown and the subsoil and parent material red. The normal soil occurs on steep relief with slopes ranging from 30 to 60 percent.

Talladega soils are related to Fannin soils but have steeper slopes and shallower profiles; also, they are more micaceous throughout. As mapped in this county they have slopes of 7 to 60 percent, whereas the Fannin soils as mapped have slopes of 2 to 30 percent. Because

of shallowness to bedrock the Talladega soils dry out more readily than Fannin soils having the same slope.

In this county this series is represented by Talladega loam and its rolling and hilly phases; Talladega stony loam; and the eroded, eroded rolling, eroded hilly, and severely eroded hill phases of Talladega clay loam. Talladega loam is the most extensive of these soils. A large proportion of these soils is in forest, and a rather large proportion of the cleared land is idle.

Talladega loam.—This soil is comparatively shallow to bedrock, is highly micaceous, and has a slick greasy feel when moist. It has formed from weathered products of micaceous schist rock, which accounts for the numerous mica flakes in the soil. The relief is steep, the slope ranging from 30 to 60 percent. External drainage is medium to very rapid and internal drainage medium to rapid.

This is one of the most extensive soils in the county, the aggregate area being 13,453 acres. Areas occur in various parts of the Hiwassee Plateau and in other places at elevations of 3,000 feet. Comparatively large areas are in the northwestern and northeastern parts of the county.

Under virgin conditions this soil has the following profile characteristics:

- 0 to 2 inches, dark grayish-brown or dark-brown friable mellow loam containing a fairly large quantity of organic matter.
- 2 to 10 inches, reddish-brown friable medium to very strongly acid loam.
- 10 to 28 inches, red or yellowish-red highly micaceous friable medium to very strongly acid clay loam or loam.
- 28 inches +, red weathered micaceous schist rock.

In places the weathered schist rock is at the surface, and in others it is at a much less depth than the above profile indicates. In general the subsoil is less well developed than that of Fannin loam, although in places a similar red micaceous subsoil may be found. The variable profile development is due largely to the steep relief.

This soil is very poor cropland and very poor to poor pasture land. Its best use is for forest. Workability is poor and conservability very poor. The content of available plant nutrients is comparatively low, and the supply of organic matter is lower than in some of the other soils of the county. The loose mellow surface soil and friable crumbly lower layers permit easy penetration by roots. The moisture-holding capacity is relatively low. In cleared areas rain water runs off quickly, and very little is absorbed.

Use and management.—About 95 percent of Talladega loam is covered with oak-chestnut forest; the rest is in miscellaneous uses or is lying idle.

As this soil is primarily forest land, the management requirements are those for forest rather than for crops and pasture.

Talladega loam, rolling phase.—This phase differs from the normal phase of the type in occupying a milder relief. It occurs on smooth ridge tops where the slope ranges from 2 to 15 percent. External and internal drainage are medium to rapid. A total area of 1,075 acres of the soil is mapped, and the individual areas are generally relatively small. Areas occur in the northern part of the county and southeast of Blairsville.

The surface soil of this phase is a little deeper than that of the normal phase, and in many places there is a well-developed but thin subsoil to a depth of 20 inches or more. Many small areas of the normal phase are included with this soil as mapped.

The soil is poor to fair cropland and fair pasture land. Its workability, conservability, and productivity are poor to fair.

Use and management.—Many areas of Talladega loam, rolling phase, are on narrow ridge tops and apparently are suited only to forest. About 60 percent of the soil is in oak and mixed forest, 20 percent is cultivated, 15 percent is in permanent pasture, and the rest is idle land.

Areas of the soil favorably situated with respect to farms are used mainly for corn, wheat, rye, and lespedeza, and the management practices are similar to those for Fannin loam. Crop yields are generally low. Corn yields 12 to 18 bushels an acre; wheat and rye, 7 to 12 bushels; and lespedeza, $\frac{3}{4}$ to $1\frac{1}{4}$ tons of hay.

Owing to the rather poor yields of grains, most farmers use the soil for hay or forage crops whenever possible.

Talladega loam, hilly phase.—This phase is similar to the normal phase of the type in physical characteristics but has a 15- to 30-percent slope, whereas the slope of the normal phase is much steeper. The grayish-brown surface soil probably averages a little more in depth, and there is a little more subsoil development. This soil has medium to rapid external and internal drainage. The cover in forested areas consists of oak-chestnut forest similar to that on the normal phase.

This soil is extensive in the northern part of the county, and it covers a total area of 12,064 acres. The individual areas range from rather small to more than 200 acres in size.

The soil is very poor to poor cropland and fair pasture land. Its workability, conservability, and productivity are poor to fair.

Use and management.—About 80 percent of Talladega loam, hilly phase, is in oak-chestnut forest, 15 percent is in pasture, and 5 percent is idle and cultivated land. The soil is too strongly sloping for use as cultivated land. Small areas could probably be used for the production of grapes. Owing to the shallowness of the soil to bedrock, most of it is too susceptible to drought for the successful production of apples and other fruits requiring more moisture than grapes. Pasture and forage are best suited to most of the cleared land. The soil is better suited to lespedeza and Bermuda grass than to bluegrass and white clover. Under careful management, yields of about $\frac{3}{4}$ ton of lespedeza hay are obtained. Pastured areas are more readily damaged by the trampling of livestock than are those of Fannin loam, hilly phase; consequently, to produce the best pasture, the soil must be pastured within a narrower range of moisture conditions than that soil.

Talladega stony loam.—This soil is similar to Talladega loam, except that it is stony. Numerous various-sized angular quartz and chert fragments are scattered over the surface and mixed throughout the soil mass. In places there are boulders and outcrops of granite gneiss. The relief is steep, the slopes ranging from 30 to 60 percent. External and internal drainage are medium to rapid. A small part

of the soil is badly eroded and lying idle. Such land is shown on the soil map by symbols.

This soil covers a total area of 2,374 acres. The largest areas are on slopes of Gumlog Mountain and the lower north-facing slopes of Duncan Ridge. Smaller areas are in various parts of the Hiwassee Plateau.

The soil is very poor cropland and very poor to poor pasture land. Its workability is very poor and conservability poor.

Use and management.—Nearly all of Talladega stony loam is in oak-chestnut forests. Its chief use is for forest, and the management requirements are those that pertain to the production of trees.

Talladega clay loam, eroded phase.—Originally this soil was identical to Talladega loam. It is very hilly or steep (30- to 60-percent slopes), and external drainage is rapid to very rapid and internal drainage medium to rapid. The total of 518 acres occurs in various parts of the Hiwassee Plateau.

All the original oak-chestnut forest has been removed and the soil used for pasture and crops. Owing to the steep slopes runoff is very difficult to control, and in cultivated areas it has removed most of the original surface soil. This, together with the mixing of subsoil material with the shallow surface layer by tillage, has resulted in a clay loam texture in the plowed layer. Over at least 50 percent of the soil little or none of the original surface soil remains, but instead red highly micaceous clay loam is found.

This soil is very poor cropland and very poor to poor pasture land. The workability, conservability, and productivity are very poor. The steepness of the soil, aside from other unfavorable characteristics, as eroded condition and shallowness of profile to bedrock, would preclude its profitable use over a long period for anything but forest.

About 135 acres of Talladega clay loam, severely eroded phase, are included in the mapped areas of this soil and are shown on the soil map by symbols. In this severely eroded soil practically none of the original surface soil remains, and the soil is badly cut by gullies 6 to 12 inches deep and in many places 3 feet or less apart.

Use and management.—About 50 percent of Talladega clay loam, eroded phase, is lying idle, 40 percent is in shortleaf pine, 5 percent in pasture, and 5 percent in cultivation. Crop yields are generally low. Corn yields are rarely more than 5 bushels an acre.

Talladega clay loam, eroded rolling phase.—This soil occurs on ridge tops and is associated with steeper Talladega soils. Although the relief is generally rolling, it is gently undulating or undulating in some places. External drainage is medium to very rapid and internal drainage medium to rapid. Most of the soil occurs in areas of 10 acres or less and covers a total of 1,184 acres in the northern part of the county and also south of Blairsville.

Originally this soil was Talladega loam, rolling phase, but it has been cleared and cultivated and has lost a large part of the original dark-brown loam surface soil through accelerated erosion. The mixing of subsoil material with the remaining surface soil by tillage has increased the clay content of the plowed layer that now consists of reddish-brown clay loam.

This phase is poor cropland and fair pasture land. It has fair workability and conservability.

Compared with Fannin clay loam, eroded phase, which has a similar relief, this soil is less resistant to drought and must be pastured within a narrower range of moisture conditions. It is probable that the small platy fragments of micaceous schist on the surface and throughout the profile render this soil more susceptible to damage from trampling by livestock during wet periods.

Some variations exist in the texture of the surface soil even within single soil areas, but they are too minor to be outlined on the soil map. In small areas where there has been only mild accelerated erosion, the texture is loam and the color grayish brown. In other small areas accelerated erosion has exposed the red fine-textured clay loam subsoil or has caused shallow gullies, which interfere very little with cultivation. These severely eroded areas, 2½ acres or less in size, are indicated on the soil map by symbols.

Use and management.—About 30 percent of Talladega clay loam, eroded rolling phase, is in cultivation, 10 percent in pasture, 30 percent in shortleaf pine, and 30 percent is lying idle. In general, corn is grown for 2 or more years in succession, and then the land is either seeded to rye or allowed to remain idle for a number of years. When fertilized, corn receives 100 to 150 pounds an acre of complete fertilizer, as 4-8-4, or a similar quantity of superphosphate. Corn yields range from 10 to 18 bushels an acre. Most of the rye is turned under for soil improvement.

Hay crops and pasture are the best use for this eroded soil. Both the surface soil and subsoil are strongly acid, and good results are obtained from lespedeza, white clover, and other pasture plants, especially where the soil has been limed to correct acidity and treated with superphosphate. Under careful management, yields of 1 to 1¼ tons of lespedeza hay and ¾ ton of crimson clover hay are obtained. Areas of the soil that are in a good state of cultivation and heavily limed and phosphated are suited to the production of red clover. Erosion control is one of the major soil management problems.

Talladega clay loam, eroded hilly phase.—This soil is similar to Talladega clay loam, eroded rolling phase, except it is hilly, the slope ranging from 15 to 30 percent rather than 7 to 15 percent. External and internal drainage are medium to rapid. The soil occurs on ridge tops associated with Talladega clay loam, eroded rolling phase, and Fannin clay loam, eroded phase. A total of 5,786 acres is mapped, mainly in the northern part of the county. All of it has been cleared of the original oak-chestnut forest and materially damaged by accelerated erosion.

This soil is very poor to poor cropland and fair pasture land. Workability and conservability are poor. Good tilth is difficult to maintain. The soil is deficient in organic matter and essential plant nutrients, and its water-holding capacity is fairly low.

Use and management.—About 40 percent of the soil is in shortleaf pine, 40 percent in idle land covered with blackberry briars and broomsedge, 5 percent in pasture, and 15 percent in cultivation. Corn is the main crop. Yields of corn are very low, ranging from 5

to 10 bushels an acre. Owing to unfavorable slopes, shallow profile, poor tilth, and general poverty of plant nutrients, the soil apparently is better suited to hay crops and pasture than to cultivated crops. With applications of lime and superphosphate, it produces 1 to 1½ tons an acre of lespedeza hay and similar quantities of other legumes and pasture grasses. Erosion control and maintenance of a supply of organic matter and plant nutrients are important problems of management.

Talladega clay loam, severely eroded hill phase.—This is a much more eroded soil than Talladega clay loam, eroded hilly phase. In many places numerous shallow gullies have formed. External drainage is rapid to very rapid and internal drainage medium to rapid. All the soil has at sometime been used for crops or pasture, but owing to accelerated erosion, much of it is now in second-growth trees.

An aggregate area of 973 acres of this soil is mapped in various parts of the county, most extensively south of Blairsville and in the Ivylog Creek drainage basin. Most individual areas are less than 10 acres in size, and they adjoin areas of Talladega clay loam, eroded hilly phase, and Talladega loam, hilly phase, and also areas of Fannin loam and Fannin clay loam, eroded phase, which occur on smooth ridge tops.

This soil is very poor cropland and very poor to poor pasture land. It has poor workability and very poor conservability.

Use and management.—About 60 percent of this soil is in shortleaf pine, 30 percent in idle land covered with a sparse growth of broom-sedge, 5 percent in cultivation, and 5 percent in pasture. Crop and pasture yields are relatively low (pl. 3, A). Its common use is for forest.

TATE SERIES

Soils of the Tate series are somewhat similar to those of the Tusquitee series in profile characteristics. They occur on foot slopes and have formed from outwash from the immediate slopes occupied in many places by soils of the Fannin, Talladega, and Hayesville series, which occur in intermountain uplands. They are nearly level to very gently sloping, although in places they may have somewhat stronger slopes.

The surface layer of these soils is brown, reddish brown, or red, friable, and 10 to 15 inches thick, but in some places is as much as 24 inches thick. The subsoil is red, brownish red, brownish yellow, or yellow, friable, and 20 to 30 inches thick. It is underlain either by residual material or by alluvium.

This series is represented in the county by Tate silt loam and Tate-Chewacla silt loams. These soils are used largely for cultivated crops.

Tate silt loam.—This soil has formed from overwash material derived from Fannin, Talladega, and Hayesville soils. The profile varies widely in character. The soil occurs on lower slopes in the intermountain uplands and also on stream terraces, the slopes ranging from 2 to 9 percent and averaging about 4 percent. External drainage is slow to medium and internal drainage medium.

A total of 678 acres of this soil is mapped at different places on the Hiwassee Plateau. Most of the areas are less than 5 acres in size. Representative areas are along Butternut Creek north of Blairsville,

along Ivylog Creek just northeast of Pleasant View School, and near Lance Mill in the northwestern part of the county.

In cultivated fields this soil has profile characteristics as follows:

0 to 12 inches, red to reddish-brown fine-textured crumbly medium to strongly acid silt loam or loam, low in content of organic matter.

12 to 48 inches, red crumbly clay loam. In some places this layer consists of yellow fine-textured moderately compact clay loam. The reaction is medium to strongly acid.

48 inches +, weathered micaceous schist or granite gneiss, or friable alluvial material.

The profile layers vary considerably in color and texture. The thickness of the upper layer is extremely variable, ranging from 10 to 24 inches. Where the overwash is deposited on soils of the Fannin and Hayesville series the subsoil is red crumbly clay loam to a depth of 35 to 40 inches. It is underlain by red, lighter textured clay loam, grading at a depth of 4 to 6 feet into weathered schist or gneiss rocks. If the buried soil is Hiwassee loam, the subsoil is a more porous crumbly red clay loam, but if the underlying soil is Altavista soil, the subsoil is yellow moderately compact fine-textured clay loam. In places where the overwash has come from severely eroded soils the surface layer consists of red dense clay loam.

This soil is good to very good cropland and pasture land. Workability is very good, conservability excellent, and productivity good. The soil probably is fairly well supplied with essential plant nutrients. Moisture relations are favorable to plant growth, but the range of moisture conditions for cultivation is narrower than in many of the soils of the county. Root penetration is easy in places where the surface soil is coarse-textured silt loam or loam but is somewhat difficult where the surface soil is fine-textured clay loam. The subsoil is easily penetrated by roots, except where it consists of fine-textured clay loam.

Use and management.—At least 80 percent of this soil is in cultivation, 15 percent in permanent pasture, and the rest in idle land or in miscellaneous uses (pl. 3, B). Corn is the principal crop in acreage, but sweet sorghum grown for sirup is the principal cash crop.

Corn is followed by corn on many fields for several years with the use of very little or no fertilizer. Where this management is practiced, corn yields average about 15 bushels an acre. Some farmers seed cowpeas in the corn before its last cultivation and harvest the mature peas. The vines are turned under the following spring for soil improvement. Where rotations of corn, rye, and lespedeza or crimson clover are practiced, the corn receives 200 pounds an acre of 4-8-4 mixture and the rye about 150 pounds of superphosphate. Under this management corn yields 25 to 40 bushels an acre; rye, 10 to 18 bushels; and lespedeza, 1 to 1½ tons of hay. Sorghum for sirup is substituted by some farmers for corn in the rotation or is alternated with corn where no definite rotation is followed. It is fertilized with 150 to 200 pounds an acre of superphosphate. Yields of the sirup range from 75 to 150 gallons an acre and average about 125 gallons.

Tate-Chewacla silt loams.—This soil complex, consisting of red soil materials that have been washed recently onto first bottoms from the uplands, comprises intricately mixed areas of Tate silt loam and Chewacla silt loam. The relief is level or nearly level. External drainage is slow to very slow and internal drainage medium to slow.

Many areas of the soil are inundated for brief periods, and a few are in a semiswampy condition a part of the year. The vegetation in the semiswampy places consists largely of water sedges and elder.

Small areas are in the first bottoms along nearly every stream in the Hiwassee Plateau. Individual areas are rarely larger than 10 acres. The total area mapped is 1,043 acres.

The uppermost layer of this soil is reddish-brown loose silt loam to an average depth of 12 inches and is low in content of organic matter. Much variation exists in the color, texture, and thickness of this layer. Yellowish-brown or nearly red colors are evident in places, textural variations include sandy loam, loam, and clay loam, and the thickness ranges from 8 to 24 inches. This layer is underlain by grayish-brown micaceous loose fluffy silt loam, which grades at a depth of 30 to 36 inches into a more compact mottled gray and brown micaceous silt loam. In places the grayish-brown layer is absent, and the surface soil passes directly into mottled medium-gray and brown silt loam or mottled dark-gray and brown silt loam of high organic-matter content. In a few places it passes into light-gray dense compact clay similar to that under Spilo silty clay loam.

The profile ranges from medium to strongly acid. Where the underlying material contains a large quantity of organic matter, the reaction is generally least acid. The soil is loose and porous enough in most places to afford easy penetration by roots and free movement of air and water.

This soil is fair to good cropland and good pasture land. It has good workability, very good conservability, and good productivity. Although most of it has adequate natural drainage for the production of the crops ordinarily grown, the semiswampy areas require artificial drainage.

Use and management.—About 80 percent of the soil is in cultivation; 15 percent in permanent pasture; and 5 percent in idle land, forest, or other uses.

This soil is managed similarly to Tate silt loam. Many areas are planted to corn for a number of years in succession, and little or no fertilizer is used. Under this practice an average yield of about 15 bushels an acre of corn may be expected. Inasmuch as soil materials are constantly being washed onto the soil from the surrounding uplands, the fertility of this soil is maintained at a little higher level than that of the soils of the uplands under such a practice. Because of occasional flooding of many of the low areas, lespedeza, crimson clover, and rye are more suitable than red clover or wheat for the rotations practiced. With similar fertilization and crop rotations as for Tate silt loam, corn, rye, lespedeza, and sorghum average 10 percent higher yields.

Because of the low content of organic matter in the surface soil and the excellent moisture conditions that prevail throughout the growing season, this soil complex is especially well adapted to sweet sorghum, which produces an excellent quality of sirup.

TOXAWAY SERIES

The soil of the Toxaway series is on first bottoms but in some places is overflowed only by unusually high water. In many places it occupies positions adjacent to the uplands. External and internal drain-

age are slow, and drainage is necessary in most places for cultivated crops. Much organic matter derived from the decay of water-tolerant plants apparently has accumulated in the upper layer of the soil.

The surface layer of the Toxaway soil is dark gray or almost black and 15 to 20 inches thick. The subsoil is dark gray, medium gray, or bluish gray, heavy textured, and 20 to 30 inches thick.

Toxaway silt loam is the only type of this series mapped in the county. Its total area is relatively small, and a large part of it has been artificially drained. Corn is the leading crop.

Toxaway silt loam.—This soil occurs on poorly drained first bottoms and is characterized by a nearly black surface soil and a gray plastic subsoil. The surface soil contains a large quantity of decomposed organic matter and is the darkest of any in the county. The soil has formed from alluvial materials derived almost entirely from wooded Porters soils and associated soils on steep slopes at high elevations. It is most typically developed in association with Transylvania silt loam and Congaree silt loam, dark-subsoil phase, which occupy better drained situations. The relief is level or nearly level. External drainage is slow to very slow and internal drainage slow.

An aggregate area of 326 acres of this soil is mapped. The larger areas occur along the Toccoa River, north of Woody Lake, and along Town Creek in the southeastern part of the county.

This soil has the following profile characteristics:

0 to 15 inches, very dark-gray or almost black plastic silt loam containing a comparatively large quantity of organic matter derived from decayed vegetation. The material is medium to strongly acid. In some places the layer is mucky because of the presence of a large quantity of well-decomposed woody matter.

15 to 40 inches, medium-gray or dark-gray highly plastic clay loam, becoming bluish gray in the lower part. Dull-brown mottles and streaks appear in the material. This layer is slightly to medium acid.

Throughout the extent of this soil, the profile layers vary somewhat in color, texture, consistence, and thickness. In some places the subsoil is considerably heavier textured than is usual. These areas are not so well suited to truck crops as the areas in which the subsoil texture is coarser.

Where adequately drained this soil is considered good to very good cropland and very good pasture land. With proper management it can be made very productive of corn and of cabbage and other truck crops. Workability and productivity are good and conservability excellent. The soil is fairly easily tilled.

The soil is naturally well supplied with organic matter in most places, and is probably fairly well supplied with most of the essential plant nutrients that can be maintained without intensive management practices. Liming and applications of fertilizer, however, are required for satisfactory results from most crops, especially truck crops.

Use and management.—A large part of Toxaway silt loam has been cleared for agricultural use. About 60 percent is planted to corn, 5 percent to small grains, 5 percent to cabbage, and 5 percent to other truck crops; 15 percent is in permanent pasture and 10 percent in swampy woodland.

Erosion control offers no problem, but drainage is a problem and artificial drainage is required for successful crop production. At least

75 percent of the soil has been sufficiently drained artificially for crop production. Under natural conditions the soil is too poorly drained for the successful production of cultivated crops. A large proportion of the soil, however, has been drained by the use of open ditches.

Corn yields vary widely. In fields that have received no lime and fertilizer the average yield is about 25 bushels an acre, but where the soil has been treated with lime and fertilized with 150 to 200 pounds an acre of 4-8-4 mixture the average acre yield is about 45 bushels.

Small grains are subject to much damage by winterkilling. Rye is not ordinarily fertilized, and its yields average about 15 bushels an acre. The fertilization and average yields of cabbage and snap beans are the same as on Congaree silt loam, dark-subsoil phase. Artificially drained areas that have been treated with lime sustain excellent pasture of bluegrass and white clover.

TRANSYLVANIA SERIES

The soil of the Transylvania series occupies positions on first bottoms similar to those of the Congaree and Toxaway series and like the Toxaway soils, it has formed from alluvial material washed from Porters soils and other soils occurring at high elevations on uplands. The chief difference between the soils is in the color of the upper layer, which in the Transylvania is dark grayish brown or dark brown and in the Congaree medium brown or light brown. The Transylvania soil is more plastic than the Congaree soils, and its internal drainage is slightly slower.

This series is represented by only one type—Transylvania silt loam. It has a very small total area and is used largely for corn.

Transylvania silt loam.—This dark-brown mellow soil is confined in development to first bottoms, mainly in the mountain districts. The relief is level or nearly level. External drainage is slow to very slow and internal drainage medium. The materials that make up the soil were washed from Porters and other wooded soils occurring at high elevations on the uplands. The soil is high in inherent fertility and is well suited physically to the production of general crops and such truck crops as cabbage, potatoes, lettuce, carrots, and spinach.

The parent material has been transported by water from areas where granite and gneiss are the predominant rocks. Owing to the average lower temperature, more active geologic erosion, and other factors, this material is less weathered, less leached, and higher in content of organic matter than alluvial material derived from uplands in the lower lying plateau country. Changes in both the character and quantity of the material have increased with removal of forest growth and clean cultivation on the uplands.

This soil has an aggregate area of only 122 acres. It occurs in places along the headwaters of the Nottely River, and some of the most typical areas are near the junctions of Wolf and Stink Creeks with that river.

The profile of this soil has characteristics as follows:

- 0 to 15 inches, dark grayish-brown or dark-brown loose very crumbly silt loam containing a large quantity of organic matter and many grit particles. This layer is medium to strongly acid and is easily pervious to moisture, air, and roots.

15 to 30 inches +, dark-brown to yellowish-brown fine-textured very crumbly silt loam containing less organic matter than the overlying layer. It is medium to strongly acid. Moisture, air, and roots penetrate it freely.

The profile layers vary slightly from place to place in color and thickness. The soil is subject to change by the deposition of sand, silt, and clay in the overflow of adjacent streams during heavy rains.

This soil is very good cropland and very good pasture land. Tilt is good, workability and conservability are excellent, and productivity is very good. The moisture relations are good, but the range of moisture conditions for cultivation is somewhat narrower than for some of the other soils of the county. Erosion control is no problem. Artificial drainage is not necessary for the production of cultivated crops. The soil has a much higher content of organic matter than Congaree silt loam, which also occurs on first bottoms. It has a higher content of plant nutrients, especially nitrogen, than Congaree fine sandy loam or Congaree silt loam. It is highly productive and can be improved and conserved by good management.

In a single area of about 10 acres a quarter of a mile southwest of the junction of Stink Creek with the Nottely River, the surface texture is fine sandy loam. This soil was included with the silt loam as mapped because of its small extent.

Use and management.—Practically all of Transylvania silt loam is in crop use. About 85 percent of it is planted to corn, 10 percent is used for snap beans, 4 percent for sorghum, and the rest for miscellaneous uses.

Management practices, including fertilization and crop rotations, are similar to those for Congaree fine sandy loam. Corn yields 35 to 60 bushels an acre, and sorghum about 150 gallons of medium quality sirup. Owing to slightly poorer drainage, the soil is not so well suited to wheat as Congaree silt loam and Congaree fine sandy loam. Snap beans are fertilized with about 600 pounds an acre of 4-8-4 mixture, and the average yield is about 200 bushels. Potatoes, fertilized similarly to snap beans, yield 120 to 180 bushels an acre.

The favorable moisture relations, high organic-matter content, and good supply of plant nutrients render this soil well suited to the commercial production of cabbage, lettuce, and carrots, but at present these crops are grown only to a relatively small extent.

TUSQUITEE SERIES

The soil of the Tusquitee series is derived from colluvial material that accumulated at the base of long slopes, although in some places it has formed from local alluvium. It is associated with Porters and other soils occurring on mountains and in places with soils occurring on foothills. It has formed from materials that washed or sloughed from these associated soils.

Tusquitee soil has a brown, dark-brown, or dark grayish-brown mellow upper layer, 10 to 20 inches thick, and a yellowish-brown to brown soft crumbly permeable subsoil, 16 to 40 inches thick. In some places the upper layer may continue to a depth of 30 inches without any change in color and texture.

Only one type of this series is mapped in this county—Tusquitee loam. It covers a small total acreage, about half of which is used for corn.

Tusquitee loam.—This dark-brown mellow soil occurs on foot slopes in the mountain districts. It has formed from material washed from steep slopes of Porters and associated soils and from Rough stony land (Porters soil material). The relief is very gently to moderately sloping, the slopes ranging from 2 to 10 percent and averaging about 6 percent. External drainage is slow to rapid and internal drainage medium.

This soil has an aggregate area of only 346 acres. The larger areas are along Kennedy Creek north of Woody Lake and southwest of Miller Gap, and the smaller ones border the eastern edge of the first bottoms along the Toccoa River near Cavender Knobs.

Following are the characteristics of the profile of this soil:

0 to 18 inches, dark grayish-brown or dark-brown loose gritty loam having a high content of organic matter. This layer is medium to strongly acid and is easily pervious to moisture, air, and roots.

18 to 45 inches, yellowish-brown or brown soft crumbly clay loam; medium to strongly acid. Moisture, air, and plant roots penetrate it easily.

45 to 78 inches, brownish-yellow crumbly clay loam.

78 inches +, weathered granite gneiss.

The thickness of the layers of the profile varies somewhat from place to place. There are also variations in the character of the lower part of the profile. In a few places, below a depth of about 26 inches, the subsoil is yellow crumbly clay loam or silty clay loam. The parent material here is mottled yellow and gray clay loam or silty clay loam, which at a variable depth rests on a layer of small white angular quartz fragments.

This type is good to very good cropland and very good pasture land, and it is well suited to the production of general crops and such truck crops as potatoes, cabbage, spinach, lettuce, and carrots. It has very good workability and conservability. It is practically free from stones, possesses good tilth, and is easy to work. Except on the stronger slopes its productivity is easy to maintain, and the control of runoff can be effected through good management. The supply of plant nutrients can be conserved by few intensive management practices. The relatively deep profile to bedrock, open texture of the profile, and high content of organic matter in the surface layer render this soil highly absorptive and retentive of moisture. The soil is inherently fertile. Its productivity for the crops commonly grown is good.

This soil as mapped includes areas that have stronger slopes (10 to 18 percent instead of 2 to 10 percent), although the profile differs very little. This inclusion is found in remote situations, and only a very small part has been cleared for agricultural use.

Use and management.—About 30 percent of Tusquitee loam is in mixed forest, consisting of deciduous trees; 40 percent is used for corn, 10 percent for rye, 5 percent for cabbage, 5 percent for snap beans, and 10 percent for pasture consisting largely of bluegrass and white clover.

Under management practices that include crop rotation and fertilization, the average yield of corn is about 35 bushels an acre and of rye about 15 bushels. When a small-grain crop is desired, a 3-year rotation of corn, rye, and red clover is practiced. For this rotation the land is limed with 1 ton an acre of ground limestone, and cornland is treated with 150 to 200 pounds an acre of 2-10-2 or 4-8-4 fertilizer. Much of the rye produced is grown on cornland and turned

under for green manure. In some places crimson clover instead of rye is seeded in cornland, and the crop is turned under.

Land for cabbage is fertilized with 1,000 to 1,500 pounds an acre of 3-9-5 mixture and land for snap beans with 300 to 600 pounds of 4-8-4 mixture. With this fertilization and other practices of management cabbage yields 10 to 21 tons an acre and snap beans about 160 bushels.

WARNE AND WORSHAM SERIES

Soils of the Warne series occur on low terraces and are closely associated with those of the Altavista, State, and Hiwassee series. They have formed from alluvium consisting of material washed from uplands underlain by igneous and metamorphic rocks. They are characterized by a light-colored, loose, friable surface layer and a light-gray, streaked with yellow, tough, very slowly pervious subsoil. External and internal drainage are slow, although in places external drainage is medium or rapid and internal drainage very slow. The characteristics of the soils are associated with the slow external and internal drainage.

Warne soils are mapped in this county only in complex with those of the Worsham series—Warne-Worsham loams and their slope phases. The aggregate area of these soils is fairly large, and a little more than half of it is used for cultivated crops.

Soils of the Worsham series somewhat resemble those of the Edneyville series but differ in occupying low slopes near drainageways and in having rather slow internal drainage. They are associated with soils of the Fannin and Talladega series and with other soils on the intermountain uplands. They are derived from weathered products of granite gneiss, although in some places the soils probably have received additions of colluvial material.

The surface layer of Worsham soils is light gray or medium gray, loose, friable, and 6 to 8 inches thick. The subsoil is yellow or brownish yellow, friable, and 12 to 18 inches thick. It is underlain by gray silt loam containing a large quantity of mica flakes.

In this county the Worsham soils are mapped only in complex with soils of the Warne series.

Warne-Worsham loams.—This complex includes areas of Warne and Worsham soils, each too small and intricately associated to be mapped separately. Warne loam comprises the greater part of the complex. It is characterized by a light-colored, tough, almost impervious layer within the profile. Worsham loam is characterized by a brownish-yellow micaceous subsoil and is more friable throughout than Warne loam. This complex has low potential value as cropland.

The relief ranges from very gently to moderately sloping, the average gradient being about 6 percent. External drainage is slow to medium and internal drainage slow to very slow.

This complex has an aggregate area of 1,165 acres. Some areas are on foot slopes of the Hiwassee Plateau, where they adjoin areas of Fannin and Talladega soils. Others are on terraces in association with Altavista soils. On the terraces they occupy seepy or other imperfectly drained situations, whereas the Altavista soils occupy better drained situations. Some of the larger areas of this complex are between Pleasant Grove Church and Bunker Hill.

In a typical profile of Warne loam the uppermost 10-inch layer is light-gray loose gritty loam, easily penetrated by plant roots. It is underlain by light-gray, streaked with dull-yellow, tough, almost impervious clay to a depth of 36 inches or more. Numerous variations exist in this soil. In many places the uppermost 10-inch layer consists of grayish-yellow tough clay loam. This is underlain to a depth of about 16 inches by mottled yellow, gray, and dull yellowish-brown plastic clay loam, which is micaceous and has a slick feel. The subsoil is dull-red, yellow, or grayish-yellow, mottled with reddish yellow and dull brown, tough clay mixed with small angular quartzite fragments. At an average depth of 22 inches the subsoil grades into light-gray, tough, nearly impervious clay. In many places at various depths in the profile accumulations of white angular quartzite fragments, up to 6 inches across, are common.

In Worsham loam the uppermost 7-inch layer is light-gray loam or silt loam, which is medium gray when moist and is highly leached. The subsoil is brownish-yellow very micaceous silty clay loam. It is underlain at an average depth of 22 inches by gray silt loam consisting of 75 to 90 percent of mica flakes. A few small areas of Altavista loam are included with this complex as mapped.

Warne-Worsham loams range from strongly to very strongly acid in the surface soil and subsoil. The tough clay layer is very difficult for plant roots to penetrate and nearly precludes the movement of air and moisture in the soil. In dry periods these are among the first soils on which plants suffer from lack of water.

The complex is poor to fair cropland and fair pasture land. Workability and conservability are fair, and productivity is low.

Use and management.—About 50 percent of Warne-Worsham loams is in cultivation, 15 percent in permanent pasture, 15 percent in oak forest, 10 percent in idle land, and 10 percent in shortleaf pine. The crops grown and the fertilizer practices followed are similar to those on Fannin loam, undulating phase. Crop yields range widely, depending on the management and on the variable character of the soil. Corn yields 5 to 20 bushels an acre, averaging about 15 bushels where the soil characteristics are most favorable and the soil management is good. Under similar conditions rye yields about 11 bushels an acre and lespedeza about 2 tons of hay. In areas where soil conditions are less favorable or where the soil is not very good, the average yields of corn and rye are about 9 and 7 bushels an acre, respectively, and the average yield of lespedeza about $\frac{3}{4}$ ton of hay. Lime aids in increasing the crop yields. High quality tobacco can be grown on some areas of this complex.

Warne-Worsham loams, slope phases.—Areas of these soils occur on slopes of 10 to 18 percent and average about 12 percent. Aside from the steeper slopes, the soils are similar to those of the normal phase of the complex. The relief is moderately sloping to strongly sloping, in some places very strongly sloping. External drainage is medium to rapid and internal drainage slow to very slow.

This complex occupies lower upland slopes and terraces in association with the normal phase of the complex and also with soils of the Altavista, Fannin, and Talladega series in various parts of the Hiwassee Plateau. Some of the areas are northwest of Blackjack Mountain in the northwestern part of the county, southwest of the Georgia

Mountain Branch Station, and east of Blairsville along Right Prong, also known as Scrougetown Creek. A total area of 685 acres is mapped in comparatively small individual areas.

The soil is fair cropland and pasture land. Workability, conservability, and productivity are poor.

Use and management.—About 65 percent of Warne-Worsham loams, slope phases, is in cultivation, 15 percent in permanent pasture, 10 percent in idle land, and the rest mostly in oak forest. Cultivated areas are managed much like cultivated areas of Fannin loam, undulating phase. Owing to the steeper slope, however, erosion is more difficult to control than on the normal phase of the complex, and about half the cultivated land has an eroded loam or clay loam surface soil. Crop yields average about 20 percent lower than on the normal phase.

USE, MANAGEMENT, AND PRODUCTIVITY OF THE SOILS

The use suitability of the soils, their management, and their productivity are treated under one head, in order to show their relations more clearly. A soil is managed for a particular use, and its productivity is affected by use and management as well as by other causes. The soils of the county are placed in five classes, which differ from one another in their suitability for different farm uses.

The present land use, present soil management practices, and the soil management requirements are presented. The soils are grouped according to their management needs, and management practices are discussed for each group.

The estimated crop yields for each of the soils on which crops are grown and the productivity ratings for the crops grown are tabulated. The crop yields and productivity ratings are based on three levels of management.

CLASSIFICATION OF THE SOILS ACCORDING TO THEIR SUITABILITY FOR AGRICULTURE

The various soils are placed in five land classes—First-, Second-, Third-, Fourth-, and Fifth-class soils—so that their relation to the agriculture of the county may be discussed more conveniently. These classes are numbered in descending order of suitability of the soils, although none is ideal for the existing agriculture.

The characteristics of a soil determine its physical suitability for use, and many characteristics contribute to its productivity, workability, and conservability. As used here, productivity means the ability of the soil to produce crops under prevailing farm practices. The soil may be productive of a crop, but not well suited to it because of poor workability, poor conservability, or both. Workability refers to ease of tillage, harvesting, and other field operations. It is affected by soil texture, structure, consistence, organic-matter content, and moisture conditions and by slope and stoniness. Conservability refers to the maintenance, improvement, or both, of the productivity and workability of the soil, including control of erosion. The conservability of a soil is revealed by the degree to which it responds to management practices.

Productivity, workability, and conservability determine the physical suitability of a soil for use. An ideal soil for crop production is very

productive, easily worked, and capable of being conserved with little effort. Congaree fine sandy loam and Congaree and Transylvania silt loams probably come nearer to such an ideal than any of the other soils of the county, although they fall short to some extent. The shortcoming in any one of these three conditions may differ greatly from that of the other two. For example, a soil may be very easily worked and conserved but very low in productivity. It is evident that the relations among productivity, workability, and conservability are complex in their influence on the use suitability of the soil. No simple method exists for evaluating the true relations among these three conditions and applying their values in ascertaining the most suitable use for a soil.

The relative physical suitability of the soils for agricultural use has been determined from the experience of farmers and others who work with the soil. For example, a farmer knows that some soils on his farm are better than others, and by comparing their nature within a farm and between farms the soil units may be ranked according to present conditions in the order of their suitability for agriculture. Where facts based on experience were lacking, the necessary information was supplied by comparisons with soils of known similar characteristics for which the information was obtainable. Arbitrary limits were then selected for ranking the soils in the five physical land classes. In choosing the limits for the physical land classes, it was generally assumed that a soil well suited physically only to pasture or forest is less desirable than one well suited physically to crops but rather poorly suited to pasture. Likewise, it was assumed that a soil well suited physically only to forest is less desirable than one well suited physically to pasture. These assumptions may be invalid for any one farm, but it is thought that they are valid for most of the farms in the county.

It may be said that under present conditions the First-class soils in general are good to excellent cropland; Second-class soils, fair to good cropland; and Third-class soils, poor to fair cropland. First-, Second-, and Third-class soils are all at least fairly well suited to pasture. Fourth-class soils are poorly suited to crops but are at least fairly well suited to pasture; and Fifth-class soils are poorly suited either to cultivated crops or to pasture and are best suited to forest, although some areas may be used for crops or pasture.

This grouping of the soils is not to be regarded as a recommendation for land use. Its purpose is to provide information about the relative physical suitability of the various soils for the present agriculture. Information on a number of additional factors is necessary even for general recommendations for land use, and knowledge of a great many factors relating to a specific farm is necessary for recommendations for land use on that farm.

The general distribution of the five physical land classes in the county is shown in a generalized land map, figure 2.

FIRST-CLASS SOILS

First-class soils constitute good to excellent cropland and very good to excellent pasture land. They differ in degree of profile development, character of parent material, color, structure, and other respects, but are relatively similar in general physical suitability for agri-

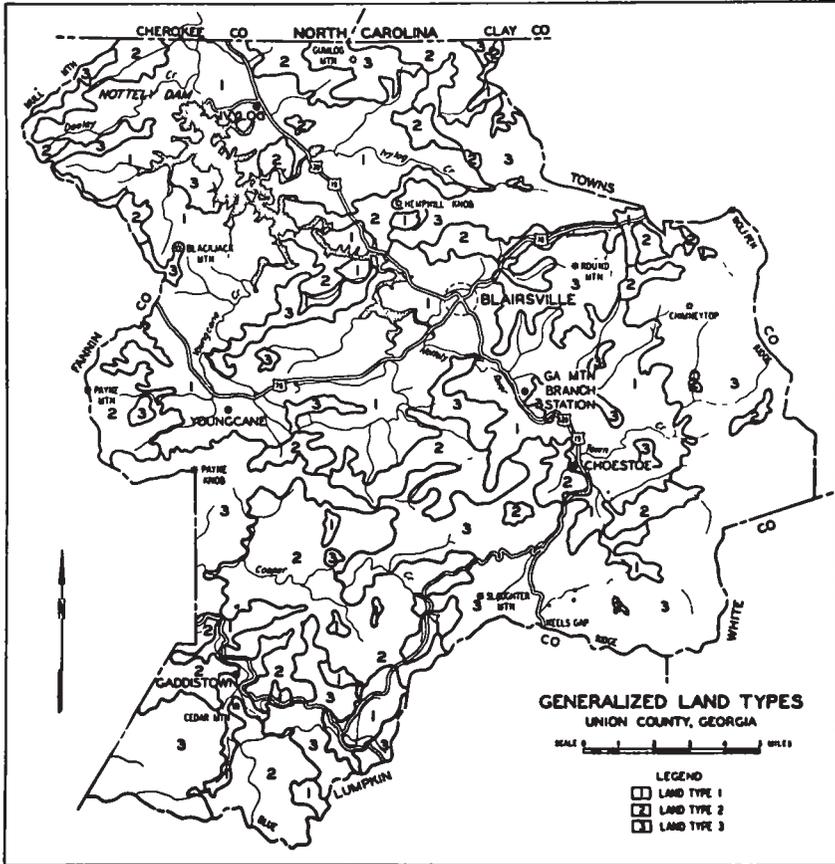


FIGURE 2.—Map showing general classification of the land in Union County, Ga.: Land type 1 comprises the general areas where the soils are mainly of classes 1, 2, and 3; land type 2, areas where the soils are mainly of class 4; and land type 3, areas where the soils are mainly of class 5.

cultural use. All are fairly well supplied with plant nutrients, compared with other soils of the county, but even the most fertile are responsive to additions of needed amendments for most crops. All are acid and need lime. All are well drained except Congaree silt loam, dark-subsoil phase, which has medium to slow external and internal drainage; and Toxaway silt loam, which has slow to very slow external and internal drainage. Their physical properties are such that they retain moisture well, thereby tending to insure an even and adequate supply for plant growth. Good tilth is easily maintained, and the range in moisture conditions for tillage is comparatively wide, though narrower in Congaree silt loam, dark-subsoil phase, and Toxaway silt loam. The soils are relatively well supplied with organic matter. The physical properties of these soils, except those of Congaree silt loam, dark-subsoil phase, and Toxaway silt loam, favor normal circulation of air and moisture; and roots freely penetrate all parts of the subsoil.

None of these soils is characterized by any prominent adverse soil condition. They are almost free from stones, their relief is favorable to soil conservation and tillage, and none is severely eroded or highly susceptible to erosion.

The natural productivity of these soils is relatively high. The soils are easily tilled, and the problem of conserving their fertility and material is relatively simple. All are well suited to most of the exacting and intensive crops of the county when these are grown under the prevailing systems of management.

The First-class soils in this county are Congaree fine sandy loam; Congaree, State, Toxaway, and Transylvania silt loams; Congaree silt loam, dark-subsoil phase; and Hiwassee and Tusquitee loams. They have an aggregate area of 3,559 acres, or 1.8 percent of the area of the county. In general these soils represent a significant part of land type 1, shown in figure 2.

SECOND-CLASS SOILS

Second-class soils constitute fair to good cropland and good to very good pasture land under present farming practices. Like the First-class soils, they include soils having considerable diversity in morphological characteristics, and this diversity is greater than in the First-class soils. They are relatively similar in physical suitability for use in the present agriculture, but they may differ in productivity, workability, and conservability within a limited range. Each soil is moderately deficient in one or more of these conditions, and the detrimental effect on the physical suitability of the soil for agricultural use is greater than for any of the First-class soils and less than for any of the Third-class soils. None of these soils, however, is so deficient in any characteristic that it is poorly suited physically for crop and pasture production.

In general the Second-class soils are at least moderately productive of most crops grown in the county, and their physical properties are at least moderately favorable to tillage, maintenance of good tilth, and normal circulation and retention of moisture. None of them occupies very strong relief and none, except in a few places, is extremely stony or severely eroded. Internal drainage is slow or slow to very slow in some of the soils.

Second-class soils are as follows: Altavista loam and its low-terrace phase; Balfour loam and its eroded phase; Chewacla and Tate silt loams; Chewacla fine sandy loam; Edneyville stony fine sandy loam, undulating phase; Fannin loam and its undulating phase; Fannin stony loam; Fannin clay loam, eroded undulating phase; Hayesville loam, undulating and rolling phases; Hayesville clay loam, rolling phase; Hiwassee loam, eroded slope phase; and Tate-Chewacla silt loams. They have an aggregate area of 23,967 acres, or 11.6 percent of the county. In general these soils represent part of land type 1, shown in figure 2.

THIRD-CLASS SOILS

Third-class soils are poor to fair cropland and fair to good pasture land. Each soil is characterized by conditions of workability, productivity, and conservability, one or a combination of which is sufficiently adverse to limit definitely the physical suitability of the

soil for the production of the common cultivated crops when grown under prevailing farming practices, but none of which is so limiting as to make the soil definitely unsuited to cultivated crops. In this class of soils one or more of the following undesirable features is prominent: Low content of plant nutrients, low content of organic matter, shallowness to bedrock, strong slope, susceptibility to erosion, eroded condition, and slow internal drainage.

These soils are better suited physically to crop production under prevailing systems of management than Fourth-class soils, but are less well suited than Second-class soils. Their best use depends, among other things, on the manner in which they occur, the other soils in the farm unit, the type of farm, and economic conditions.

The Third-class soils are as follows: Altavista loam, slope phase; Altavista clay loam, eroded phase; Edneyville stony fine sandy loam; Fannin clay loam, eroded phase; Fannin stony clay loam, eroded phase; Spilo silty clay loam; Talladega loam, rolling phase; Warne-Worsham loams; and Warne-Worsham loams, slope phases. Their aggregate area is 14,605 acres or 7 percent of the county. In general, these soils represent a significant part of land type 1, shown in figure 2.

FOURTH-CLASS SOILS

Fourth-class soils are very poor to poor cropland and fair to very good pasture land. Each is so difficult to work or to conserve, or both, that it is generally infeasible to cultivate it, but each is sufficiently fertile and has sufficiently good moisture relations to maintain at least a moderate cover of pasture plants.

In general, under the prevailing farm practices these soils are best suited physically to pasture. They are generally in such use where an adequate acreage of fair to good cropland is available, but at present the greatest acreage is probably used for forest, largely because it is in isolated parts of the county or consists of land once cropped. Areas of some of the soils are used for cultivated crops.

The Fourth-class soils comprise Alluvial soils, undifferentiated; Hayesville and Porters loams; Chewacla-Spilo silt loams; Fannin loam, hilly phase; Fannin stony loam, hilly phase; Fannin clay loam, eroded hilly phase; Fannin stony clay loam, eroded hilly phase; Hayesville clay loam, eroded and severely eroded phases; Porters stony loam, hill phase; Porters-Balfour loams; Porters-Balfour loams, eroded phases; Rabun clay loam, hill phase; Stony colluvium (Fannin and Hayesville soil materials); Talladega loam, hilly phase; Talladega clay loam, eroded rolling phase and eroded hilly phase. These soils cover an aggregate area of 84,162 acres, or 40.9 percent of the county. In general they constitute the greater part of land type 2, shown in figure 2.

FIFTH-CLASS SOILS

Fifth-class soils are very poor cropland and very poor to poor pasture land. Each is so difficult to work or to conserve, or both, that cultivation is generally infeasible under the prevailing system of farming; and each is so low in content of plant nutrients or has such poor moisture relations, or both, that common pasture plants produce very little feed. Although forest trees may grow more slowly on most of these soils than on most of the soils of the four preceding classes, the

Fifth-class soils are better suited physically to forest than to crops or pasture. On some farms that possess little or no land better suited to crops or pasture, it has been necessary for farmers to use some of these soils for pasture or even for crops, and this condition is expected to continue to some extent.

Each soil of this class is characterized by one or more of the following undesirable features: Hilly, steep, or very steep relief, high content of loose stone, shallowness to bedrock, numerous outcrops of bedrock, or severe erosion. In addition some of them are low in content of available plant nutrients, are excessively drained, and are strongly to very strongly acid. As a result of these undesirable characteristics, the natural productivity of both cultivated crop plants and pasture plants is generally low or tillage with common farm implements is either impossible or very difficult. Some of the soils can be cultivated only with hand implements. If the soils are used for crops, the requirements for their conservation will be exacting.

Although the Fifth-class soils are similar in physical suitability for use, they differ widely in a great many physical characteristics. It is reasonable to assume that some of the differences may cause differences in the suitability of the individual soils for forest.

The Fifth-class soils are Fannin clay loam, severely eroded hilly phase; Hayesville loam, steep phase; Porters loam, eroded phase; Porters and Talladega stony loams; Ranger slate loam; Rough stony land (Porters soil material); Talladega loam; Talladega clay loam, eroded phase and severely eroded hill phase. Their aggregate area is 79,787 acres, or 38.7 percent of the county. In general these soils constitute the greater part of land type 3, shown in figure 2.

LAND USE AND SOIL MANAGEMENT

The purpose of this section is to present specific information relating to (1) the use of the land and the management of the soils and (2) some of the requirements for good management.

Land use as used here refers to broad classes of use, as for (1) cultivated crops, (2) permanent pasture, and (3) forestry. Soil management refers to such practices as (1) choice and rotation of crops, (2) application of lime, commercial fertilizer, and manure, (3) tillage, and (4) engineering measures to assist in the control of water on the land. The soils of this county differ in characteristics affecting workability, conservability, and productivity, all of which are related directly to management requirements.

The farmer who attempts to readjust the use and management of his soils is confronted with a number of problems, over some of which he has no control. Among the factors to be dealt with are the size and type of farm; the physical character of the land, including the pattern of soils on the farm; the operator's tenure; the number, age, and health of the operator's family; the surrounding social and economic conditions, as transportation, market, church, and school facilities; the immediate demand for a cash income to meet taxes, indebtedness, support of family, and other expenses; the availability of labor; the relation between prices of farm products and other commodities; the farm operator's facilities and resources for operating purposes, including buildings, equipment, kind and number of livestock, cash, and

available credit; the farm operator's ability, preferences, and other characteristics; and community cooperation with respect to drainage, water disposal, marketing, buying, and other operations.

The farmer as an individual has full or partial control over some of these conditions but little or no control over others. A full solution of some of the problems requires community, State, or even national action. The farmer individually can make only those adjustments toward better management that are possible within his limited financial and personal ability. Some of the suggestions for management practices for the various soils may not be feasible for some farmers in their present circumstances, but it is thought that the practices suggested are feasible under present conditions for the majority of farms in the county. Many farmers may attain the same objective by the use of different combinations of management practices better suited to their particular conditions than those indicated in this section.

Considerable attention has been given to the physical character of the soil by farmers in this county. Proper use and management as they affect sustained production, however, have been given too little heed on many farms. Furthermore, in the early settlement of the area the farm land was drawn by lot rather than being selected by choice after a systematic search for land fitted to the particular needs of the settler. Such a method resulted in maladjustment of much land to use, which doubtless led to widespread soil depletion and land abandonment in later years.

Estimates of the proportions of the soils in different uses are given in the section on Soils. The proportion may vary greatly in different parts of the county or among farms in the same part. The present use of a soil on any one farm has been determined by many causes, including on some farms the necessity of growing crops on soils unsuited to them, and on these the farmer has no feasible alternative.

Proper land use and soil management are essential to the highest productivity of the soil. Any information that may enable farmers to increase the productivity of their soils leads to better profits and hence to better living.

The soils of this county exhibit certain deficiencies in nitrogen, phosphate, potash, and other plant nutrients. All the soils are also low in content of calcium, and their acidity is generally higher than the optimum for most crops adapted to the climate. Soluble aluminum compounds are present in quantities ranging from 50 to 500 pounds an acre. These compounds are considered toxic to plant growth if they exceed 250 pounds an acre. Lime added in proper quantities would supply calcium and thereby decrease the solubility and toxicity of the aluminum compounds. When soil acidity has been lowered, the phosphate in the soil becomes more available to plants, and the phosphate derived from fertilizer becomes more efficient. The addition of nitrogen, phosphate, potash, and lime is generally necessary, therefore, to obtain the maximum productivity of most crops from most of the soils.

Several composite samples of soils have been collected in this and adjoining counties, and results of their analyses are given in table 11.

TABLE 11.—The pH determinations and the available plant nutrients and soluble aluminum (pounds per acre) in samples of various soils in Union County, Ga., and adjoining counties ¹

Soil	Number of soil samples	pH	NO ₃	P	K	Ca	Mg	NH ₃	Mn	Al
Altavista loam:										
Surface soil.....	3	5.0	7.0	0	44.0	117	27.0	8.0	2.0	233.0
Subsoil.....	3	5.0	2.0	0	44.0	183	43.0	8.0	7.0	300.0
Chewacla silt loam.										
Surface soil.....	1	4.7	15.0	20.0	160.0	250	50.0	10.0	0	300.0
Subsoil.....	1	4.6	10.0	10.0	120.0	100	25.0	10.0	5.0	300.0
Congaree fine sandy loam:										
Surface soil.....	5	5.2	1.0	10.0	71.0	170	53.0	8.0	3.0	160.0
Subsoil.....	(²)	4.3	3.0	0	40.0	160	35.0	8.0	3.0	230.0
Congaree silt loam:										
Surface soil.....	4	5.4	15.0	7.5	75.0	400	50.0	35.0	6.0	375.0
Subsoil.....	4	5.2	12.5	12.5	58.0	425	50.0	86.0	7.5	500.0
Fannin loam:										
Surface soil.....	9	5.4	15.0	8.0	138.0	278	47.0	24.5	3.0	325.0
Subsoil.....	9	5.3	6.0	0	154.0	228	39.0	27.0	3.0	372.0
Fannin clay loam, eroded phase:										
Surface soil.....	6	5.3	6.0	8.0	112.0	250	40.0	23.0	4.0	229.0
Subsoil.....	6	5.3	5.0	5.0	123.0	200	34.0	23.0	5.0	283.0
Hayesville loam, rolling phase:										
Surface soil.....	4	5.3	1.0	0	69.0	112	100.0	7.5	2.5	281.0
Subsoil.....	4	5.4	0	0	59.0	90	75.0	7.5	2.5	300.0
Hayesville clay loam, rolling phase:										
Surface soil.....	3	5.6	3.0	0	112.0	175	67.0	10.0	5.0	150.0
Subsoil.....	2	5.7	0	0	156.0	250	75.0	10.0	5.0	100.0
Hiwassee loam:										
Surface soil.....	2	5.4	2.5	25.0	140.5	125	37.5	7.5	5.0	150.0
Subsoil.....	2	5.4	0	12.5	170.5	175	67.5	10.0	5.0	162.5

Ranger slate loam:										
Surface soil	2	5.0	5.0	0	150.0	175	27.5	10.0	10.0	225.0
Subsoil	2	4.4	5.0	0	120.0	175	22.5	10.0	7.5	375.0
State silt loam:										
Surface soil	2	5.3	15.0	2.5	68.0	375	75.0	42.5	7.5	350.0
Subsoil	1	5.2	30.0	10.0	105.0	400	50.0	75.0	10.0	250.0
Talladega clay loam, eroded phase:										
Surface soil	1	5.4	5.0	0	213.0	100	75.0	0	0	500.0
Subsoil	1	5.5	5.0	0	230.0	100	10.0	5.0	0	500.0
Toxaway silt loam:										
Surface soil	2	4.8	12.5	5.0	101.0	200	37.5	42.5	10.0	400.0
Subsoil	2	4.7	10.0	0	50.0	200	25.0	42.5	7.5	500.0
Warne-Worsham loams:										
Surface soil	1	5.3	0	0	75.0	100	50.0	10.0	5.0	150.0
Subsoil	1	5.6	0	0	120.0	100	50.0	10.0	5.0	250.0

¹ Unpublished data by H. P. Stuckey, director; soil samples collected from cultivated fields in Union and adjoining counties in 1938 by J. C. Mercer, assistant project leader; chemical analyses by L. C. Olson, assistant agronomist; all of Georgia Agricultural Experiment Station. pH determinations made by the glass-electrode method. Phosphorus was extracted by a 0.75 normal hydrochloric acid solution; other elements, except nitrate nitrogen, were extracted by 25-percent sodium perchlorate buffered at pH 4.8. Nitrogen is stated as nitrates and ammonia, the other constituents as elements.

² Not reported.

The data given in table 11 may be interpreted as follows:

When the available phosphorus (P) is 0 to 40 pounds an acre, the relative content is low and the probable response to fertilizer containing this element good; at 40 to 60 pounds, the relative content is medium and the response to fertilizer fair; at more than 60 pounds, the relative content is high and the response to fertilizer poor.

When the available potash (K) is less than 40 pounds an acre, the relative content is very low and the probable response to fertilizer containing this element excellent; at 40 to 120 pounds, the relative content is low and the response to fertilizer good; at 120 to 200 pounds, the relative content is medium and the response to fertilizer fair; at more than 200 pounds, the relative content is high and the response to fertilizer poor.

When the available nitrogen (NO_3) is 0 to 15 pounds an acre, the relative content is low and the probable response to fertilizer containing this element excellent; at 15 to 30 pounds, the content is medium and the response to fertilizer good; at more than 30 pounds, the content is high and the response to fertilizer fair.

Table 11 shows that only soils of the Talladega series are well supplied with available potassium. Inasmuch as these soils are shallow to bedrock and in most places too steep for the production of cultivated crops, their potassium content is of little material benefit to the agricultural economy.

The nitrate nitrogen content of the soils, although generally low, depends on the soil type, cropping practices, and to a minor degree on the climatic conditions at the time the soil sample was taken. Ammonia (NH_3) becomes available as nitrates generally through bacterial action. Magnesium (Mg) makes up part of the green coloring matter of plants and is therefore essential to plant growth, but only small quantities are required. Where present in sufficient quantities, it is beneficial in reducing the acidity of the soil. Manganese (Mn) is a common constituent of soils and plants, and small quantities are apparently necessary to normal plant growth.

In addition to the chemical deficiencies that must be supplied, the physical characteristics of the soil must be considered. These include lay of land, extent of erosion, depth to bedrock, soil texture, consistence, structure, porosity, tilth, and organic-matter content. Any of these characteristics may influence favorably or unfavorably the suitability of the soil for crops and other uses.

Different uses of soils require different management practices. In general the management of a soil for any one cultivated crop is modified by the management of that soil for other crops grown in the rotation, and the length and kind of rotation are factors of management as well. For these reasons the management requirements of the soils physically suited to the growth of cultivated crops are discussed in reference to that broad use, although the requirements of individual crops within the use group may differ.

In the first part of this section the soils are classified in five physical land classes according to their suitability for the agriculture of the county. This grouping does not constitute recommendations for use. First-, Second-, and Third-class soils comprise all the soils considered at least fairly well suited to the cultivated crops commonly grown. The soils of the five physical land classes are placed in three major

groups—soils well suited physically to tilled crops; soils poorly suited physically to tilled crops but fairly well suited to pasture; and soils poorly suited physically to tilled crops and permanent pasture but fairly well suited to forest—which are subdivided into smaller groups (A-1, A-2, A-3, B-1, B-2, and C-1) each having about the same requirements for use and management.

SOILS WELL SUITED PHYSICALLY TO TILLED CROPS

Soils well suited physically to tilled crops are placed in three groups—A-1, A-2, and A-3. The suggested management practices for each group include crop rotation, fertilization, and engineering measures to assist in the control of water on the land.

GROUP A-1

The 11 soils in group A-1 are derived from transported material deposited as alluvium along streams or as wash near the foot of slopes. The relief ranges from level to gently sloping but is predominantly nearly level. Except the State and Tusquitee soils, which have been mildly or moderately eroded in places, the soils of this group have been affected very little or not at all by accelerated erosion. The surface layer is sufficiently thick to constitute nearly everywhere all the plowed layer, and very little or no subsoil is brought up by the plow. Tillage is fairly easy, and moisture relations are generally good for tillage; but the range of moisture conditions when tillage is feasible is rather narrow in some of the soils. Small areas in most of the soils are poorly drained internally and require underdrainage for best results from most crops. Congaree silt loam, dark-subsoil phase; Tate-Chewacla silt loams; and Toxaway silt loam have slow internal drainage, but adequate drainage has been obtained over much of these soils by means of ditches. Wheat may be winterkilled on some areas, especially where internal drainage is insufficient.

Table 12 lists the soils of group A-1 according to similar use suitability and management requirements and gives the physical characteristics of each.

TABLE 12.—*Physical characteristics of group A-1 soils, well suited physically to tilled crops and of similar use suitability and management requirements, Union County, Ga.*

Map symbol	Soil	Physical land class	Workability	Conservability	Productivity
Ch....	Chewacla silt loam....	Second	Good....	Excellent..	Good.
Cd....	Chewacla fine sandy loam.	do....	Very good..	Very good..	Fair.
Cf....	Congaree fine sandy loam.	First...	Excellent..	do.....	Good.
Co....	Congaree silt loam....	do....	do.....	Excellent..	Very good.
Coa....	Dark-subsoil phase.	do....	Good....	do.....	Do.
St....	State silt loam.....	do....	Excellent..	Very good..	Do.
Ta....	Tate silt loam.....	Second	Very good..	Excellent..	Good.
TC....	Tate-Chewacla silt loams.	do....	Good....	Very good..	Do.
Tx....	Toxaway silt loam ¹	First...	do.....	Excellent..	Do.
Tr....	Transylvania silt loam.	do....	Excellent..	do.....	Very good.
Tl....	Tusquitee loam.....	do....	Very good..	Very good..	Good.

¹ Where adequately drained.

Present management.—Corn is the principal crop; and rye, wheat, oats, lespedeza, red clover, crimson clover, soybeans, and cowpeas are more or less important. Snap beans, potatoes, and cabbage are grown as truck crops. Some areas of the soils are used for permanent pasture, and small areas are wooded.

Crop rotations are practiced by some in the management of a number of these soils. A 3-year rotation of corn, wheat or rye, and red clover and one of corn, rye, lespedeza or crimson clover are the most common. In the first rotation corn receives 150 to 200 pounds an acre of 2-10-2 mixture and in the second 200 pounds of 4-8-4. Other fertilization of corn includes 100 to 150 pounds of superphosphate; also, a few apply 200 to 300 pounds of superphosphate and top-dress with 100 pounds of nitrate of soda. Rye is not ordinarily fertilized, but in some fields 150 pounds of superphosphate is applied.

On some farms corn is grown year after year with the use of very little or no fertilizer. Liming is practiced with some crops on some farms, and 1 to 2 tons an acre of ground limestone is applied. Truck crops receive moderate to heavy applications of complete fertilizer.

Management requirements.—Most farmers prefer a short crop rotation for the State, Transylvania, Congaree, Tusquitee, Tate, Chewacla, Tate-Chewacla, and Toxaway soils. A rotation of corn and crimson clover is advisable, the crimson clover to be broadcast when the corn is laid by and to be turned under the following spring for green manure. The corn should be fertilized with 200 to 400 pounds an acre of 3-9-5 or 4-8-6 mixture. When a 3-year rotation of corn, rye, and lespedeza is practiced, the rye should be fertilized with 150 to 300 pounds of 0-10-4 mixture. In some instances where State silt loam has been well limed and is in a high state of fertility, a 3-year rotation of corn, wheat, and red clover would be desirable in the management of this soil. Fertilization for the corn should include 200 to 400 pounds of 4-8-4 or 4-10-4 mixture, and for the wheat 100 to 300 pounds of 0-16-0. Lime is a very important amendment for these soils.

Toxaway silt loam under natural conditions is poorly drained, being covered with water part of the time. Red maple and alder are common on the virgin soil, and water sedges and other water-tolerant plants are on the cleared soil. Close spacing of ditches is necessary to drain the soil adequately for cultivated crops. Congaree silt loam, dark-subsoil phase, and Chewacla silt loam require some drainage but not so much as Toxaway silt loam.

Congaree, State, Tusquitee, Toxaway, and Chewacla soils are well suited to truck crops. Cabbage, potatoes, snap beans, spinach, and tomatoes are the principal vegetables grown on them for sale and for domestic use. Tomatoes, collards, bell peppers, beets, carrots, squash, onions, and pumpkins are grown to some extent as truck crops and for home use. Rhubarb, radishes, lima beans, cucumbers, various greens, and other vegetables are grown in most home gardens for table use but seldom for sale.

As early as about 1900 cabbage was grown on a commercial scale in the Canada district in the southwestern part of the county, even though the crop had to be transported in covered wagons over unimproved roads across the Blue Ridge through Cooper Gap to the market at Gainesville, about 50 miles away. The cabbage consisted chiefly of varieties that could be hauled over the long route without damage.

With improved roads and other transportation facilities, marketing has become less difficult, and the acreage of cabbage and other truck crops has expanded considerably. The yield and quality of the cabbage have been improved through the introduction of new varieties, as Marion Market and Resistant Detroit, which are resistant to the yellows. The soils best suited to cabbage are Toxaway silt loam; Congaree silt loam, dark-subsoil phase; State silt loam; Tusquitee loam; and Congaree silt loam, in approximately the order given.

The largest acreages of snap beans and potatoes are grown on soils of the Chewacla series. Very little spinach and lettuce have been grown on a commercial basis. From the limited information on these crops, they seem to require a soil of high fertility and one that, when well drained, has excellent structure but only a moderate content of organic matter. These conditions are best met by the State and Congaree soils.

GROUP A-2

With the exception of the Hiwassee soils, which are derived from alluvium, the soils of group A-2, are derived from granite gneiss or micaceous schist rocks. The Hiwassee soils are on high terraces made by streams and the others on uplands mainly in intermountain valleys. The relief ranges from gently undulating to strongly sloping but is predominantly gently rolling to rolling. External drainage is slow to very rapid, but on most of the soils it is slow to medium. Internal drainage is medium, although in some of the soils it is rapid. Workability ranges from fair in some soils to very good in others but is mostly good and very good. Conservability is good in Balfour loam; Hayesville loam, undulating phase; and Hiwassee loam and poor in Fannin clay loam, eroded phase. It is fair or good in the other soils of this group.

Table 13 lists the soils of group A-2 according to similar use suitability and management requirements and gives the physical characteristics of each.

Present management.—Some of the soils have been in large part cleared for agriculture, but when need for more cropland arises it would be feasible to clear and use much more of this land for crops. Many of the soils are used in large part for crops, but some are in permanent pasture. Some areas of cleared land are lying idle and others have grown up with shortleaf pine.

Corn is the principal crop. Rye, wheat, lespedeza, red clover, crimson clover, and cowpeas are grown to some extent. Truck crops, especially snap beans, are produced on some of the soils.

Crop rotations are practiced in places on most of the soils. In some places, however, the practice of growing corn continuously without the use of fertilizer and cover crops has caused rapid depletion of the soil. A 3-year rotation consisting of corn, rye, and lespedeza is used in many fields. The rye is cut for grain or is grazed and then turned under for green manure. In this rotation corn is fertilized with 100 to 200 pounds an acre of 2-10-2 or 4-8-4 mixture or superphosphate, and rye with 100 pounds of superphosphate. Lespedeza generally receives no fertilizer, but moderate quantities of ground limestone are applied to the land every 5 or 6 years. Another 3-year rotation practiced consists of corn, wheat or rye, and lespedeza, red

TABLE 13.—*Physical characteristics of group A-2 soils, well suited physically to tilled crops and of similar use suitability and management requirements, Union County, Ga.*

Map symbol	Soil	Physical land class	Workability	Conservability	Productivity
Bl.....	Balfour loam.....	Second..	Very good..	Very good..	Good..
Blr.....	Eroded phase.....	do.....	Good.....	Fair.....	Do.....
Fl.....	Fannin loam.....	do.....	do.....	do.....	Fair..
Flu.....	Undulating phase.....	do.....	Very good..	Good.....	Do.....
Fs.....	Fannin stony loam.....	do.....	Fair.....	do.....	Do.....
	Fannin clay loam.				
Fer.....	Eroded phase.....	Third..	Good.....	Poor.....	Do.....
Fct.....	Eroded undulating phase.	Second..	Very good..	Fair.....	Do.....
Ftr.....	Fannin stony clay loam, croded phase.	Third..	Fair.....	do.....	Do.....
	Hayesville loam:				
Hlu.....	Undulating phase.....	Second..	Very good..	Very good..	Good..
Hln.....	Rolling phase.....	do.....	Good.....	Good.....	Do.....
Hcn.....	Hayesville clay loam, rolling phase.	do.....	Fair.....	Fair.....	Fair..
Hw.....	Hiwassee loam.....	First..	Very good..	Very good..	Good..
Hws.....	Eroded slope phase..	Second..	Good.....	Good.....	Do.....
Tgn.....	Talladega loam, rolling phase.	Third..	do.....	Fair.....	Fair..

clover, or crimson clover. When crimson clover is grown, the crop is turned under for soil improvement. Corn is fertilized with 100 to 200 pounds of superphosphate, and the wheat and rye with 150 pounds of 4-8-4 mixture. On some soils a legume-small grain rotation is practiced, the fertilization for the small grains being similar to that for small grains in other rotations. In the production of crops on these soils, stable manure when available is applied to the cornland. Truck crops receive rather heavy applications of a complete fertilizer.

Measures are taken for the control of water on the land on several farms. Strip cropping is practiced on Fannin clay loam, croded phase, in a few places; also, a fairly large part of the soil has been terraced. Hayesville loam, rolling phase, requires careful management for the control of erosion, and most of it has been terraced. A few farmers practice strip cropping on it. On many farms Hayesville clay loam, rolling phase, has been used several years in succession for clean-cultivated crops, mainly corn. Cover crops, especially winter cover crops, are not grown, and much of the surface soil material has been lost through accelerated erosion. Most of the cultivated land has been terraced, and strip cropping is practiced in places to impede further erosion.

Management requirements.—A 3-year crop rotation practiced by some farmers is suitable for the soils of this group. In the first year of this rotation the crops consist of corn interplanted with cowpeas or soybeans, or either of these crops sown at the last cultivation of the corn. Fertilization includes 200 to 400 pounds an acre of 4-8-4

or 4-10-4 mixture. When a heavy quantity of fertilizer is applied, some farmers prefer to use about half of it in the corn row at planting and the rest as a side dressing when the corn is about 18 inches high. Some farmers report satisfactory results with applications of fertilizer as heavy as 600 pounds, even when the soil is in a high state of fertility. The corn is followed in fall by a small-grain crop drilled in and fertilized with 100 to 300 pounds of 0-16-0 grade.

In the second year of this rotation lespedeza is broadcast in spring over the small grain at the rate of 25 pounds an acre. Some farmers prefer a mixture of 20 pounds of lespedeza and 5 pounds of red clover or alsike for land recently limed and in a high condition of fertility. When the small grain has been harvested, lespedeza is left on the ground or is cut for hay. Crimson clover is broadcast over the land late in summer, or small grain is drilled in the lespedeza in fall. The crimson clover or the red clover or alsike sown in spring and the small grain furnish a living cover for the land through the winter.

In the third year the crimson clover or small-grain crop is turned under for green manure and the land planted to corn. An initial application of 1 to 2 tons of ground limestone should be given the land and this treatment repeated at 3- to 5-year intervals.

Where Balfour loam has been adequately limed and is otherwise in a high state of fertility, a 3-year rotation of corn, wheat, and red clover might be preferred in the management of the soil. If this rotation is practiced, the quantity and kind of fertilizer should be similar to those in the above rotation.

Where snap beans are grown on a commercial basis, it is suggested that they be substituted for corn in the rotation first given above. They should be fertilized with 800 to 1,000 pounds of 4-8-6 mixture. If late beans are grown they may be preceded by an early crop of cabbage, which should be fertilized with 1,000 pounds of 4-8-6 mixture. On the fields from which the cabbage has been harvested the quantity of fertilizer ordinarily applied to beans may be materially reduced.

GROUP A-3

The Altavista, Spilo, and Warne soils of group A-3 have formed from alluvium consisting of sand, silt, and clay deposited near streams by running water, whereas the Edneyville and Worsham soils have formed mainly from weathered products of granite gneiss in place.

These soils are very gently sloping or gently undulating to strongly sloping or rolling, though some areas are nearly level and some very strongly sloping. External drainage ranges from slow to rapid, and internal drainage from very slow to medium. Workability and conservability range from very good to fair.

Table 14 lists the soils of group A-3 according to similar use suitability and management requirements and gives the physical characteristics of each.

TABLE 14.—*Physical characteristics of group A-3 soils, well suited physically to tilled crops and of similar use suitability and management requirements, Union County, Ga.*

Map symbol	Soil	Physical land class	Workability	Conservability	Productivity
Al----	Altavista loam.....	Second.	Very good.	Very good.	Fair.
Alx----	Slope phase.....	Third.	Good.	Good.	Do.
Ale----	Low-terrace phase.....	Second.	Very good.	Very good.	Good.
Acr----	Altavista clay loam, eroded phase.	Third.	Fair.	Fair.	Fair.
Ed----	Edneyville stony fine sandy loam.	do.	do.	Very good.	Do.
Edu----	Undulating phase.....	Second.	Good.	do.	Do.
Ss----	Spilo silty clay loam.....	Third.	Fair.	do.	Do.
WW----	Warne-Worsham loams.....	do.	Good.	Good.	Do.
WWx----	Slope phases.....	do.	Fair.	Fair.	Do.

Present management.—Except the Edneyville and Spilo soils, 50 to 85 percent of the area of the soils of this group is used for cultivated crops. The Edneyville soils are largely in forest, and relatively small acreages are cropped or pastured. More of these soils possibly could be cropped if more cropland is needed. A small part of Spilo silty clay loam is used for cultivated crops and a fairly large part for pasture.

Corn, rye, and lespedeza are the principal crops, and some crimson clover, cowpeas, soybeans, oats, and sorghum are grown. Good quality tobacco is grown on Altavista loam and Warne-Worsham loams. Crop rotations are used to some extent, and the most common is a 3-year rotation of corn, rye, and lespedeza. In some places crimson clover or cowpeas is substituted for lespedeza in this rotation. An average of about 150 pounds an acre of 2-10-2 or 4-8-4 fertilizer is applied for corn. When fertilized, rye is treated with 100 to 150 pounds of superphosphate. Tobacco is fertilized with 250 to 400 pounds of 4-8-4 mixture. Ground limestone is applied to cropped land in some places.

Engineering measures for the control of water on the land are required to some extent. Many of the larger areas of Altavista loam have been drained by open or covered ditches. Altavista loam, slope phase, has been considerably eroded, and the erosion is difficult to control. Altavista loam, low-terrace phase, has slow external and internal drainage, and open or covered ditches drain the soil. Spilo soil has rather poor drainage, but small acreages have been drained and are used for crops. About 50 percent of the cultivated Warne-Worsham loams, slope phases, has been more or less eroded and offers a rather difficult problem in the control of runoff.

Management requirements.—The main management requirement for soils of this group, including those adequately drained by artificial means, is the rotation of crops. The suggested rotations, fertilization, and other practices are the same as those given for group A-2. The first rotation given for that group, however, might be lengthened to 4 years by the addition of a small-grain crop to soils of this group.

Snap beans, when grown on a commercial basis, might be substituted for corn in the rotation. They should be fertilized with 800 to 1,000 pounds an acre of 4-8-6 mixture. If late beans are grown, they may be preceded by an early crop of cabbage. Cabbage should be fertilized with 1,000 pounds of 4-8-6 mixture. On the fields where cabbage has been harvested, fertilizer application for beans may be materially reduced.

SOILS POORLY SUITED PHYSICALLY TO TILLED CROPS BUT FAIRLY WELL SUITED TO PASTURE

The soils poorly suited physically to tilled crops but fairly well suited to pasture—the Fourth-class soils in the county—are subdivided into two groups, B-1 and B-2, based on management requirements. In general the requirements for permanent pasture include (1) fertilization, (2) liming, (3) regulated grazing, (4) clipping ungrazed herbage, and (5) scattering droppings and feed over the land. The main management practice in this county consists of the use of lime and superphosphate. Seeding pastures with selected mixtures is important. Although these soils are fairly well suited physically to pasture, some are in forest, some have been cropped but now lie idle or support a growth of shortleaf pine, and some are used for crops.

GROUP B-1

The two soils in group B-1 occur in first bottoms and are subject to overflow from the adjacent streams. They are nearly level, and drainage is poorly established in most places. The aggregate area is fairly large.

Table 15 lists the soils of group B-1 according to similar use suitability and management requirements and gives the physical characteristics of each.

TABLE 15.—*Physical characteristics of group B-1 soils, poorly suited physically to tilled crops but fairly well suited to pasture and of similar use suitability and management requirements, Union County, Ga.*

Map symbol	Soil	Physical land class	Workability	Conservability	Productivity
A.....	Alluvial soils, undifferentiated.	Fourth.	Good..	Very good..	Fair.
CS.....	Chewacla-Spilo silt loams....	...do...	Poor...	...do.....	Do.

Present management.—Most of the Alluvial soils, undifferentiated, remain uncleared and are too far from present habitation to be used for anything but forest. The soil, however, is inherently fertile and well suited to bluegrass and white clover. Excellent pasture could be produced if the soil is needed for that purpose.

Probably 75 percent of Chewacla-Spilo silt loams has been cleared for pasture and hay. The most common plants for these uses are lespedeza and native grasses mixed. The soil is best suited physically to the production of hay, forage, and pasture.

Management requirements.—Lime and superphosphate and proper pasture mixtures are important in the management of the soils of this group. Underdrainage also would probably prove beneficial in the wetter areas. An application of 1 to 2 tons an acre of ground limestone in the fall should prove adequate. In the spring an application of 100 pounds of muriate of potash and 200 to 300 pounds of triple superphosphate, or its equivalent, should be made. This should be followed by annual applications of 100 pounds of triple superphosphate and 1 ton of ground limestone at 3- to 5-year intervals. The land should then be seeded to the following mixture: Bluegrass, 6 pounds; orchard grass, 8 pounds; herd's-grass, 5 pounds; alsike, 3 pounds; white clover, 3 pounds; and common lespedeza, 10 pounds. This fertilization and this pasture mixture are especially suitable for Chewacla-Spilo silt loams once the soil has been adequately drained. They are also well suited to pastured areas of Spilo silty clay loam, which is included in group A-3. The pastured soil, however, needs to be adequately drained and given an initial application of 2 tons of ground limestone to reduce its acidity and improve its structure.

GROUP B-2

The 16 soils in group B-2 are best suited physically to permanent pasture, although only a comparatively small proportion of many of them is in that use. Areas of some of the Fannin, Hayesville, and Talladega soils and of Porters-Balfour loams have been cleared and used largely for crops, but the cropping practices, consisting in many places of clean cultivation, have not been beneficial. As a result of poor adjustment of soil use and management to soil requirements, accelerated erosion has affected the cropped soils to the extent that pasture appears to be one of the most feasible uses for them, although there are possibilities on some for growing fruit, especially apples and grapes.

Table 16 lists the soils of group B-2 according to similar use suitability and management requirements and gives the physical characteristics of each.

Present management.—A large part of Fannin loam, hilly phase; Fannin stony loam, hilly phase; Hayesville loam; Porters-Balfour loams; Rabun clay loam, hill phase; Stony colluvium (Fannin and Hayesville soil materials); and Talladega loam, hilly phase, has never been cleared either for crops or pasture. These soils, however, may be considered as a reserve for pasture, although some areas are too remote from present homesteads for such use. Porters loam, with a slope of 30 to 60 percent, is practically all in forest, but the less steep soil, where it is located favorably with respect to habitation, should be well suited to management as pasture. Porters stony loam, hill phase, in addition to areas never cleared of forest, includes areas that have been cleared and cropped and as a result have been materially damaged by accelerated erosion. Although a large part of this soil is best suited to forest, some areas should be suitable for pasture land under good management.

Fannin clay loam, eroded hilly phase; Fannin stony clay loam, eroded hilly phase; Hayesville clay loam, eroded phase; Hayesville clay loam, severely eroded phase; Porters-Balfour loams, eroded phases; Talla-

TABLE 16.—*Physical characteristics of group B-2 soils, poorly suited physically to tilled crops but fairly well suited to pasture and of similar use suitability and management requirements, Union County, Ga.*

Map symbol	Soil	Physical land class	Workability	Conservability	Productivity
Flh....	Fannin loam, hilly phase.	Fourth.	Fair.....	Poor.....	Fair.
Fsh....	Fannin stony loam, hilly phase.	do....	Poor.....	Fair.....	Do.
Fco....	Fannin clay loam, eroded hilly phase.	do....	do.....	Poor.....	Poor.
Fto....	Fannin stony clay loam, eroded hilly phase.	do....	Very poor.	Fair.....	Do.
Hi....	Hayesville loam	do....	Fair.....	do.....	Fair.
Hcr....	Hayesville clay loam:				
	Eroded phase.....	do....	Poor.....	Poor.....	Poor.
Hed....	Severely eroded phase.	do....	do.....	do.....	Do.
Pl....	Porters loam.....	do....	Fair.....	Fair.....	Fair.
Psl....	Porters stony loam, hill phase	do....	Poor.....	do.....	Do.
PB....	Porters-Balfour loams.....	do....	Good.....	Good.....	Good.
PBr....	Eroded phases.....	do....	do.....	Fair.....	Fair.
Rbl....	Rabun clay loam, hill phase.	do....	Fair.....	do.....	Good.
ScF....	Stony colluvium (Fannin and Hayesville soil materials).	do....	Very poor.	Very good.	Fair.
Tgh....	Talladega loam, hilly phase.	do....	Fair.....	Poor.....	Do.
Teg....	Talladega clay loam:				
	Eroded rolling phase.....	do....	Good.....	Fair.....	Poor.
Teo....	Eroded hilly phase.....	do....	Fair.....	Poor.....	Do.

dega clay loam, eroded rolling phase; and Talladega clay loam, eroded hilly phase, have at one time or another been cultivated and materially damaged, largely by use for clean-cultivated crops. Some areas are used for crops and some for pasture, but many are either lying idle or have grown up to shortleaf pine. Practically all the soils are hilly, and all are subject to further loss of material through accelerated erosion unless runoff is controlled. In view of the cropping history of these soils and the consequent abandonment of large acreages, permanent pasture, when properly managed, would doubtless be a feasible use for much of the soil when there is need for more pasture land.

Few if any of the better pasture practices are followed on many of the farms. On many of them no amendments are applied to pastures, and clipping and seeding are not practiced. On some, however, the pasture land is treated with suitable quantities of lime and superphosphate and some land is seeded with pasture mixtures.

Management requirements.—Applications of lime and superphosphate and in many places the use of pasture mixtures are required. Where the soils are in good physical condition, 1 to 2 tons an acre of ground limestone in fall should prove beneficial, followed in spring by 100 pounds of muriate of potash and 200 to 300 pounds of triple superphosphate or its equivalent. This should be followed by 100

pounds of triple superphosphate each year and 1 ton of ground limestone or 2,500 pounds of calcium silicate slag at 3- to 5-year intervals. The following mixture should be satisfactory: Bluegrass, 6 pounds; Orchard grass, 8 pounds; herd's-grass, 5 pounds; alsike, 3 pounds; white clover, 3 pounds; and common lespedeza, 10 pounds.

If productivity is low, lighter applications of superphosphate would be more beneficial until better soil structure and a higher content of organic matter have been obtained through the use of ground limestone and leguminous crops. Alexander (1) recommends the following mixture for soils of low fertility: Lespedeza, 10 to 15 pounds; herd's-grass, 2 to 3 pounds; and white clover, 2 to 3 pounds.

On areas that have been rather severely damaged by erosion, sericea lespedeza is excellent for so reconditioning the soil that it can be seeded to more palatable pasture plants.

Some of the soils of this group are well suited to the production of apples, and areas could be put to such use on a commercial scale, provided other factors besides soil are favorable. The soils suitable for apples include Fannin loam, hilly phase; Fannin stony loam, hilly phase; Fannin clay loam, eroded hilly phase; Fannin stony clay loam, eroded hilly phase; Hayesville loam; Hayesville clay loam, eroded phase; Porters-Balfour loams; Porters-Balfour loams, eroded phases; and Porters stony loam, hill phase.

The most desirable sites for apple orchards are on north- and northeast-facing slopes, which afford good air drainage. The Georgia Agricultural Experiment Station recommends the following varieties of apples as adapted to the soil and climate of this part of the State: Red June, Red Astrachan, Horse, Red Delicious, Kinnard, Stayman, Yates, and Terry (2). Others that might be used are the Pumpkin, Jumbo, and Sheep Nose varieties. Low-growing summer cover crops, such as lespedeza, soybeans, or cowpeas, should be grown on the land while the apple trees are young. These should be followed by winter cover crops of crimson clover, rye, or vetch to prevent excessive soil erosion and to gather up and conserve the nitrates that would otherwise be leached from the soil. The crimson clover and vetch also add to the supply of nitrogen in the soil. A 4-8-4 fertilizer in quantities of 1 pound for each young tree and 15 pounds for each large bearing tree is recommended.

Possibilities also exist for the production of bunch grapes on a commercial scale. Soils of this group suitable for grape production include those given for apple production and, in addition, Talladega loam, hilly phase, and Talladega clay loam, eroded hilly phase.

The Georgia Agricultural Experiment Station recommends at least 16 varieties of grapes for commercial production (3). The fertilization should include barnyard manure supplemented by 600 to 800 pounds an acre of 4-8-6 fertilizer. Cover crops similar to those recommended for apple orchards also should be included in the management practices for the production of grapes.

**SOILS POORLY SUITED PHYSICALLY TO TILLED CROPS AND PERMANENT PASTURE
BUT FAIRLY WELL SUITED TO FOREST**

A large part of the county is much better suited physically to forest than to crops or pasture, and most of the forest is on soils of this group. Like the soils suited physically to crops and pasture, the soils of the

group not so suited cannot everywhere be used for the purposes to which they are physically best suited. They differ widely in suitability for the production of forest. For example, Porters stony loam and Talladega stony loam are best suited physically to forest, but a much better forest can be expected to grow on the Porters soil than on the Talladega.

GROUP C-1

Group C-1 comprises all the Fifth-class soils in the county. The soils are very poorly suited physically to crops and very poorly to poorly suited to pasture. Their best use is for forest, and nearly all of each soil in this group is in this use.

Table 17 lists the soils of group C-1 according to similar use suitability and management requirements and gives the physical characteristics of each.

TABLE 17.—*Physical characteristics of group C-1 soils, poorly suited physically to tilled crops and permanent pasture but fairly well suited to forest and of similar use suitability and management requirements, Union County, Ga.*

Map symbol	Soil	Physical land class	Workability	Conservability	Productivity
Fce---	Fannin clay loam, severely eroded hilly phase.	Fifth ..	Poor.....	Very poor..	Very poor.
Hlz---	Hayesville loam, steep phase.	..do...	Fair.....	Poor.....	Poor.
Plr---	Porters loam, eroded phase.	..do...	..do.....	..do.....	Fair.
Ps----	Porters stony loam.....	..do...	Very poor	Fair.....	Poor.
Ra----	Ranger slate loam.....	..do...	Poor.....	Poor.....	Very poor.
RsP---	Rough stony land (Porters soil material).	..do...	Very poor.	Very poor	Do.
Tg----	Talladega loam.....	..do...	Poor.....	..do.....	Poor.
Tn----	Talladega stony loam.....	..do...	Very poor.	Poor.....	Do.
Ter----	Talladega clay loam: Eroded phase.....	..do...	..do.....	Very poor..	Very poor.
Tev---	Severely eroded hill phase.	..do...	Poor.....	..do.....	Do.

Fannin clay loam, severely eroded hilly phase, is too severely eroded for crop and pasture use. Hayesville loam, steep phase, is too steep and otherwise unsuitable for practical use as cropland and pasture land, although a small proportion is in these uses. Porters loam, eroded phase, is steep and has been damaged by accelerated erosion to the extent that it is suitable in most instances only for forest.

Porters stony loam, although one of the most extensive soils in the county, is generally suited only to forest because of steepness, stoniness, and shallowness to bedrock. Ranger slate loam is predominantly steep, although some areas have milder relief than Porters stony loam. It is subject to much erosion when cleared, shallow to bedrock in many places, and generally low in fertility. These characteristics limit the soil to use for forest in most places. Rough stony land (Porters soil

material) is very steep, having slopes of 60 percent or more. Rock outcrops and boulders and smaller loose rock fragments are abundant. Owing to the steepness, stoniness, and other unfavorable characteristics, the land is generally unsuitable for crops and pasture. Practically all of it is in forest inferior to that on Porters stony loam, although some good timber trees are grown.

Talladega loam is one of the most extensive soils in the county, and most of it is in forest. The soil is steep, relatively shallow to bedrock, easily eroded, and dries out soon after rain. Talladega stony loam, in addition to being stony, is steep, generally shallow to bedrock, and of low water-holding capacity. The external and internal characteristics of these two soils are generally unfavorable for crops and pasture. Talladega clay loam, eroded phase, is steep and moderately to severely eroded. All the soil has been cleared and cultivated at some time, but probably 90 percent of it is now either lying idle or has grown up with shortleaf pine; the rest is used for crops and pasture. Owing to steepness, shallowness, and erodibility, the soil is very poor cropland and poor to very poor pasture land. Talladega clay loam, severely eroded hill phase, although of somewhat milder relief than Talladega loam, has been eroded badly. All of it was once in crop or pasture use, but probably 90 percent of it either has been returned to forest or is idle land; the rest is used for crops and pasture. The soil has possibilities for crops and pasture if restored and properly managed, but its present eroded condition is unfavorable for such use.

Forests under the supervision of the United States Forest Service are protected from fires and are being developed according to a forest-management plan, by which the timber is cut in 30-year cycles. Forests controlled by individuals should be protected from fires, and the pastured areas should not be overgrazed. Wherever possible, forest should be established on badly eroded soils and abandoned fields.

Most of the forest management practices may be grouped as follows: (1) Maintenance of a full stand of species; (2) systematic cutting and weeding of trees; (3) harvesting the mature trees in such manner that desirable species may succeed them; and (4) the control, insofar as possible, of fires, browsing, trampling, and damage from the use of harvesting machinery and other causes. Practices in the first three groups are strictly of forest management, whereas those in the last group pertain also to soil management.

ESTIMATED YIELDS AND PRODUCTIVITY RATINGS

Average yields that may be expected from various crops are given for each of the soils of this county in table 18. For most of the crops three yields are given for each soil, representing expected average yields under three different kinds of treatment. Yields that may be expected vary widely, according to the way the soil and the crop are managed. Management differs greatly from farm to farm.

In this county only a fairly small percentage of land is producing crops without amendments. On the other hand, under prevailing practices at least 75 percent of the cultivated land receives light applications of fertilizer, and a fairly large total acreage has received one or more applications of ground limestone. A small percentage of the land used for cultivated crops or for pasture receives heavy applications of commercial fertilizer and lime.

TABLE 18.—*Expected average acre yields of the principal crops under each of three levels of management, Union County, Ga.*

[In columns A—without the use of manure, amendments, or beneficial crop rotation. In columns B—under the current practices of management, including light applications of commercial fertilizer and some ground limestone. In columns C—under the better practices of management, which include heavy applications of commercial fertilizer, winter cover crops, and green-manure crops in rotation with soil-depleting crops. Absence of yield figure indicates that the crop is not commonly grown because of poor adaptation.]

Soil (type, phase, complex, or land type)	Corn			Wheat			Rye			Lespedeza hay			Red clover hay			Potatoes		Snap beans		Permanent pasture ¹	
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	B	C	B	C	A	C
	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Tons	Tons	Tons	Tons	Tons	Tons	Bu.	Bu.	Bu.	Bu.	Cow- acres- days ²	Cow- acres- days ²
Alluvial soils, undifferentiated	8	14	32	6	10	15	6	10	15	0.8	1.0	1.5	0.5	0.9	1.5					50	80
Altavista clay loam, eroded phase	12	22	40	6	12	18	6	13	18	.7	1.2	1.8	.4	1.1	1.9	110	170	90	165	45	100
Altavista loam	13	25	45	8	12	18	8	13	18	.8	1.3	1.9	.4	1.2	2.0	100	150	105	180	55	110
Low-terrace phase ³	7	16	30	6	9	14	6	9	14	.5	.8	1.5	.3	.7	1.6	60	120	75	135	35	80
Slope phase	20	25	40	10	14	20	10	14	18	.9	1.3	1.8	.5	1.3	2.0	120	180	105	195	50	100
Balfour loam	18	20	35	9	12	17	9	12	16	.8	1.2	1.7	.4	1.2	1.8	100	160	90	180	45	95
Eroded phase	13	22	35	9	14	19	9	14	19	.7	1.1	1.5	.5	.9	1.5	120	180	105	189	70	95
Chewacla fine sandy loam	13	22	35	9	14	19	9	14	19	1.0	1.2	1.8		.8	1.6	110	160	105	195	80	110
Chewacla silt loam	15	25	42	10	12	18	10	15	20	.8	1.0	1.5		.7	1.4					60	100
Chewacla-Spilo silt loams	20	30	40	13	15	20	13	15	18	1.0	1.2	1.9	.7	1.2	1.9	110	170	105	195	60	100
Congaree fine sandy loam	30	35	55	13	16	22	13	14	20	1.2	1.4	2.0	.7	1.3	2.2	120	180	120	210	90	125
Congaree silt loam	35	40	60	13	16	22	13	14	20	1.3	1.5	2.1	.8	1.5	2.2	120	180	150	240	95	125
Dark-subsoil phase	8	15	28	5	8	13	5	8	13	.6	.9	1.6		.8	1.6	40	80	75	135	30	80
Edneyville stony fine sandy loam	10	18	38	6	11	15	7	12	16	.6	1.1	1.8		.9	1.7	90	150	90	165	35	85
Undulating phase	5	10		3	5		3	5		.4	.7	1.3	.2	.7	1.6					30	70
Fannin clay loam	10	12	30	5	9	12	5	9	14	.5	.8	1.6	.2	.7	1.7	40	90	90	165	35	85
Eroded hilly phase	12	15	35	6	10	14	6	10	15	.7	1.0	1.7	.3	.9	1.8	50	100	90	165	40	90
Eroded phase										.2	.4	1.0								15	45
Severely eroded hilly phase	15	20	35	7	12	18	8	13	18	.6	.9	1.7	.4	.8	1.8	60	100	105	180	40	85
Fannin loam	8	15	4	4	8		4	8		.6	.9	1.7	.3	.8	1.7					30	80
Hilly phase	15	22	40	8	13	20	8	13	20	.7	1.1	1.8	.4	1.1	1.9	50	100	105	180	40	90
Undulating phase	5	12		3	6		3	6		.5	.8	1.6	.1	.7	1.5					25	60
Fannin stony clay loam	10	13	30	5	9	12	5	9	14	.6	.9	1.6	.2	.7	1.6	40	90	90	165	30	80
Eroded hilly phase	15	20	35	7	12	18	8	13	18	.7	1.0	1.7	.4	.9	1.8	50	100	105	180	35	85
Eroded phase	7	13		4	6		4	6		.5	.9	1.6	.2	.8	1.7					30	70
Fannin stony loam	8	14		4	7	12	4	7	12	.4	.8	1.4	.3	.7	1.7					35	80
Hilly phase	15	18	35	8	13	18	8	12	15	.5	.9	1.7	.3	.8	1.8	50	100	90	165	40	90
Hayesville clay loam										.2	.5	1.1		.6	1.5					15	50
Eroded phase																					
Rolling phase																					
Severely eroded phase																					

See footnotes at end of table.

TABLE 18.—Expected average acre yields of the principal crops under each of three levels of management, Union County, Ga.—Continued

Soil (type, phase, complex, or land type) ¹	Corn			Wheat			Rye			Lespedeza hay			Red clover hay			Potatoes		Snap beans		Permanent pasture ¹	
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	B	C	B	C	A	C
	Bu	Bu.	Bu	Bu	Bu	Bu	Bu	Bu	Bu	Tons	Tons	Tons	Tons	Tons	Tons	Bu	Bu	Ru	Bu	Cow- acre- days ²	Cow- acre- days ²
Hayesville loam.....	10	16	40	5	8	15	5	8	15	0.5	0.9	1.7	0.3	0.8	1.8					35	90
Rolling phase.....	18	20		10	14	20	10	13	18	7	1.1	1.8	4	1.0	1.9	70	120	105	180	40	95
Steep phase.....																					
Undulating phase.....	20	23	45	10	15	20	10	13	18	8	1.2	1.9	4	1.2	2.0	80	140	105	180	50	100
Hiwassee loam.....	23	30	50	10	18	25	10	15	23	1.1	1.4	2.0	4	1.3	2.1	140	200	105	165	60	110
Eroded slope phase.....	20	25	40	8	15	20	8	13	18	9	1.3	1.9	5	1.2	2.0	80	150	90	180	45	95
Porters-Balfour loams.....	10	16		5	8	15	5	8	15	6	1.0	1.8	4	1.0	1.9					40	90
Eroded phases.....	6	14		4	7	12	4	7	12	5	9	1.7	3	8	1.8					40	90
Porters loam.....																				35	75
Eroded phase.....																				35	75
Porters stony loam.....																				35	75
Hill phase.....										5	9	1.7	3	8	1.8					35	75
Rabun clay loam, hill phase.....	15	25	35	9	13	15	9	13	15	7	1.1	1.9	5	1.1	2.0	100	160	90	180	55	105
Ranger slate loam.....																					
Rough stony land (Porters soil material).....																					
Spilo silty clay loam ²	10	15	30	5	6	10	8	10	18	6	1.0	1.4								40	80
State silt loam.....	25	35	55	10	18	25	10	15	23	1.1	1.4	2.0	6	1.3	2.2	140	200	120	210	90	120
Stony colluvium (Fannin and Hayesville soil materials).....																					
Talladega clay loam.....																				30	50
Eroded hilly phase.....										3	7	1.1								25	40
Eroded phase.....																				20	35
Eroded rolling phase.....	8	15	25	5	8	10	5	9	12	4	8	1.3								25	60
Severely eroded hill phase.....																					
Talladega loam.....																				15	45
Hilly phase.....										4	7	1.2								20	65
Rolling phase.....	8	15	25	5	9	11	5	10	13	6	9	1.5								25	70
Talladega stony loams.....																				15	30
Tate-Chewacla silt loams.....	17	25	45	9	15	20	9	15	20	1.0	1.3	1.9	5	1.2	2.0	110	170	90	180	70	100
Tate silt loam.....	15	23	40	8	13	18	8	13	18	9	1.1	1.8	5	1.2	1.9	120	180	90	165	50	95
Toxaway silt loam ³	25	35	55	8	12	18	9	15	22	1.2	1.5	2.1	2	1.0	2.0	140	200	150	240	90	125
Transylvania silt loam.....	30	40	60	13	16	22	13	15	22	1.2	1.5	2.1	7	1.4	2.2	120	180	150	240	95	125
Transquite loam.....	25	35	55	10	18	25	10	15	23	1.1	1.4	2.0	6	1.2	2.2	140	200	120	210	90	120
Warne-Worsham loams.....	10	15	30	6	9	13	6	11	18	6	9	1.5								45	85
Slope phase.....	8	12	25	5	8	10	6	9	15	5	.8	1.4								45	80

¹ The carrying capacity of pasture land is indicated only for columns A and C, figures in column A represent the carrying capacity of pasture land that has received no amendments, and those in column C represent the carrying capacity of pasture land treated with heavy applications of commercial fertilizer and lime.

² Cow-acre-days, used to express the carrying capacity of pasture land, is the product

of the number of animal units carried per acre multiplied by the number of days that animals can be grazed without injury to pasture, for example, a soil that supports 1 animal unit per acre for 360 days rates 360, a soil supporting 1 animal unit on 2 acres for 180 days rates 90, and a soil supporting 1 animal unit on 4 acres for 100 days rates 25.

³ Yields are for crops produced on artificially drained areas of this soil.

Because of the wide differences in cropping practices, three different expected yields are given in table 18 for each general farm crop. The first (column A) is the average yield that might be expected without the aid of soil amendments and without the use of other measures to restore, maintain, or increase productivity. The second (column B) is the average yield likely to be obtained under the common practices of management, which include mainly the use of some commercial fertilizer and lime. The third (column C) is the average expected yield for crops grown on soils managed according to the better practices, which include proper choice and rotation of crops; growing legumes, winter cover crops, and green-manure crops; heavy applications of commercial fertilizer and ground limestone; proper tillage methods; and, where needed, engineering measures for the control of water on the land. For potatoes and snap beans, yields are given only in columns B and C, as these crops are rarely if ever grown without at least some fertilizer.

A considerable part of the land used for permanent pasture has not received amendments, but small acreages have received heavy applications of both lime and commercial fertilizer. The yields on the various soils, therefore, represent those for permanent pasture not receiving amendments and those for permanent pasture receiving heavy applications of amendments.

The inherent fertility of nearly all the soils is low, when judged by some of the better soils used elsewhere for the production of similar crops. The general level of productivity of most of the soils is too low to return satisfactory yields without amendments, and the crops produced without amendments are subject to other adverse conditions. The yields given in columns A in table 18 are therefore less reliable than those in columns B, which represent largely yields obtained under the current practices.

The expected average crop yields in table 18 are based on information obtained from (1) unit-demonstration farmers and other farmers in the county, (2) the county agent and his assistant, and (3) State agricultural workers. These data were supplemented by experiences of farmers on similar soils in Towns County, Ga., the adjoining county to the east; and by observations made during the course of the survey of crops on the various soils. In general these yields represent the relative ability of the various soils to produce crops under physically defined systems of management but they must not be considered final, because the basic data were not complete. In the case of some crops infrequently grown, especially on some of the minor soils, the estimates were based largely on crop yields obtained on similar soils and under corresponding conditions of climate and management.

Although present knowledge about good management required by specific soils for specific crops is limited, some of the deficiencies of the soils are known with reasonable certainty and others are considered probable. From this knowledge, some of the requirements for good management are discussed under the individual soil types and phases in the section on Soils and in the section on Land Use and Soil Management.

It must be remembered that, just as the requirements of different crops on the same soil are different, so also are the requirements of the same crop on different soils. Moreover, the point at which it is no longer profitable for a farmer to intensify management depends not only on the soil and the crop but on prices, costs, and changes in technology. Practical limits to good management, therefore, are not defined rigidly in this report, both because of lack of knowledge and the inconstancy of such limits.

It is difficult to define rigidly what constitutes good management for each soil and crop. Furthermore, data on crop yields obtained under good management conditions are scarce. The expected yield estimates shown in columns C of table 18, therefore, are based largely on the best judgment of men who have had experience with the soils and crops and who are in good position to estimate the increased yield the crops could be expected to make if known soil deficiencies were corrected. They are, of course, subject to the deficiencies in knowledge and shortcomings in judgment inherent in the nature of an estimate.

The yields listed in columns C may be generally reached by feasibly good practices of management. Some one of these practices may supplement or replace another; others are essential. The best choice depends on the farm business as a whole. On one farm it may be practical to manage the soil so that the yields exceed the goal; on others it may not be practical to reach it. The best practical management for a farm unit may give yields in excess of the goal for one crop and soil and below the goal for another crop on the same soil. The yields in columns C, when compared with those in columns A and B, give some idea of the responses that may be expected from good management.

The expected yields of various crops grown on the soils of this county, converted into indexes, and the grouping of the soils according to their physical suitability for use are shown in table 19. The rating compares the productivity of each of the soils for each crop to a standard—100. This standard index represents what would be considered a good average yield in the better areas of production, taking the United States as a whole. An index of 50 indicates that the soil is about half as productive of the specified crop as the soil with the standard index. Soils given amendments, such as lime or commercial fertilizer, or unusually productive soils may have productivity indexes of more than 100 for some crops.

The indexes in the productivity rating table are the expected yields shown in table 18 expressed as percentages of the standard yields adopted for the Nation as a whole

$$\left(\text{productivity rating index} = \frac{\text{expected yield}}{\text{standard yield}} \times 100 \right).$$

The standard yields on which the indexes are based are stated in the table under the names of the crops for which the ratings are given. Columns A, B, and C under each crop refer to three levels of management and correspond to similar columns in table 18, for which the levels of management are defined.

TABLE 19.—*Productivity ratings of the soils under 3 levels of management for the crops most commonly grown and the physical land classification* ¹ *of the soils of Union County, Ga.*

[Indexes refer to yields to be expected—in columns A, without the use of manure, amendments, or beneficial crop rotation, in columns B, under the current practices of management, including light applications of commercial fertilizer and some ground limestone, and in columns C, under the better practices of management, including heavy applications of commercial fertilizer, winter cover crops, and green-manure crops in rotation with soil-depleting crops]

FIRST-CLASS SOILS—VERY GOOD TO EXCELLENT FOR AGRICULTURE, GOOD TO EXCELLENT CROPLAND, VERY GOOD TO EXCELLENT PASTURE LAND

Soil (type, phase, complex, or miscellaneous land type)	Crop productivity index ² for—																				
	Corn (100=50 bu.)			Wheat (100=25 bu.)			Rye (100=25 bu.)			Lespedeza hay (100=1.5 tons)			Red clover hay (100=2 tons)			Potatoes (100=200 bu.)		Snap beans (100=300 bu.)		Perma- nent pas- ture ³ (100= 100 cow- acre- days) ⁴	
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	B	C	B	C	A	C
Congaree silt loam.....	60	70	110	50	65	90	50	55	80	80	95	135	35	65	110	60	90	40	70	90	125
Dark-subsoil phase.....	70	80	120	50	65	90	50	55	80	85	100	140	40	75	110	60	90	50	80	95	125
Transylvania silt loam.....	60	80	120	50	65	90	50	66	90	80	100	140	35	70	110	60	90	50	80	95	125
Congaree fine sandy loam.....	40	60	80	50	60	80	50	60	70	65	80	125	35	60	95	55	85	35	65	60	100
State silt loam.....	50	70	110	40	70	100	40	60	90	75	95	135	30	65	110	70	100	40	70	80	120
Toxaway silt loam ⁵	50	70	110	30	50	70	35	60	90	80	100	140	10	50	100	70	100	50	80	90	125
Hwassee loam.....	45	60	100	40	70	100	40	60	90	75	95	135	20	65	105	70	100	35	55	60	110
Tusquitee loam.....	50	70	110	40	70	100	40	60	90	75	95	135	30	60	110	70	100	40	70	90	120

See footnotes at end of table.

TABLE 19.—*Productivity ratings of the soils under 3 levels of management for the crops most commonly grown and the physical land classification*¹ of the soils of Union County, Ga.—Continued

SECOND-CLASS SOILS—GOOD TO VERY GOOD FOR AGRICULTURE, FAIR TO GOOD CROPLAND, GOOD TO VERY GOOD PASTURE LAND

Soil (type, phase, complex, or miscellaneous land type)	Crop productivity index ² for—																				
	Corn (100=50 bu.)			Wheat (100=25 bu.)			Rye (100=25 bu.)			Lespedeza hay (100=1.5 tons)			Red clover hay (100=2 tons)			Potatoes (100=200 bu.)		Snap beans (100=300 bu.)		Perman-ent pas-ture ³ (100=100 cow-acre-days) ⁴	
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	B	C	B	C	A	C
Chewacla silt loam.....	30	50	85	40	50	70	40	60	80	65	80	120	40	80	120	55	80	35	65	80	110
Chewacla fine sandy loam.....	25	45	70	35	55	75	35	55	75	45	75	100	25	45	75	60	90	35	60	70	95
Tate-Chewacla silt loams.....	35	50	90	35	60	80	35	60	80	65	85	125	25	60	80	55	85	30	60	70	100
Tate silt loam.....	30	45	80	30	50	70	30	50	70	60	75	120	25	60	95	60	90	30	55	50	95
Hiwassee loam, eroded slope phase.....	40	50	80	30	60	80	30	50	70	60	85	125	25	60	80	40	75	30	60	45	95
Balfour loam.....	40	50	80	40	55	80	40	55	70	60	85	120	25	65	100	60	90	35	65	50	100
Hayesville loam:																					
Undulating phase.....	40	45	90	40	60	80	40	50	70	55	80	125	20	60	100	40	70	35	60	50	100
Rolling phase.....	35	40	80	40	55	80	40	50	70	45	75	120	20	50	95	35	60	35	60	40	95
Hayesville clay loam, rolling phase.....	30	35	70	30	50	70	30	50	60	35	60	115	15	40	90	25	50	30	55	40	90

Fannin loam, undulating phase	30	45	80	30	50	80	30	50	80	45	75	120	35	55	90	25	50	35	60	40	90
Fannin loam	30	40	70	30	50	70	30	50	70	40	60	115	20	40	90	25	50	35	60	40	85
Fannin clay loam, eroded undulating phase	25	30	70	25	40	55	25	40	60	45	65	115	15	45	90	25	50	30	55	40	90
Fannin stony loam	30	40	70	30	50	70	30	50	70	45	65	115	20	45	90	25	50	35	60	35	85
Altavista loam	25	45	80	25	50	70	25	50	70	45	80	120	20	55	95	55	85	30	55	45	100
Low-terrace phase ⁵	25	50	90	30	50	70	30	50	70	55	85	125	20	60	80	50	75	35	60	55	110
Edneyville stony fine sandy loam, undulating phase	20	35	75	25	45	60	30	50	65	40	75	120	---	45	85	45	75	30	55	35	85
Balfour loam, eroded phase	35	40	70	35	50	70	35	50	65	55	80	115	20	60	90	50	80	30	60	45	95

THIRD-CLASS SOILS—FAIR TO GOOD FOR AGRICULTURE, POOR TO FAIR CROPLAND, FAIR TO GOOD PASTURE LAND

Altavista clay loam, eroded phase	15	30	65	25	40	60	25	40	60	40	65	105	10	45	85	35	70	25	45	40	90
Altavista loam, slope phase	15	30	60	25	35	55	25	35	55	35	55	100	15	35	80	30	60	25	45	35	80
Spilo silty clay loam ⁵	20	30	60	20	25	40	30	40	70	40	65	95	---	---	---	---	---	---	---	40	80
Warne-Worsham loams	20	30	60	25	35	50	25	45	70	40	60	100	---	40	70	---	---	---	---	45	85
Slope phases	15	25	50	20	30	40	25	35	60	35	55	95	---	40	65	---	---	---	---	45	80
Fannin clay loam, eroded phase	20	25	60	20	35	50	20	35	55	35	55	105	10	35	85	20	45	30	55	35	85
Fannin stony clay loam, eroded phase	20	25	60	20	35	50	20	35	55	40	60	105	10	35	80	20	45	30	55	30	80
Edneyville stony fine sandy loam	15	30	55	20	30	50	20	30	50	40	60	105	---	40	80	20	40	25	45	30	80
Talladega loam, rolling phase	15	30	50	20	35	45	20	40	50	40	60	100	---	---	---	---	---	---	---	25	70

See footnotes at end of table.

TABLE 19. — *Productivity ratings of the soils under 3 levels of management for the crops most commonly grown and the physical land classification*¹ of the soils of Union County, Ga. — Continued

FOURTH-CLASS SOILS—POOR TO FAIR FOR AGRICULTURE, VERY POOR TO POOR CROPLAND, FAIR TO VERY GOOD PASTURE LAND

Soil (type, phase, complex, or miscellaneous land type)	Crop productivity index ² for—																					
	Corn (100=50 bu.)			Wheat (100=25 bu.)			Rye (100=25 bu.)			Lespedeza hay (100=1.5 tons)			Red clover hay (100=2 tons)			Potatoes (100=200 bu.)		Snap beans (100=300 bu.)		Permanent pasture ³ (100=100 cow-acre-days) ⁴		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	B	C	B	C	A	C	
Chewacla-Spilo silt loams.....	-----	-----	-----	-----	-----	-----	-----	-----	-----	45	65	100	-----	35	70	-----	-----	-----	-----	-----	60	100
Alluvial soils, undifferentiated.....	-----	-----	-----	-----	-----	-----	-----	-----	-----	55	65	100	25	45	75	-----	-----	-----	-----	-----	50	80
Stony colluvium (Fannin and Hayesville soil materials).....	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	30	50
Hayesville loam.....	20	30	-----	20	30	60	20	30	60	35	60	115	15	40	90	-----	-----	-----	-----	-----	35	90
Hayesville clay loam, eroded phase.....	10	30	-----	15	30	50	15	30	50	25	55	95	15	35	85	-----	-----	-----	-----	-----	35	80
Porters-Balfour loams.....	20	30	-----	20	30	60	20	30	60	40	65	120	20	50	95	-----	-----	-----	-----	-----	40	90
Eroded phases.....	10	30	-----	15	30	50	15	30	50	35	60	115	15	40	90	-----	-----	-----	-----	-----	40	90
Porters loam.....	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	35	75
Porters stony loam, hill phase.....	-----	-----	-----	-----	-----	-----	-----	-----	-----	35	60	115	15	40	90	-----	-----	-----	-----	-----	35	75
Rabun clay loam, hill phase.....	30	50	70	35	50	60	35	50	60	45	75	125	25	55	100	50	80	30	60	55	105	
Fannin loam, hilly phase.....	15	30	-----	15	30	-----	15	30	-----	40	60	115	15	40	85	-----	-----	-----	-----	-----	30	80
Fannin clay loam, eroded hilly phase.....	10	20	-----	10	20	-----	10	20	-----	25	45	85	10	35	80	-----	-----	-----	-----	-----	30	70

The ratings or the estimated average expectable yields cannot be interpreted directly into land values. Distance to market, relative prices of farm products, association with other soils of different use suitability, and many other factors influence land values. The ratings are designed to compare the productivity for specific crops of (1) different soils within the county and (2) soils of this county with some of the better soils of the United States.

WATER CONTROL ON THE LAND

Water control on the land includes the following practices for maintaining favorable soil-moisture conditions for plant growth: (1) Regulation of runoff, (2) protection from floods, (3) drainage, and (4) irrigation.

Irrigation is little used in this county at present, although in dry seasons it doubtless would increase crop production on many soils. Its use to supplement rainfall might prove economical under some conditions, especially on gardens and on small tracts of truck and other high-value crops.

Little has been done to protect land from floods, despite the considerable damage that has resulted from overflow of streams. Most floods occur early in spring before crops are on the land. Flooding therefore is not so serious a problem here as on lands farther from the source of the streams.

Ditches have been used to drain some poorly drained soil, but little tiling has been done. Artificial drainage is a minor problem on most farms.

The major problem is concerned with maintenance of the most favorable soil-moisture conditions for plants through the regulation of runoff. Many of the soils are of such nature that the runoff is too swift for them to absorb a sufficient supply of moisture. Many of these soils are capable of improvement, however, by so regulating the runoff that they can absorb more moisture for plant use.

Two undesirable results may be directly caused by too rapid runoff: (1) Loss of water that could have been useful to plants and (2) loss of soil material. Loss of water always results; loss of soil material may or may not accompany such loss. Of the two, the loss of soil material is the most apparent, because it leaves the soil in an eroded condition, and its visible effects are generally cumulative.

Since runoff is the common agent of soil and water loss, conservation of both water and soil may be accomplished through the proper control of water on the land.

Water is a natural resource to be utilized on the land as well as in the streams. It is necessary for plant growth, and even in an area of high rainfall, as the one in which this county is situated, lack of water is commonly a limiting factor in the growth of plants during certain periods of the year. Any measures that bring about a more nearly adequate and even supply of water during the growing season will promote increased production of the plants on which people on the land depend for their livelihood.

Effective use of water by plants may be limited by other factors of crop production, and in this county one of the major limiting factors is the supply of mineral plant nutrients in the soil. If the water that

falls on the land is to be used most effectively by plants, enough must remain in the soil to meet the needs of the plants, an adequate supply of plant nutrients must be available, the physical condition of the soil must be favorable to the development of plant roots, and plant diseases and destructive insects must be controlled.

Vegetation retards runoff in proportion to its denseness and its ability to condition the soil to absorb and retain water. In addition the vegetative cover and its debris and root system materially lessen the loss of soil by impeding runoff and binding the soil particles. Forests are effective agents in reducing the loss of water and soil, as also are such sod-forming crops as hay, pasture grasses, and some legumes. Close-growing crops, as small grains, are somewhat less effective than sod-forming crops, and intertilled crops are generally the least effective.

Several soil characteristics have a direct bearing on the problem of runoff control. Of these, slope is of outstanding importance. If the other soil characteristics are similar, the soils having a steep slope are the most susceptible to damage by runoff, and their suitability for agricultural use is the most restricted; whereas those having a moderate slope or nearly level relief are the least susceptible to such damage, and in general their suitability for agricultural use is restricted the least. Other characteristics of the soil that have an important bearing on the problem of runoff control are consistence, texture, and depth to bedrock.

In general, soil use and crop rotations should be so adjusted that the soils will be protected by a vegetative cover from damage by runoff. This cover should be determined by the volume and rapidity of the runoff as well as by the physical characteristics of the soil.

To be most effective the vegetative cover on cropland and pasture land should be of vigorous growth. Applications of lime, manure, and fertilizer in suitable quantities and the use of legumes in the crop rotations will promote vigorous plant growth and thereby help control runoff. Agricultural lime supplies the plant nutrient calcium and adjusts the acidity of the soil. Manure supplies nitrogen, potash, and organic matter and aids in keeping the soil in good physical condition. Mineral fertilizer supplies nitrogen, phosphorus, and potash and may furnish minor nutrient elements as well. Legumes, if properly inoculated, fix nitrogen obtained from the air; their roots add organic matter to the soil; and the plants thus aid in maintaining the soil in good physical condition. Such practices are desirable not only in the control of runoff but in the effective use of water in the soil for the production of crops.

The soil should be so tilled that it will retard runoff and absorb water and at such times and in such manner as to be bare of vegetation for as brief a period as possible. Contour tillage is desirable on many slopes, as it impedes runoff. Contour strip cropping may be desirable on the steeper slopes and is generally most feasible and most desirable on long slopes.

Engineering measures for the control of runoff are commonly expensive. Terraces must be maintained in good condition to be effective, as poorly kept terraces may be worse than none. Under certain conditions they have a place in the control of runoff but are

to be employed only when other measures, consisting essentially of good soil management for good production, are inadequate.

Like all other soil-management practices, the practices for water control depend not only on the soil but on conditions peculiar to each farm unit. Each farmer should choose the combination of practices that will meet the requirements of his farm unit and provide the maximum degree of control his circumstances permit. He should choose practices that will provide the proper medium for plant growth and the plant nutrients necessary for efficient use of the water conserved. Runoff is effectively controlled on many farms and may be obtained on many more by sound soil-management practices.

The control of water on the land is not an isolated problem. It involves all the practices of good soil management that would ordinarily be considered necessary for successful crop production. Such control, therefore, is a part of successful crop production. It may be accomplished largely through good farming practices, including choice and rotation of crops, proper fertilization and tillage, control of plant diseases and destructive insects, and in some places engineering measures (pl. 4).

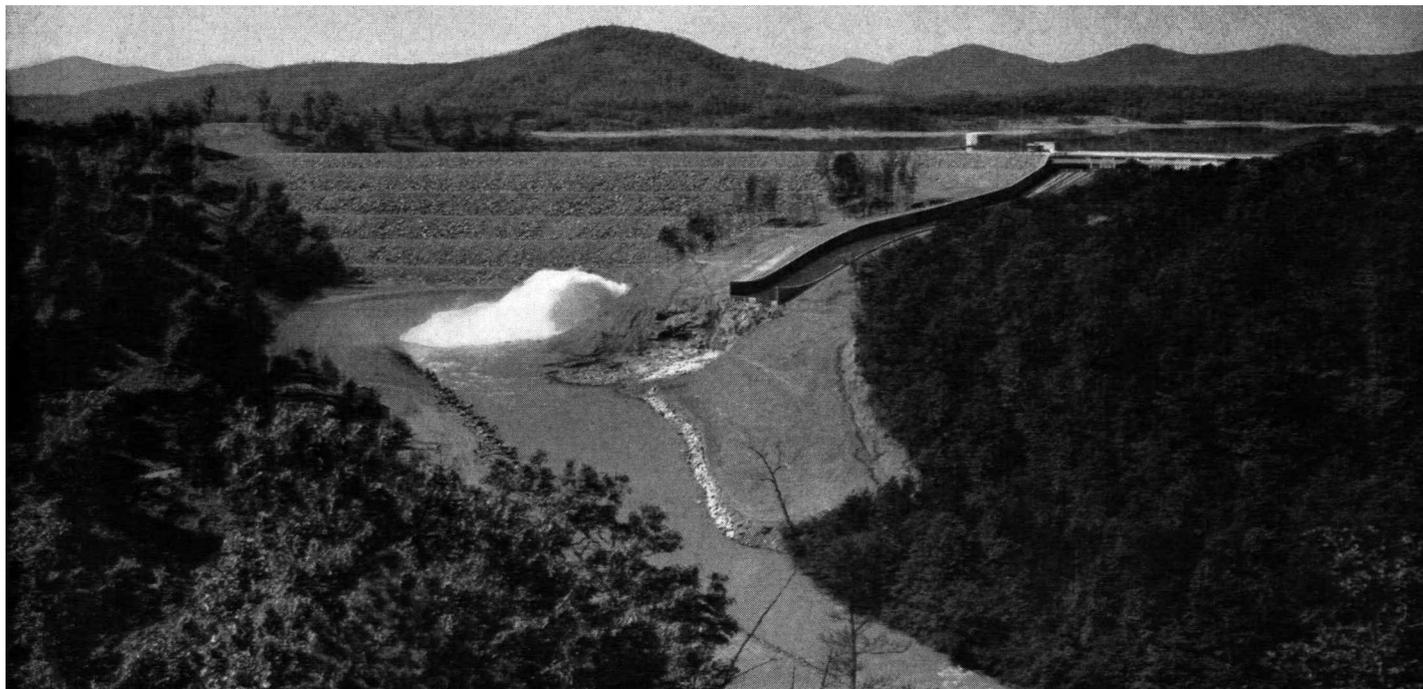
MORPHOLOGY AND GENESIS OF SOILS

A study of the morphology and genesis of soils involves consideration of (1) factors of soil formation that have contributed to their similarities and differences, (2) the natural classification of the soils, and (3) the characteristics of the soil series.

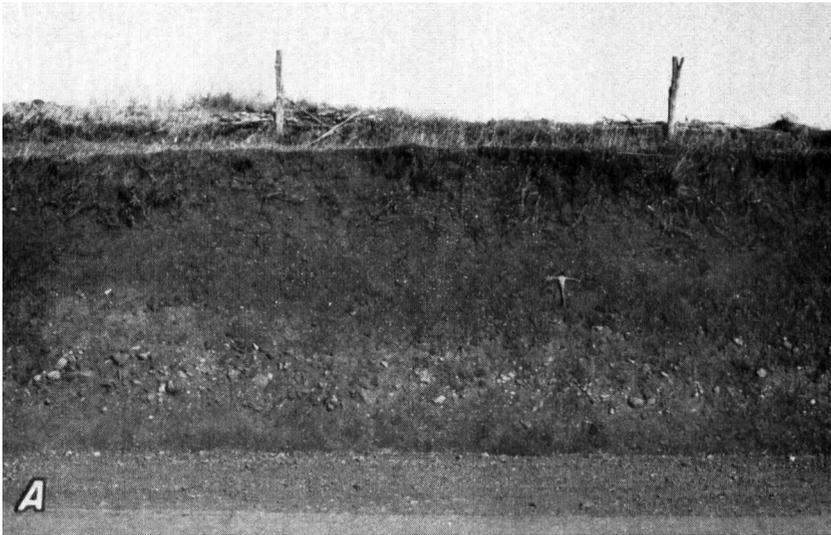
FACTORS OF SOIL FORMATION

Soil is the product of the forces of weathering and soil development acting on the parent material deposited or accumulated by geologic agencies. The characteristics of the soil at any given point depend on (1) the physical and mineralogical composition of the parent material; (2) the climate under which the soil material has accumulated and has since existed; (3) the biological activities in and on the soil; (4) relief, or lay of the land; and (5) the length of time the forces of development have acted on the material. The climate and its influence on soil and plants depend not only on temperature, rainfall, and humidity but also on the physical characteristics of the soil or soil material and on the relief, which, in turn, strongly influences drainage, aeration, runoff, erosion, and exposure to sun and wind.

Climate and biological forces change the parent material from an inert heterogeneous mass to a body having more or less definite genetic morphology. Their action on the parent material is aided or hindered to varying degrees by the relief, which determines to some extent runoff, the movement of water through the soil, natural erosion, and the native vegetation. The character of the parent material also aids climate and vegetation in soil formation and is important in determining the kinds of native vegetation. Throughout the genesis of soil, time brings about changes; hence, age is a factor in the development of the soil into a body in equilibrium with its environment. The degree of soil development depends not only on time but on the rate at which the forces of climate and vegetation act, which, in turn, are regulated by the character of the relief and parent material.



Nottely Dam, an earth structure impounding a reservoir of about 4,290 acres, was built by the Tennessee Valley Authority for controlling stream flow on Nottely River, in Union County, Ga.



A, Deep profile of Hiwassee loam south of Blairsville, Ga., where U. S. Highway No. 19 crosses the Nottely River. Stratified gravel occurs at a depth of 7 feet.
B, Granite and gneiss, showing many quartz veins. This parent rock generally underlies both the Porters and Hayesville soils and is weathered more deeply under the Hayesville than under the Porters. Rock outcrops are numerous on Rough stony land (Porters soil material), and some outcrops occur on the Porters soils.

The parent material of the soils of this county consists of two classes, based on its source—(1) residual material derived from the decomposition of rocks in place and (2) transported material or material removed from its original position and deposited at the foot of slopes, on valley uplands, and near streams. The first class consists of weathered products of the underlying rocks; the second, of rock fragments and other rock waste and soil material moved by gravity and water from the uplands and deposited at the foot of slopes and of alluvial material derived from the uplands and deposited near streams by running water. The material of the first class is related directly to the underlying rocks from which it was formed, and that of the second class to the soils or rocks from which it was removed.

Igneous and metamorphic rocks have given rise to the parent material. These rocks differ somewhat in chemical and mineralogical composition, and the parent material derived from them differs likewise. Sufficient study of the rocks has not been made to compare differences in their mineralogical and chemical composition with differences in the resultant soils. It is probably true, however, that local differences among most soils developed from the residuum of rocks in place may be attributable to differences in the mineral composition of the rocks. Yet in some places within the county the same kind of rock underlies different kinds of soils, and here the differences in the soils are the result of other causes.

Although many of the characteristics of soils can be correlated with the kinds of parent material, some, especially those of regional significance to soil genesis, are due to other factors.

Climate in the valleys differs from that on the mountains. It is characterized by long moderately warm summers, short mild winters, and moderately high rainfall. As moderately warm weather prevails and the soil is moist most of the time, chemical reactions are rapid. The large volume of rainfall has caused leaching of soluble materials, as bases, from the soil and also the removal of less soluble materials and colloidal matter downward in the soil. The soil is frozen for only short periods and to shallow depths, and this condition intensifies the action of weathering and the translocation of insoluble materials within the soil.

The climate of the mountains is characterized by somewhat lower temperatures than that of the valleys. This difference probably somewhat retards chemical reactions that cause leaching of the soils on the mountains. The soil is frozen longer and to greater depths than in the valleys; hence, leaching is somewhat less active.

In general the climatic conditions in the valleys give rise to Red and Yellow Podzolic soils, whereas those on the mountains give rise to predominantly Gray-Brown Podzolic soils.

Within any climatic zone certain outstanding characteristics are common to the well-drained, well-developed soils, but the soils differ in other characteristics that may be due to factors other than climate. The character of the parent material seems to have been an outstanding cause in bringing about the differences. A large part of the county has a climate that is marginal between the characteristic climate of the Red and Yellow Podzolic region and that of the Gray-Brown Podzolic region; consequently, Red Podzolic, Yellow Podzolic, and Gray-Brown Podzolic soils are closely associated, and differences

caused by parent material, drainage, and age are important in determining the great soil group to which many of them belong.

Higher plants, micro-organisms, earthworms, and other forms of life that exist on and in the soil contribute to its morphology. The nature of the changes brought about by these depends, among other things, on the kinds of life and the life processes peculiar to each. The kinds of plants and animals are determined by climate and many other factors of environment. Climate is the most apparent but not the most important determinant of the kinds of higher plants that grow on the well-developed, well-drained soils, and in this indirect way it greatly influences the morphology of the soils. Hence, climate and vegetation together constitute the active factors of soil genesis.

A forest consisting largely of deciduous trees originally covered the territory in which this county is situated. An undergrowth of bushes and various shrubs and smaller plants was present in many places. Practically all the original forest has been removed for timber, and the present stand consists of second-growth trees, some original trees, and an understory of various plants.

Many of the trees of the present forest are moderately deep feeders and shed their leaves annually. Although the content of plant nutrients in the leaves has a considerable range, the quantity of bases and phosphorus returned to the soil is generally high compared with that returned by the leaves of conifers. Essential plant nutrients are thus translocated to the upper part of the soil from the lower, and the organic matter that accumulates in the soil impedes soil depletion by retarding the action of percolating water. It is probable that such retardation is more effective in the valleys than on the mountains and that it tends to counterbalance the effects of the rapid rock weathering and soil leaching.

Much organic matter accumulates in the upper part of the soil from the decay of leaves, twigs, roots, and some entire plants. This material is acted on by micro-organisms, earthworms, and other life, and chemical reactions directly result. The organic material, it seems, decomposes more slowly on the mountains than in the valleys, with the result that some soils on the higher mountains accumulate more organic matter than comparable soils in the valleys.

The decomposition of the organic material releases organic acids, which promote the solution of slowly soluble constituents and also the leaching and translocation of inorganic materials. The intensity of the results, however, is conditioned by the climate, as it affects the kinds of vegetation, the kinds of micro-organisms, and the rates of reactions and leaching.

The relief ranges from nearly level in first bottoms near streams to very steep in the mountainous districts. It modifies the effect of climate and vegetation. On some steep slopes the runoff may be great; hence, geologic erosion is rapid and keeps almost even pace with rock weathering and soil formation. As material for soil formation is constantly being removed from these steep places by water or is being mixed by local slides, enough of it seldom remains in place a sufficient time for a profile of genetically related horizons to form. Only small quantities of water percolate through the soil, and leaching and translocation of insoluble materials downward in the soil are correspondingly small. The vegetative stands are generally thinner than on soils hav-

ing better moisture relations. In many places soil on the concave slope has a more nearly complete profile development than that on the convex slope, geologic erosion is apparently slower, and the moisture relations are more conducive to the growth of dense stands of vegetation.

Soil material that has been in place for a short time has been altered too little by climate and vegetation for a well-defined soil profile of genetically related horizons to be formed. Most of the soils on the first bottoms along streams are of such character. Soil material on steep slopes is replenished by rock weathering as the soil cover is removed by geologic erosion, and here very little opportunity is afforded for the formation of the genetic soil profile. These two broad classes of soil comprise the young or very young soils. Soil material that has been in place for a long time will, under favorable conditions of relief and other factors of soil genesis, develop into a soil which, when it has reached approximate equilibrium with its environment, is considered mature or old. The soils range from very young to very old, but over a large part of the county they are very young and young.

CLASSIFICATION OF SOILS

Soils are classified on the basis of characteristics that will enable one to remember them and their relations. On the other hand, they may be classified on such bases as need of lime, ease of tillage, or productivity. Rarely, however, is a classification suitable for more than one use, that is to aid in solving special problems involving certain soils. This section deals with natural classification based on characteristics and is presented in order that the soils may be remembered through their characteristics and that the solution of problems concerning them may be facilitated.

In soil classification the simplest unit is the soil phase, which has the narrowest range in all observable characteristics, both external and internal. It is the unit concerning which the greatest number and most precise statements can be made.

Soil types that have layers, or horizons, similar in such characteristics as color, thickness, and arrangement but that differ in texture and associated characteristics, as consistence, are grouped in series. In general, differences in the texture of soil types of the same series are reflected in all the layers of the profile, but the types are defined in terms of the texture of the surface layers. Fewer and less specific statements can be made regarding the soil series as a whole than regarding any of its types, except where there is only one type in the series.

Soil series may be grouped in higher categories, the highest of which is called the soil order. There are three soil orders—zonal, intrazonal, and azonal.

A classification of the soil series of this county according to soil orders and great soil groups as well as some of the factors contributing to the morphology of the soils are given in table 20. It is realized that the classification of soil series in higher categories is incomplete and that such classification is subject to revision as knowledge of the series and their relations increases.

TABLE 20.—*Classification of the soil series of Union County, Ga. in higher categories, and some of the factors that have contributed to the morphology of the soils*

ZONAL SOILS

Great soil group and soil series	Parent material	Relief	Internal drainage
Red Podzolic:	Residuum from the weathering of—		
Hayesville.....	Granite gneiss.....	Undulating to steep....	Medium.
Fannin.....	Micaceous schist.....	Undulating to hilly....	Medium to rapid.
Rabun.....	Hornblende gneiss mixed in places with biotite schist and granite gneiss.	Rolling to hilly.....	Medium.
Hiwassee.....	Old alluvium consisting of materials derived from uplands underlain principally by granite gneiss and schist.	Gently sloping to strongly sloping.	Do.
Talladega ¹	Residuum from the weathering of micaceous schist.....	Hilly to steep.....	Medium to rapid.
Yellow Podzolic:			
Altavista.....	General alluvium consisting of materials derived from uplands underlain by granite gneiss and schist.	Nearly level to strongly sloping.	Slow to very slow.
Worsham ²	Residuum from the weathering of— Granite and gneiss, in places, local alluvial and colluvial materials.	Very gently sloping to strongly sloping.	Do.
Gray-Brown Podzolic:			
Balfour.....	Chiefly granite gneiss.....	Undulating to rolling....	Medium.
Edneyville.....	Schists of high quartz content, or schists containing pegmatite or granite gneiss.	Gently undulating to rolling.	Medium to slow.
Tusquitee.....	Colluvium and local alluvium consisting of material derived from uplands underlain by— Mainly granite gneiss.....	Very gently sloping to moderately sloping.	Medium.
Tate.....	Micaceous schist and granite gneiss.....	Nearly level to gently sloping.	Medium to slow.
State.....	General alluvium consisting of materials derived from uplands underlain by granite gneiss and micaceous schist.	Nearly level to very gently sloping.	Medium.

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Porters ¹	Residuum from the weathering of— Granite gneiss.....	Steep to very steep....	Do.
Ranger ¹			

INTRAZONAL SOILS

Planosols:	General alluvium consisting of materials derived from uplands underlain by— Granite gneiss and schist.....	Very gently sloping to strongly sloping.	Slow to very slow.
Warne.....			

AZONAL SOILS

Alluvial soils:	General alluvium consisting of materials derived from uplands underlain by— Granite gneiss, micaceous schist, and to a less extent by basic and subbasic metamorphic rocks. Granite gneiss and micaceous schist..... Principally micaceous schist..... Granite gneiss and micaceous schist..... Micaceous schist and granite gneiss.....	Level or nearly level... .....do..... .....do..... .....do..... .....do.....	Medium. Medium to rather slow. Slow to very slow. Very slow. ³ Do. ³
Congaree.....			
Transylvania.....			
Chewacla.....			
Toxaway ²			
Spilo.....			
Lithosols (miscellaneous land types):	Residuum from the weathering of granite gneiss.....	Very steep to precipi- tous.	Medium.
Rough stony land (Porters soil ma- terial).			
Stony colluvium (Fannin and Hayesville soil materials).			
Alluvial soils, undif- ferentiated.	General alluvium consisting of material derived from uplands underlain by granite gneiss and micaceous schist.	Level or nearly level... .....do.....	Medium to rapid. Medium to slow.

¹ Lithosolic.

² With glei layer.

³ In the undrained soil.

ZONAL SOILS

Zonal soils include those great soil groups having well-developed soil characteristics that reflect the influence of the active factors of soil genesis—climate and living organisms (chiefly vegetation) (14). In this county the Red Podzolic, Yellow Podzolic, and Gray-Brown Podzolic great soil groups are zonal soils.

This county is near the southeastern limits of the Gray-Brown Podzolic soils region, where the soils of this region merge with those of the Red Podzolic and Yellow Podzolic soils region.⁸ Soils characteristic of each region are developed in the county. In their typical environment the soils of these regions have sharply contrasting characteristics, but in the geographic location of this county widely divergent profile characteristics that distinguish these great soil groups as a whole are not generally well expressed. Rather, in some places there is a blending of the characteristics of soils of the Gray-Brown great soil group with some of the most representative soils of the Red Podzolic great soil group; in others the regional characteristics of the Gray-Brown Podzolic soils are better expressed.

In the Gray-Brown Podzolic soils there is a thin surface covering of leaf litter. This is underlain by a crumb-structured loamy surface layer, or A horizon, which is slightly darkened by well-decomposed mild humus and thoroughly mixed with the mineral soil. The light grayish-brown or grayish-yellow A₂ layer is leached but not so strongly as the A₂ layer in well-developed podzol profiles. The subsoil, or B horizon, is yellowish brown, brown, or reddish brown, becoming lighter colored with depth. It is heavier textured than the surface layer, nut-structured, and otherwise a well-developed illuvial horizon. Below the subsoil there may or may not be a layer of parent material, or C horizon, differing from the underlying D horizon. The depth of the solum to the parent material rarely exceeds 4 feet.

The Gray-Brown Podzolic soils are developed under an average summer temperature of about 73° F., and an average winter temperature of about 32° except east of the Appalachian Mountains where the temperature is a little higher, or about 35°. The climate is humid and characterized by warm summers, cold winters, and an average annual rainfall of about 40 inches. The native vegetation consists mostly of mixed deciduous trees, predominantly oaks.

Some of the most representative Red Podzolic soils are developed on the Piedmont Plateau under oak-pine forests, in which oak is the predominating species. Summer temperatures range from 2° to 7° higher and winter temperatures 8° to 15° higher than corresponding temperatures in the region of Gray-Brown Podzolic soils. The average rainfall is a little higher in the Red Podzolic soils region. In the profiles of the two groups, those of the Red Podzolic soils are more highly eluviated in the A horizons and generally have sharper demarcation between the A and B horizons than between corresponding horizons of the Gray-Brown Podzolic soils. The B horizons are better developed and are generally underlain by a thicker layer of parent material. In soils of comparable texture there is a lower percentage of alkaline earths, alkalis, and silicate silica, and a higher percentage

⁸ The soils have been grouped according to the classification outlined by Baldwin, Kellogg, and Thorp (4) and by Marbut (12).

of iron and alumina. Furthermore the chemical composition of the mineral colloids of all horizons does not vary so greatly in the Red Podzolic soils. Details of the chemical and physical characteristics of typical soils of these groups may be found in studies by Byers and others (8) and also by Brown and Byers (6).

RED PODZOLIC SOILS

Red Podzolic soils are a zonal group of soils having thin organic and organic-mineral layers over a yellowish-brown leached layer that rests on an illuvial red horizon. They are developed under deciduous or mixed forest in a warm-temperate moist climate. The processes by which the soils were formed are podzolization and laterization (14).

In this county these soils belong to the Hayesville, Fannin, Rabun, Hiwassee, and Talladega series. Soils of the first four series have the characteristics common to Red Podzolic soils and have apparently developed under relatively similar climate and vegetation; those of the Talladega series are regarded as lithosolic because of the weak development of their texture profile and their close relation to the parent rock.

These soils are well drained, and, although their state of maturity ranges somewhat, they have at least a moderately well developed Red Podzolic profile. The relief ranges from undulating or gently sloping to steep, some members of the Hayesville and Talladega soils having the steepest relief. Differences among these soils, however, cannot be accounted for altogether by differences in relief. There are rather marked differences in the composition of the parent material, and these differences may be chiefly the direct or indirect cause of the differences among the soils. Except the Rabun and Talladega, these soils are in the lower parts of the county and occur on rolling to steep intermountain uplands or gently to strongly sloping terraces that lie high above the streams. Rabun soils are on mountain ridges and slopes and Talladega soils on mountains and foothills. The Fannin, Hayesville, and Hiwassee soils are in the warmest parts of the county. All the soils have formed from rock material that generally has a greater content of bases or has been in place longer than the parent material of the Gray-Brown Podzolic soils at similar elevations. They have better internal drainage than the Yellow Podzolic soils, with which they are closely associated.

HAYESVILLE SERIES

Compared with soils of the Porters series, which occur at relatively high elevations on mountains and belong to the Gray-Brown Podzolic great soil group, Hayesville soils are typically developed at lower elevations and on smoother relief of the Hiwassee Plateau, where the parent material has remained in place long enough for the normal soil profile to develop. The soils of both series are derived from granite gneiss of similar composition. The Hayesville soils have developed under warmer average temperature and a lower average annual rainfall of about 50 inches. They are friable but not so crumbly and friable as the Porters soils, and their A₁ layer contains less organic matter. The A horizon is loamy, being similar in texture to that of Porters soils, but it is more leached and more sharply differentiated

from the B horizon than in those soils. The B horizon is red friable clay loam, whereas that of the Porters soils is yellowish-brown, medium-brown, or slightly reddish-brown soft crumbly clay loam.

Below the B horizon is a thick layer of red or, in some places, reticulately mottled red, yellow, and gray thoroughly weathered parent material to a depth of 5 to 8 feet. Except a few small quartz particles and flakes of muscovite, very little evidence of the mineralogical content of the original rocks remains. In contrast, in most places only a thin layer of parent material underlies the subsoil of soils of the Porters series. This layer generally consists of incompletely oxidized yellowish-brown or light-brown clay loam, in which small subangular quartz particles and subrounded feldspar particles indicate disintegration of the rocks into the various mineral components but only partial decomposition of the minerals themselves, including the less resistant, as feldspar and biotite.

Hayesville loam in a forested area has profile characteristics as follows:

- A₀. A thin layer of partly decomposed leaves, twigs, and other vegetable matter.
- A₁. 0 to 2 inches, very dark-brown gritty loam in which are many small roots, mold, and mycelium.
- A₂. 2 to 7 inches, dark grayish-brown or dark-brown loose friable gritty loam of single-grain structure, apparently containing a fairly large quantity of decomposed organic matter and some small roots.
- B₁. 7 to 11 inches, brownish-red crumbly coarse-textured soft massive clay loam, apparently having a low content of organic matter.
- B₂. 11 to 30 inches, red slightly micaceous heavy-textured soft massive clay loam, breaking readily to medium crumbs and containing small soft dark-gray or grayish-green concretions. Large roots pass through this layer and into the parent material.
- C₁. 30 inches +, light-red soft massive clay loam parent material, coarser textured, more micaceous, and less oxidized than the material in layer B₂ and containing more numerous small concretions.

The underlying weathered granite gneiss is reached in typical profiles at a depth of 60 to 96 inches. In places the parent material passes gradually into the reddish weathered rocks, but in others the transition is rather sharp, especially where a fairly large quantity of quartz occurs in the rocks.

The granite gneiss that underlies Hayesville loam is typically high in content of light-gray or pinkish feldspar. It contains moderate quantities of quartz and biotite, a small quantity of muscovite, and narrow quartz veins, many of which reach nearly to the surface layer of the soil and have weathered very little. In most places the granite and gneiss has weathered to a depth of 10 feet or more, but the weathering of the different minerals in the rock has been unequal. The feldspar and biotite have been weathered more or less throughout the zone of weathering, but the quartz has been weathered very little in the upper part of this zone.

FANNIN SERIES

On the smoother areas of the Hiwassee Plateau where the surface rocks are mica schist instead of granite gneiss, soils of the Fannin series rather than the Hayesville are developed. Only slight differences exist between these series, and these are apparently the direct

result of differences in the composition of the parent material. Soils of each series have a leached A horizon and red well-developed B horizon, but the B horizon of the Fannin soils is higher in content of muscovite, has a slick greasy feel when moist, is dense, and is slightly compact compared with the Hayesville soils. Only a thin layer of red weathered rock material lies between the B horizon and the mica schist bedrock, and in places the B horizon is relatively shallow over the weathered rock. The depth of the solum to the weathered rock is normally 36 to 60 inches, whereas in the Hayesville soils it is normally 60 to 96 inches.

RABUN SERIES

The soil of the Rabun series has well-developed Red Podzolic profiles and forms on rolling and hilly mountain ridges and fairly steep mountain slopes from residual material of dark-colored basic igneous rocks. It is characterized by a dark-brown or reddish-brown friable surface layer and red firm but brittle silty clay subsoil. This soil developed under a forest of deciduous trees and in a climate characteristic of the cooler parts of the region of the Red Podzolic soils. The soil probably owes its red color to the basic minerals that compose the parent rock.

HIWASSEE SERIES

Soils of the Hiwassee series are medium Red Podzolic soils that have developed from an old alluvium, the material of which was derived from uplands underlain by granite gneiss, schist, and other igneous and metamorphic rocks. These soils are on gently to strongly sloping relief of smooth terrace land near large streams and are characterized by a dark-brown or very dark-brown surface layer and a red rather heavy-textured subsoil. The drainage is good, and the soils are the most mature of any of the soils on stream terraces in this county.

These soils develop under a forest of deciduous trees and in a warm moist climate characteristic of the cooler parts of the Red Podzolic soil region. The relief is favorable to the development of a mature soil.

These soils occupy positions on higher terraces than the Altavista soils, which are classified as Yellow Podzolic soils, and are apparently older in degree of development. It is possible that the character of the parent material of soils of these two series caused the development of red and yellow soils, respectively.

Hiwassee soils closely resemble Hayesville soils except in the character of the D horizon. In many places the parent material continues to a depth of 10 to 15 feet but in most places about 6 feet.

A profile of Hiwassee loam in a forested area shows the following characteristics:

- A₁. 0 to 2 inches, dark grayish-brown friable crumbly loam apparently of high organic-matter content.
- A₂. 2 to 9 inches, dark reddish-brown friable crumbly loam apparently containing a fairly large quantity of decomposed organic matter, seemingly well combined with the mineral soil.
- B₂. 9 to 24 inches, dark-red crumbly clay loam having a soft massive structure and containing a few soft dark-gray manganese concretions.

- B₃. 24 to 40 inches, dark-red crumbly clay loam, slightly coarser textured than layer B₂.
- C₁. 40 to 90 inches, yellow and greenish-yellow friable micaceous sandy loam mixed with well-rounded stratified quartzite gravel.

The gravel that underlies the profile may be reached at a depth of 60 to 120 inches. In most places the gravel stratum ranges from 24 to 48 inches thick and rests on weathered granite gneiss or schist (pl. 5, A).

TALLADEGA SERIES

Soils of the Talladega series are mainly on hilly and steep relief in a mountainous landscape. They have formed from weathered material of highly micaceous schist or sericitic phyllite, and finely divided mica flakes and small pieces of the schist or phyllite rock are characteristic of the soil profile. They developed under a forest of deciduous trees and in a moderately cool moist climate similar to that in which the Porters soils of the Gray-Brown Podzolic great soil group developed. They are shallower to bedrock than Fannin soils and have weakly developed profiles.

Soils of this series have a reddish-brown, light-brown, or yellowish-red surface layer and red to yellowish-red subsoil. The mica flakes in the profile cause the soil to have a shiny appearance and a slick greasy feel. The soils nearly everywhere are shallow to the weathered parent rock, and the composition of the parent material has probably caused the red color of the soils.

Owing to their close relation to the parent rock, these soils have been designated as being lithosolic in contradistinction to the well-developed Red Podzolic soils of the Fannin series, which are derived from similar parent material.

YELLOW PODZOLIC SOILS

Yellow Podzolic soils are a zonal group of soils having thin organic and organic-mineral layers over a grayish-yellow leached layer that rests on a yellow horizon; developed under coniferous or mixed forest in a warm-temperate moist climate. The soil development processes are podzolization and some laterization (14). In this county these soils consist of members of the Altavista and Worsham series.

The Yellow Podzolic soils are associated geographically with Red Podzolic soils and have developed under similar climate, relief, and vegetation. Their parent material is apparently similar in character to that of those soils but, in general, has been in place for a shorter time. The drainage is somewhat restricted, which may be the cause of their characteristic yellow color. The cause of the differences between Yellow Podzolic and Red Podzolic soils, however, is not fully understood.

ALTAVISTA SERIES

Soils of the Altavista series have developed on low terraces near streams from an alluvium composed of materials derived from soils on uplands underlain by igneous and metamorphic rocks. Their relief is nearly level to strongly sloping and internal drainage slightly restricted. They occur in narrow to fairly wide areas in association with soils of the Hiwassee series on the higher terraces, soils of the

State series on low terraces or high first bottoms, and Congaree and other soils in the first bottoms.

These soils have a grayish-yellow surface layer and pale-yellow or medium-yellow moderately compact subsoil. They appear to be derived from the same kind of alluvium that gives rise to the Hiwassee and State soils and to have developed under similar vegetation and on similar relief. They also appear to be younger than the Hiwassee soils and older than the State soils and may be in an intermediate stage in the development of a Red Podzolic soil. It is probable that they have developed from more acidic material than have the Hiwassee soils. The yellow color of the profile may have been caused by the restricted internal drainage.

A low-terrace phase of Altavista loam has developed in situations only slightly elevated above the adjoining first bottoms. In this phase the upper part of the subsoil is not so fine-textured as in the normal phase of the type, and the lower part is mottled dull yellow and gray, which indicates gleization in this part of the profile.

Altavista loam in forested areas has the following profile characteristics:

- A₀. A very thin layer of leaf litter.
- A₁. 0 to 2 inches, gray or dark-gray friable light-textured loam, apparently containing a fairly large quantity of organic matter derived from the decay of vegetation.
- A₂. 2 to 8 inches, medium-gray or slightly grayish-yellow loose gritty loam, light gray when dry, low in content of organic matter, and very much eluviated. After rains, many coarse grains of white sand may be seen on the surface of the land.
- B₂. 8 to 13 inches, grayish-yellow gritty moderately compact clay loam, stiff but moderately plastic when moist.
- B₃. 13 to 34 inches, pale-yellow stiff fine-textured clay loam, which when moist may be pressed into short ribbons, but when dry is compact and difficult to break. It, however, is a little less compact and contains less clay than layer B₂. A few light-gray mottles appear near the bottom.
- C₁. 34 to 50 inches, mottled light-gray and yellow stiff compact slightly micaceous sandy clay, containing less clay than layer B₃.
- C₂. 50 to 72 inches, light-gray crumbly sandy clay to coarse sandy clay, stained yellow in places, and less compact than the material in layer C₁.

At a depth of 60 to 84 inches the parent material is underlain by white rounded stratified quartzite gravel and cobblestones.

WORSHAM SERIES

Soils of the Worsham series have formed from residual material of weathered granite gneiss, and in places colluvial and local alluvial materials possibly have contributed to their formation. They occur in relatively small areas at the base of slopes bordering streams. The relief ranges from very gently sloping to strongly sloping. External drainage is slow to rapid and internal drainage slow to very slow. The soils are characterized by a light-gray or medium-gray surface layer and medium-yellow or brownish-yellow subsoil. Beneath the subsoil is a gray layer containing a large quantity of mica flakes.

In this county the Worsham soils are so intricately associated with soils of the Warne series that they are mapped only in complex with the Warne soils, which are classified as Planosols.

GRAY-BROWN PODZOLIC SOILS

Gray-Brown Podzolic soils are a zonal group of soils developed under deciduous forest in a temperate moist climate and having a comparatively thin organic covering and organic-mineral layers over a grayish-brown leached layer that rests on an illuvial brown layer. Podzolization is the dominant process in the development of these soils (14).

In this county these soils are members of the Balfour, Edneyville, Tusquitee, Tate, State, Porters, and Ranger series. They lie at high elevations, where the climate is cooler than in most places at similar latitudes. Generally the positions they occupy on the landscape are higher than those of the Red Podzolic soils, although Gray-Brown Podzolic and Red Podzolic soils occur side by side in some places. In nearly all places where the soils of these two great soil groups occur in such close association, the Gray-Brown Podzolic soils either are derived from materials that are lower in content of bases or are younger than the Red Podzolic soils. Soils of both groups are well drained and, in general, have developed under similar conditions of relief and vegetation.

Differences among the Gray-Brown Podzolic soils appear to be the result of differences in parent material or relief. Soils of the Porters and Ranger series are considered lithosolic because of their weakly developed texture profiles and close relation to the parent rocks. Soils of the Balfour series may be considered as well-developed Porters soils. The soils of these two series have formed from the same kind of parent material and under similar climate and vegetation, but, in general, the Balfour soils are developed on a milder relief.

BALFOUR SERIES

Soils of the Balfour series have undulating to rolling relief and have formed from weathered products of granite gneiss. They occupy positions on the tops of mountain ridges and on the foot slopes of mountains and lie at comparatively high elevations. They developed under a forest cover of deciduous trees and in a cool moist climate similar to that of the Gray-Brown Podzolic soil regions in higher latitudes. The surface layer is brown and mellow, and the subsoil brown to reddish brown, friable, and porous.

These soils developed in the same kind of climatic and vegetational environment and from the same kind of parent material as Porters soils. In general they have a milder relief than Porters soils, and the milder relief apparently has caused more percolation of water but less runoff, geologic erosion, and mixing of materials than the steeper relief of the Porters soils. As a result the Balfour soils have the well-developed Gray-Brown Podzolic profile in contrast to the weakly developed Gray-Brown Podzolic profile of the Porters soils.

The following profile description of Balfour loam, as observed on a 10-percent east-facing slope at an elevation of 3,200 feet at Wolfpen Gap in the southern part of the county, is representative of the better developed Gray-Brown Podzolic soil:

A₀. A thin covering of leaves, mostly oak.

A₁. 0 to 3 inches, grayish-brown fluffy silt loam containing a fairly large quantity of well-decomposed organic matter and many small roots,

- mold, and mycelium. The soil is sticky when moist, and the small quartz particles present are sharply angular.
- A₃. 3 to 8 inches, brown gritty fine-textured loam of soft crumbly consistence and containing a small quantity of finely divided muscovite flakes and weathered biotite.
 - B₁. 8 to 16 inches, brown gritty clay loam of finer texture than layer A₃ and of fine blocky or nutlike structure. When moist it is slightly reddish brown and can be crushed to soft crumbs.
 - B₂. 16 to 26 inches, brown gritty finer textured clay loam having nutlike structure, and containing finely divided mica flakes and small particles of partly weathered feldspar. When moist, it is slightly reddish brown.
 - B₃. 26 to 32 inches, light-brown or slightly yellowish-brown gritty clay loam, coarser textured and containing more and larger feldspar particles than layer B₂.
 - C. 32 to 54 inches, light-brown or yellowish-brown gritty clay loam of massive structure; when moist easily broken to soft medium crumbs. Subangular quartz grains, partly weathered feldspar grains, partly weathered biotite, and a few finely divided muscovite flakes are distributed throughout this layer.
 - D. 54 inches +, granite gneiss composed of quartz, feldspar (probably mainly orthoclase), and small proportions of biotite and muscovite. The rock is weathered and partly disintegrated to an average depth of about 72 inches.

EDNEYVILLE SERIES

Soils of the Edneyville series have developed on gently undulating to rolling upland from residual material of schist of high quartz content and schist containing pegmatite or granite gneiss. They are on foot slopes of mountains and on intermountain uplands closely associated with soils of the Fannin series. They differ from this series chiefly in the character of the subsoil and parent rock. The subsoil is yellow rather than red as in the Fannin soils and slightly more compact. The rocks from which the soils are derived, being especially high in content of quartz, are more acidic with respect to mineral composition. In this county sharply angular quartz fragments of various sizes are strewn over the surface of the Edneyville soils and mixed through their profiles.

These soils lie at comparatively high elevations and have developed under a forest of deciduous trees in a cool, moist climate similar to that of the Gray-Brown Podzolic soil areas in higher latitudes. The soils are characterized by a gray or grayish-yellow surface layer and by a yellow or brownish-yellow subsoil that is finer textured than the surface layer.

The rocks that give rise to these soils possibly have a higher content of quartz and a lower content of feldspar and other clay-forming minerals than the rocks that give rise to the Balfour soils, which have developed under the same conditions of climate, vegetation, and relief.

Edneyville soils are comparable with soils of the Ashe series—a series common to the Appalachian Mountains but not represented in this county. They generally have a milder relief, however, than the Ashe soils, and probably because of the milder relief have more distinctly developed texture profiles.

TUSQUITEE SERIES

The soil of the Tusquitee series is on colluvial slopes and has formed from rock waste and soil material that accumulated on foot slopes

through the action of gravity and water. The relief is very gently sloping to moderately sloping.

There is considerable range in the age of this soil, and the soil is subject to change by the addition of new material by colluvial action. Although the well-developed soil belongs to the Gray-Brown Podzolic great soil group, as mapped it includes young soil that lacks clearly defined profile development and throughout shows very little differentiation in color and other characteristics, and should therefore be considered as belonging to the Alluvial soils great soil group.

In forested areas Tusquitec loam has the following profile characteristics:

- A. 0 to 18 inches, dark grayish-brown loose gritty loam apparently having a high content of organic matter derived from the decay of vegetation. A thin transitional layer lies between the A and B horizons.
- B. 18 to 43 inches, yellowish-brown soft crumbly clay loam, which can be pressed into short plastic ribbons when moist.
- C. 43 to 78 inches, brownish-yellow crumbly clay loam underlain by weathered granite gneiss, apparently not related to the composition of the overlying profile.

TATE SERIES

Soils of the Tate series have formed in nearly level to gently sloping places near the foot of upland slopes from colluvium and local alluvium consisting of materials washed or sloughed from soils on the immediate uplands. They are characterized by the presence of finely divided mica flakes. External drainage is slow to medium. Internal drainage is medium, but in some places it is rather slow in the lower part of the profile.

The profile of these soils varies somewhat in color and content of mica flakes according to the character of the soil from which the parent material was derived.

STATE SERIES

The soil of the State series is on nearly level to very gently sloping stream terraces, somewhat lower than those on which soils of the Hiwassee series occur. It has developed from alluvium composed of materials derived from soils on uplands underlain by igneous and metamorphic rocks.

This soil has an immature profile that in some respects resembles the Gray-Brown Podzolic soil profile, although it is generally associated with Red Podzolic and Yellow Podzolic soils.

PORTERS SERIES

Porters soils are on hilly, steep, and very steep relief in a mountainous landscape. They are young and in places are immaturity developed Gray-Brown Podzolic soils that have formed from weathered products of granite gneiss. Their depth to bedrock is in many places less than 40 inches, and they contain many outcrops of bedrock. Loose rock fragments, up to 10 inches in diameter, are common on and in the soil over a large part of the area. The soils are characterized by a dark-brown mellow surface layer and brown to yellowish-brown very permeable subsoil. Although their color profile is dis-

tinctly divided into horizons, their texture profile, in general, shows no sharp differentiation.

These soils generally lie at high elevations on mountains and have developed under a forest of deciduous trees in a cool moist climate comparable with that of the Gray-Brown Podzolic soil region in higher latitudes. They differ from soils of the Balfour series, which have developed from the same kind of material but generally at lower elevations, in that their profiles are less well developed, mainly because of steep relief. The restricted profile development, generally steep relief, and high elevation distinguish them from the Balfour soils, which, in general, lie at lower elevations and on milder relief and have moderately well developed profiles.

RANGER SERIES

The soil of the Ranger series is similar in morphological characteristics to soils of the Talladega series but has formed from weathered products of slate or phyllite rather than from weathered products of micaceous schist. Small pieces of slate rock are scattered over the surface and throughout the soil. Because of close relation to the parent rock this soil is classified as being lithosolic. The color of the surface layer is dull grayish yellow and that of the lower layers dull yellowish brown, indicating slower drainage and less oxidation than in the corresponding layers of the Talladega soils.

INTRAZONAL SOILS

Intrazonal soils are any of the great groups of soils with more or less well-developed soil characteristics that reflect the dominating influence of some local factor of relief, parent material, or age over the normal effect of the climate and vegetation (14). In this county they include members of the Planosols great soil group.

PLANOSOLS

Planosols are an intrazonal group of soils with eluviated surface horizons underlain by B horizons more strongly illuviated, cemented, or compacted than associated normal soils developed on nearly flat upland surface under grass or forest vegetation in a humid or sub-humid climate (14). Planosols are represented in this county by members of the Warne series.

WARNE SERIES

Soils of the Warne series have formed from alluvium consisting of materials derived from soils on uplands underlain by igneous and metamorphic rocks. They are developed on low terraces of very gently sloping to strongly sloping relief and are associated with soils of the Altavista, State, and Hiwassee series of the stream terraces and with Congaree and other soils of the bottom lands. In this county they are also associated with soils of the Worsham series and are mapped only in complex with these soils.

The outstanding features of the Warne soils are their light-gray friable surface layer about 10 inches thick and light-gray very stiff

compact clay B horizon. The cause of the development of such an abnormally dense layer is not known. This layer is associated with slow external and internal drainage, but whether the slow internal drainage was the cause or is the effect of the dense layer is not known. It is possible that relatively dense layers in the original alluvium restricted the internal drainage, which in conjunction with slow external drainage and fine-textured soil material brought about abnormal concentration and compactness in the illuvial horizon.

At an average depth of about 36 inches is the D horizon that generally consists of white angular quartz gravel, but in places the light-gray stiff clay layer continues to a depth of 72 inches or more.

AZONAL SOILS

Azonal soils are any group of soils without well-developed profile characteristics either because of their youth or because of conditions of parent material or relief that have prevented the development of normal soil-profile characteristics (14). The azonal soils in this county belong to the Alluvial soils and Lithosols great soil groups.

ALLUVIAL SOILS

Alluvial soils are an azonal group of soils, developed from transported and relatively recently deposited material (alluvium) and characterized by showing little or no modification of the original material by soil-forming processes (14).

In this county these soils belong to the Congaree, Transylvania, Chewacla, Toxaway, and Spilo series. Congaree and Transylvania soils are well drained, and Chewacla soils imperfectly drained in most places. Toxaway soils are poorly drained and have some of the characteristics of Half Bog soils. They are considered, however, as Alluvial soils but are designated as having a glei layer.

Congaree soils are similar to the Chewacla but are derived from alluvial materials coming from regions where the soils of the uplands are derived from both granite gneiss and micaceous schist. Congaree silt loam, dark-subsoil phase; Transylvania silt loam; and Toxaway silt loam are found mainly near the headwaters of mountain streams. These soils are composed of sediments washed mainly from wooded areas of the Porters soils. Compared with Congaree silt loam, both Transylvania silt loam and Congaree silt loam, dark-subsoil phase, are higher in organic-matter content and more crumbly and plastic throughout. Toxaway silt loam has a nearly black surface layer, which is apparently the result of accumulated organic matter. The underlying layer is mottled gray and brown pervious silty clay loam of plastic consistence. In some of the narrow first bottoms in the mountains Transylvania silt loam; Congaree silt loam, dark-subsoil phase; and Toxaway silt loam are members of a catena.

CONGAREE SERIES

Soils of the Congaree series are in first bottoms near streams and have formed from alluvium consisting of material washed from soils on uplands underlain by igneous and metamorphic rocks. They are

overflowed by the streams during heavy rains, and new materials are left on them when the waters recede.

Owing to the addition of new materials from time to time, the soils remain young, and very little development of genetically related profile horizons is evident. The profile varies from place to place in the kind, thickness, and arrangement of the poorly defined layers that have formed. The color ranges from medium brown to light brown from the surface downward, becoming mottled medium brown and light brown in the lower part of the profile.

Congaree fine sandy loam in cultivated areas has the following characteristics:

1. 0 to 10 inches, grayish-brown friable loose fine sandy loam; content of organic matter apparently low, but large enough to impart a slightly gray color to the mineral soil.
2. 10 to 36 inches, yellowish-brown friable loose fine sandy loam.
3. 36 inches +, medium-brown friable fine sandy loam, becoming mottled dull brown and gray with depth and grading at a variable depth into crumbly silt loam or resting on stratified well-rounded channel gravel.

TRANSYLVANIA SERIES

The soil of the Transylvania series occurs in first bottoms near streams and is associated with Congaree and other soils of the bottom lands. It has formed from the same kind of alluvium as the Congaree soils and differs from them in having a darker colored surface layer, which is probably caused by a larger quantity of organic matter. The soil is young, and the texture profile shows very little differentiation. Like the Congaree soils, this soil is mottled in the lower part. Profile development is restricted by the low relief of the soil, which lies only a few feet above the streams, and by new material deposited now and then by overflow of the streams.

CHEWACLA SERIES

Soils of the Chewacla series have formed in first bottoms near streams from alluvium washed from soils on uplands underlain mainly by micaceous schist rock. They are highly micaceous and are friable throughout. In general they lack the crumbly consistence of soils of the Congaree and Toxaway series.

These soils are imperfectly drained, although in some places drainage is fairly well established. In some places they are alternately wet and dry and in some other places waterlogged in the lower part of the profile throughout most of the year. Apparently, as a result of the imperfect drainage, the profile is mottled in color below a depth of a few inches.

TOXAWAY SERIES

The soil of the Toxaway series is associated in first bottoms with Congaree and other soils of the bottom lands. It has formed from the same kind of alluvial material as the Congaree soils but occupies flat places in the bottoms, which in many places lie next to the uplands. External drainage is slow to very slow and internal drainage

slow. Seepage from the uplands doubtless helps keep the soil in its poorly drained state.

A most noticeable feature of this soil is the dark-gray to almost black color of the surface layer, which apparently is due to the large quantity of organic matter that has accumulated through the decay of vegetation. Beneath the surface layer is a fine-textured layer, which is underlain by a lighter colored and coarser textured material having glei characteristics.

This soil resembles Half Bog soils in the lower part of the profile, but its surface layer contains somewhat less organic matter. In this county it is classified as a member of Alluvial soils with glei layer.

Under virgin conditions Toxaway silt loam shows profile characteristics as follows:

1. 0 to 15 inches, very dark-gray crumbly plastic silt loam containing a large quantity of decomposed organic matter.
2. 15 to 28 inches, dark-gray to medium-gray, mottled or streaked with dull brown, plastic silty clay.
3. 28 inches +, bluish-gray plastic silty clay mottled or streaked with dull brown.

SPILO SERIES

The soil of the Spilo series is an Alluvial soil and is associated with soils of the Chewacla series of the Alluvial soils great soil group.

In this county only one type of the series—Spilo silty clay loam—is mapped. It occupies slightly higher positions than the Chewacla soils and generally borders on the uplands. The relief is level or nearly level, and external and internal drainage are very slow.

In representative areas the surface layer is light-gray to medium-gray compact silty clay loam; the subsoil is light-gray dense fine-textured clay or sandy clay, almost impervious to water. Below a depth of about 30 inches, the material grades from light-gray micaceous sandy clay, stained with yellow, into a similarly colored micaceous loamy fine sand in many places. The general character of the deeper parts of the profile varies greatly from place to place, depending chiefly on deposition.

LITHOSOLS

Lithosols constitute an azonal group of soils having no clearly expressed soil morphology. They consist of a freshly and imperfectly weathered mass of rock fragments and are largely confined to steeply sloping land (14).

In this county Lithosols consist of three miscellaneous land types that could not be correlated as definite soil types. The most extensive land type is rough, stony, and very steep. The other two are relatively inextensive. One of these is colluvium containing many gravel, boulders, and rock fragments and the other is a mixture of soils. On the steep slopes of the extensive land type, either geologic erosion almost keeps pace with rock weathering and soil formation or the rock and soil material slough, slide, or roll down the steep slopes, so that very little true soil can form.

Some small areas of zonal soils are included with these Lithosols as mapped.

MISCELLANEOUS LAND TYPES

The miscellaneous land types are Rough stony land (Porters soil material), Stony colluvium (Fannin and Hayesville soil materials), and Alluvial soils, undifferentiated.

Rough stony land (Porters soil material) comprises rough, very steep, and stony mountain land in which the soil consists of Porters soil material. The prevailing slope is 60 to 70 percent. Outcrops and loose fragments of bedrock, mainly of granite and gneiss, are numerous. Very little profile development has taken place, and what soil has formed is shallow to bedrock in most places. In places only the surface layer has formed, and it passes into decomposed rock or lies on the bedrock (pl. 5, *B*).

Stony colluvium (Fannin and Hayesville soil materials) occurs at the foot of slopes, mainly on the intermountain uplands. It consists mainly of colluvial material derived from soils of the Fannin and Hayesville series, although in places it consists of alluvial material. Angular rock fragments, gravel, and boulders are strewn over the surface and mixed with the soil mass. This stony material is unfavorable to the formation of a soil profile, and very little profile development has occurred.

Alluvial soils, undifferentiated, consists of a mixture of soils of different color, texture, consistence, and condition of drainage, the individual areas of which are too small to map separately. These soils are on first bottoms along streams and are associated with Congaree and other soils of the bottom lands. They are subject to change by the addition of new material each time the streams overflow.

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