
Soil Survey

Swain County North Carolina

By

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UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Administration
Bureau of Plant Industry, Soils, and Agricultural Engineering
In cooperation with the
NORTH CAROLINA DEPARTMENT OF AGRICULTURE
NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION
and the
TENNESSEE VALLEY AUTHORITY

HOW TO USE THE SOIL SURVEY REPORT

SOIL SURVEYS PROVIDE a foundation for all land use programs. The report on each survey and the map that accompanies the report present information both general and specific about the soils, the crops, and the agriculture of the area surveyed. The individual reader may be interested in the whole report or only in some particular part. Ordinarily he will be able to obtain the information he needs without reading the whole. Prepared for both general and detailed use, the report is designed to meet the needs of a wide variety of readers of three general groups: (1) Those interested in the area as a whole; (2) those interested in specific parts of it; and (3) students and teachers of soil science and related agricultural subjects. Attempt has been made to meet the needs of all three groups by making the report comprehensive for purposes of reference.

Readers interested in the area as a whole include those concerned with general land use planning—the placement and development of highways, power lines, docks, urban sites, industries, community cooperatives, resettlement projects, and areas for private or public forests, recreation, and wildlife management. The following sections are intended for such users: (1) General Nature of the County, in which physiography, relief, drainage, climate, water supply, vegetation, history, population, industries, transportation, markets, and cultural developments are discussed; (2) Agriculture, in which a brief history of the agriculture is given and the present agriculture described; (3) Productivity Ratings and Land Classification, in which the productivity of the soils is given and a grouping of soils presented according to their relative physical suitability for agricultural use; (4) Land Use and Soil Management, in which the present use of the soils is described, their management requirements are discussed, and suggestions made for improvement in management; and (5) Water Control on the Land, in which problems pertaining to drainage and control of runoff are treated.

Readers interested chiefly in specific areas—such as some particular locality, farm, or field—include farmers, agricultural technicians interested in planning operations in communities or on individual farms, and real estate agents, land appraisers, prospective purchasers and tenants, and farm loan agencies. The reader's first step is to locate on the map the tract with which he is concerned. The second is to identify the soils on the tract by locating in the legend on the margin of the map the symbols and colors that represent them. The third step is to locate in the table of contents in the section on Soils the page where each type is described in detail and information given as to its suitability for use and its relation to crops and agriculture. He will also find useful specific information relating to the soils in the sections on Productivity Ratings and Land Classification, Land Use and Soil Management, and Water Control on the Land.

Students and teachers of soil science and allied subjects, including crop production, forestry, animal husbandry, economics, rural sociology, geography, and geology, will find their special interest in the section on Morphology and Genesis of Soils. They will also find useful information in the section on Soils, in which are presented the general scheme of classification of the soils of the area and a detailed discussion of each type. For those not already familiar with the classification and mapping of soils, these subjects are discussed under Soil Survey Methods and Definitions. Teachers of other subjects will find the sections on General Nature of the Area, Agriculture, Productivity Ratings and Land Classification, and the first part of those on Soils of particular value in determining the relations between their special subjects and the soils in the area.

This soil survey of Swain County, N. C., is a cooperative contribution from the—

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SOIL SURVEY OF SWAIN COUNTY, NORTH CAROLINA

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United States Department of Agriculture in cooperation with the North Carolina Department of Agriculture, the North Carolina Agricultural Experiment Station, and the Tennessee Valley Authority

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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

² Much of the report was written by R. C. Journey and M. G. Cline, Division of Soil Survey, Bureau of Plant Industry, Soils, and Agricultural Engineering.

SITUATED in the great Smoky Mountains in western North Carolina, Swain County is one of the highest and most rugged areas in eastern United States. Second-growth forests cover 90 percent of the steep uplands area rising over 6,000 feet above sea level. Lumbering continues a lucrative source of income from the sale of acid-extract wood, pulpwood, and tanbark as well as the usual lumber forms. Agriculture, restricted to rather limited areas, has been carried on successfully from early days, with corn, wheat, rye, and oats as the chief crops, although some hay, sweetpotatoes, and tobacco are grown. Livestock is raised mainly for local use. Garden vegetables and fruits make up locally consumed products. To provide a basis for the best use of the land agriculturally a cooperative soil survey was begun in 1937 by the United States Department of Agriculture, the North Carolina Department of Agriculture, and the North Carolina Agricultural Experiment Station. The report is here presented and may be briefly summarized as follows.

SUMMARY OF THE SURVEY

Swain County, formed in 1871, is in the extreme western part of North Carolina, its northern boundary adjoining the State of Tennessee.

The county is in the Appalachian Mountains, its northern part in the Great Smoky Mountains. The elevation ranges from about 1,100 feet on the North Carolina-Tennessee State line to 6,642 feet on Clingmans Dome, one of the highest points in eastern United States. Surface relief ranges from nearly level in the first bottoms along streams to hilly in the intermountain upland and steep and rugged in the mountain upland.

The streams have dissected the uplands thoroughly, and all the county except some small areas near streams has good to excessive surface drainage.

A large part of the county is forested, although practically all the virgin timber has been cut for lumber and other uses. The forests consist mostly of deciduous trees and some pines. Red spruce and balsam grow in places on some of the high mountains.

The Cherokee Indian Reservation is in the county, as are parts of the Great Smoky Mountains National Park and the Nantahala National Forest.

The soil survey of the county disclosed 14 soil types, 9 soil phases, 2 soil complexes, and 5 miscellaneous land types.

The soils of the county are grouped in five classes, on the basis of their relative physical suitability to the agriculture: The First-, Second-, and Third-class soils are considered suitable for the production of crops, although they differ somewhat for this use; soils of the Fourth-class are considered better suited to pasture than to crops, although some areas of some of the soils can be used for crops; and the Fifth-class soils are better suited to forestry than to pasture, but some areas can be used as pasture land. This grouping is not to be taken as recommendation for use.

Water control on the land involves practices having to do with the regulation of runoff and with the maintenance of favorable soil-moisture conditions.

The factors of soil formation and the descriptions of soils representing great soil groups are of value to those interested in the morphology and genesis of the soils. The great soil groups represented in Swain County are Red Podzolic, Gray-Brown Podzolic, Brown Forest, Lithosols and shallow soils, and alluvial soils.

GENERAL NATURE OF THE AREA

LOCATION AND EXTENT

Situated in the extreme western part of North Carolina, adjoining Tennessee (fig. 1), Swain County is very irregular in outline, most of its boundary following natural features. It comprises an area of 539

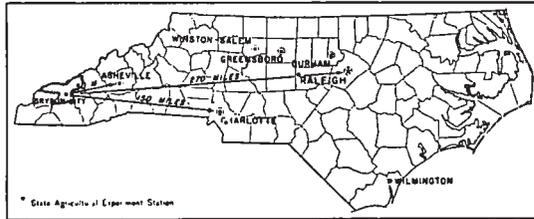


FIGURE 1.—Location of Swain County in North Carolina.

square miles, or 344,960 acres. Bryson City, the county seat, is in the south-central part, 50 miles west of Asheville and 270 miles west of Raleigh.

PHYSIOGRAPHY, RELIEF, AND DRAINAGE

The county lies in the Appalachian Mountains, which is the eastern division of the Appalachian province, the three main divisions of which are the Appalachian Valley, the Cumberland Plateau, and the Appalachian Mountains. The Appalachian System comprises a number of minor ranges, which under different local names, extend from southern New York to central Alabama. Some of the prominent ranges are the South Mountain of Pennsylvania, the Blue Ridge and Catoctin Mountains of Maryland and Virginia, the Great Smoky Mountains of Tennessee and North Carolina, and the Cohutta Mountains of Georgia.³

The eastern division of the Appalachian province also includes the Piedmont Plateau, a vast upland that stretches eastward and southward from the foot of the Appalachian Mountains to the Coastal Plain, which borders the Atlantic Ocean. The Appalachian Mountains and the Piedmont Plateau merge with no clear-cut boundary. The same rocks and the same structures appear in each, and the form of the surface varies in large measure according to the ability of the streams to wear down the rocks. Most of the rocks are more or less crystalline, consisting of slates, schists, or similar rocks and of granite

³ UNITED STATES GEOLOGICAL SURVEY. GEOLOGICAL ATLAS OF THE UNITED STATES, NANTAHALA FOLIO, NORTH CAROLINA-TENNESSEE. Folio 143, 11 pp., illus. 1907

and diabase, which have formed from molten material. The Appalachian Valley is sharply outlined against the northwest side of the Appalachian Mountains. Its rocks, which include much limestone, are softer than those of the Appalachian Mountains; therefore, its surface is more readily worn down by streams and is lower and less broken than the surface of the Appalachian Mountains.

The Appalachian Mountains rise gradually from less than 1,000 feet in Alabama to more than 6,700 feet in western North Carolina. From this highest part they decrease in elevation to 4,000 feet in central Virginia, and to 1,500 to 2,000 feet on the Maryland-Pennsylvania line.

Swain County (fig. 2) is one of the highest and most rugged parts of the Appalachian Mountains. It is situated in the midst of a number of mountain ranges extending in several directions. The Great Smoky Mountains, one of the highest ranges in the East, cross the northern part of the county, their crest forming the northern boundary; Balsam Mountain forms a part of the eastern county line; Cowee Mountains are partly in the southern part and their crest forms the southern county line for a distance of about 15 miles; a peak of the Blue Ridge is about 18 miles south of the southern boundary of the county.

The Great Smoky Mountains range in elevation from about 4,000 to 6,642 feet⁴ above sea level on Clingmans Dome—the highest point in the county and one of the highest points in eastern United States. Many spurs, leading from the crest of the Great Smoky Mountains southward, extend for a distance of 3 to 12 miles. Forney Ridge and Thomas Divide are two of the longest spurs. Balsam Mountain, which extends southward from the crest of the Great Smoky Mountains for a distance of about 15 miles, is 5,000 to 6,500 feet high. Spurs, 1 to 8 miles long, extend from this mountain into the county. The elevation of Cowee Mountains, in the southern part of the county, ranges from 3,000 to 5,000 feet. The slopes are steep, and low peaks appear in places on the crest.

A rock formation⁵ known as Great Smoky conglomerate is the most extensive formation in the county. It underlies a large part of the mountainous country and consists of conglomerate, coarse gray sandstone, graywacke, and many beds of black slate and schist. The height of the mountains is due to the hardness and the great mass of this formation. The rocks are so hard that they have withstood the forces of weathering and erosion for ages, and the mountains owe their form and stability to the resistance the rocks have offered the agencies of rock destruction.

The Great Smoky conglomerate is thick and not divided; therefore, it does not control the direction of the streams. The summits of the ridges and mountains are usually smooth and round, and many of them have large areas of easy slope, which are called balds when bare of trees. The easy arch of the crests soon gives place, however, to steep ravines and narrow V-shaped valleys. From the crests the spurs branch and fall rapidly to the streams. Knobs appear here and there on the spurs, and cross spurs are frequent.

⁴ Elevations from topographic maps of the U. S. Geological Survey.

⁵ UNITED STATES GEOLOGICAL SURVEY. GEOLOGIC ATLAS OF THE UNITED STATES, KNOXVILLE FOLIO, TENNESSEE-NORTH CAROLINA. Folio 16, 6 pp., illus. 1895



- A.* The courses of the Little Tennessee and Tuckasegee Rivers in the western part of Swain County are tortuous and the valleys deep and narrow. Very little of the land is adapted to crops, most of it being best suited to forest.
- B.* Valleys in the vicinity of Bryson City and eastward are noticeably more open. Along the river that is hidden by the bushes is a strip of Congaree soil about a quarter of a mile wide. The terrace on which the house is situated is about a third of a mile wide and consists of State leam. The low hills beyond are occupied by Hayesville soils, which extend a mile or so to the mountainous Ramsey soils in the far background.



A The broader parts of the valleys generally afford the most desirable sites for farms, with fairly extensive areas of smooth productive soils. Congaree State, and alluvial soils undifferentiated predominate in these areas.
B Several of the well-drained soils are adapted to apples, but although the climate is suitable very little tree fruit is grown.

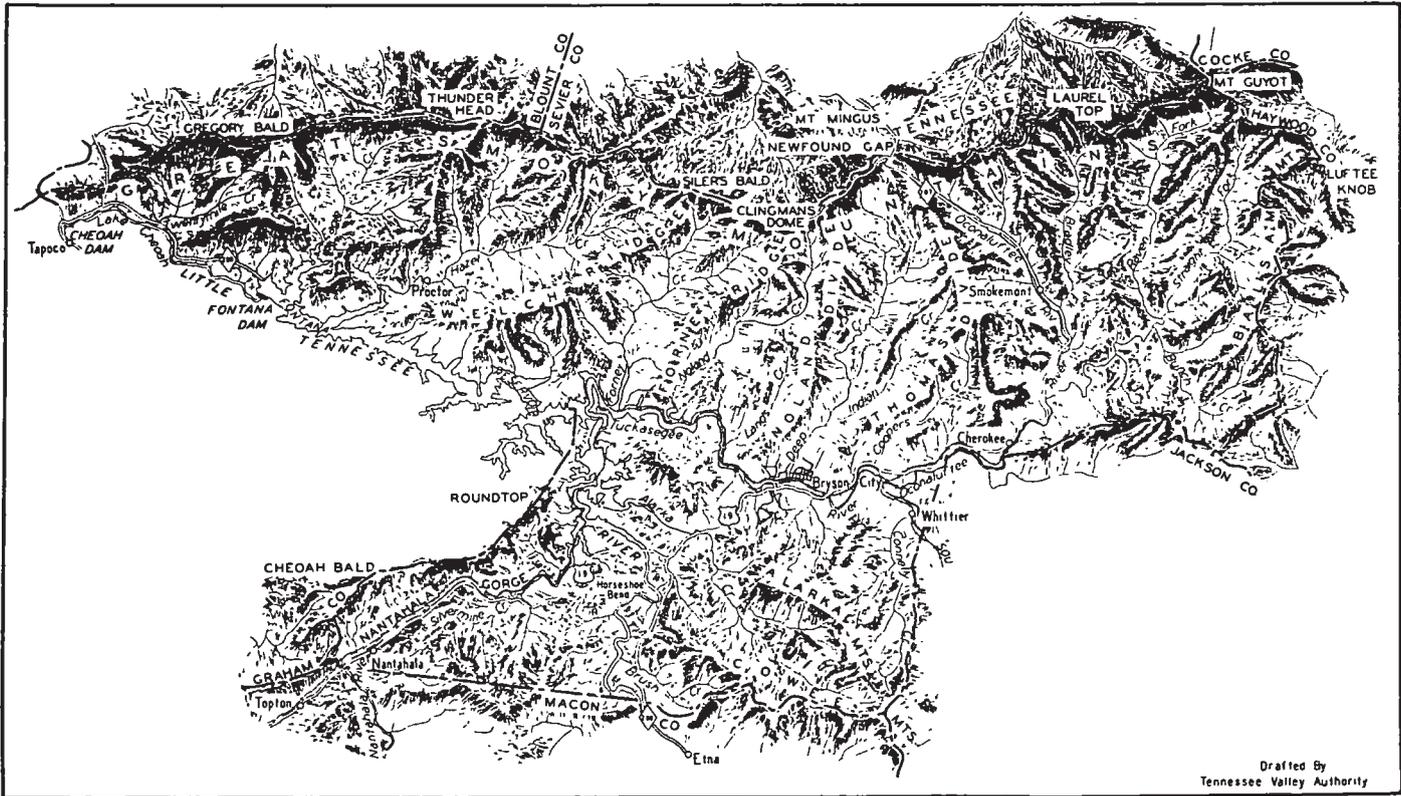


FIGURE 2.—Relief map of Swain County, with parts of adjacent counties in North Carolina and Tennessee.

Elevations of peaks in the northern part of the county are as follows: Clingmans Dome, 6,642 feet; Gregory Bald, 4,948; Little Bald, 5,052; Thunderhead Mountain, 5,530; Silers Bald, 5,620; Mount Collins, 6,255; Mount Kephart, 6,400; Luttee Knob, 6,216; Spruce Mountain, 5,590; Cataloochee, 5,940; and Whim Knob, 5,496 feet. Newfound Gap, a well-known pass in the Great Smoky Mountains, is 5,045 feet above sea level. Elevations of some peaks in the southwestern part are as follows: Potato Hill, about 3,000 feet; Round Top, about 3,211; Lowing Bald, about 4,360; and Cheoah Bald, about 5,000 feet.

Between the mountains lie narrow valleys made by the rivers and their tributaries, which have thoroughly dissected the county (pl. 1, *A*). The rivers divide the southern part into fairly low valley upland, with a general level of 2,000 to 2,500 feet, and have cut their way 200 to 500 feet below the upland surface. Above the levels of the valley upland the stream valleys are wild and rocky V-shaped ravines, in which the slopes steadily increase nearly to the ridge crests. The valley upland is characterized by low rounded hills, knobs, and short steep slopes. The width of the belt that it occupies is variable and is greatest near Bryson City, Judson, Almond, and Wesser (pl. 1, *B*).

Only a few areas have gentle slopes and these consist of terraces near streams and narrow benchlike places at the foot of the mountains. The only level areas are in the first bottoms, bordering many of the streams, and the proportion of such land to the hilly and steep country is small (pl. 2, *A*).

The elevations of places near rivers in the valley area are approximately as follows: Bushnell, 1,500 feet; Almond, 1,600; Wesser, 1,700; Bryson City, 1,725; Whittier and Ela, 1,900; Birdtown and Cherokee, 2,000; and Nantahala, 2,100 feet.

Near Nantahala in the southwestern part of the county, the Nantahala River finds its way between steep mountains, and the walls of its narrow valley are so close together that they form a deep and picturesque gorge. In this gorge, as well as in places along the Tuckasegee and the Little Tennessee Rivers, are almost perpendicular walls of solid rock rising to heights of 200 to 300 feet.

Because of its hilly and steep surface the county has excellent natural drainage. It drains into the Tuckasegee, Oconaluftee, Little Tennessee, and Nantahala Rivers. The Tuckasegee River enters the county from Jackson County and is joined at a point near Ela by the Oconaluftee River; and thence flows westward to a place near Bushnell where it joins the Little Tennessee River, which flows northward out of Macon County. The Little Tennessee River turns westward near Bushnell and flows between Swain County and Graham County into the State of Tennessee. The Nantahala River enters the county from Macon County and flows northeastward for about 15 miles to a point near Almond, where it empties into the Little Tennessee River.

The rivers of the area have heavy grades. The Nantahala River falls from 4,100 feet on the Blue Ridge to a little less than 1,600

feet where it unites with the Little Tennessee River. The average grade of the river is about 65 feet a mile, although the greater part comes in the upper 25 miles. The Little Tennessee River drops from an elevation of about 1,500 feet near Bushnell to about 1,100 feet on the North Carolina-Tennessee State line, a distance of about 25 miles.

CLIMATE

The climate of Swain County is continental. Considerable difference exists between the mean summer and winter temperatures, and very little difference exists between the mean temperatures of spring and fall.⁶ The summers are comparatively short; and because of the high altitudes the days are never very warm or sultry and the nights are prevailingly cool. The climate is considered healthful.

Because of the invigorating and healthful climate, the rugged scenery of the Great Smoky Mountains, and the mountain recreation to be had, many tourists visit the county each year.

The winter usually is not severe, and some kinds of farm work can be done most of the time. The average length of the frost-free season is 176 days, extending from April 25 to October 18, and although the period is comparatively short, it is sufficient for maturing the crops generally grown. The latest killing frost was on May 24 and the earliest on September 26. The cool climate and bountiful rains afford ideal conditions for growing grasses, especially for pasture. The length of the grazing season depends to some extent on the character of the soil and the management of the pastures. The climate, as well as many of the soils, is suited to growing apples (pl. 2, *B*), although in the planting of apple orchards the proper site and air drainage are to be considered. Even with the advantages of climate and soil for apple growing, there is only one commercial apple orchard in the county.

The rainfall at Bryson City is well distributed and is ample for the crops generally grown. Many of the rains in summer accompany thunderstorms, and others are light or moderate showers. During some of the thunderstorms the rainfall is heavy, but the storms last only an hour or two. Much washing of the soil occurs in places. Steady rains lasting for 3 or 4 days that soak well into the ground sometimes come in summer. Hard showers and also protracted rains come in other seasons of the year. Snow has fallen as early as October and as late as April. The snowfall, which is usually light, stays on the ground for only a short time. Some of the high peaks in the mountains remain covered with snow during midwinter, and an opportunity is afforded in some places for skiing.

The normal monthly, seasonal, and annual temperature and precipitation at Cullowhee, Jackson County, and the normal monthly, seasonal, and annual precipitation at Bryson City are given in table 1.

⁶ As no records of temperature are given by the Weather Bureau station at Bryson City, the weather data used here are compiled from the records of the Weather Bureau station at Cullowhee, Jackson County. Cullowhee is 2,100 feet above sea level, and the weather data gathered there are fairly representative of the weather conditions in the lower lying parts of Swain County.

TABLE 1—Normal monthly, seasonal, and annual temperature and precipitation at Cullowhee, Jackson County and precipitation at Bryson City,¹ Swain County, N. C.²

CULLOWHEE, ELEVATION, 2,100 FEET

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total for the driest year	Total for the wettest year	Average snow fall
	° F.	° F.	° F.	Inches	Inches	Inches	Inches
December.....	40.3	77	-11	4.20	0.77	11.93	2.1
January.....	40.4	79	-9	3.90	1.57	5.51	2.7
February.....	41.6	79	-9	3.20	2.39	5.64	2.4
Winter.....	40.8	79	-11	11.30	7.73	23.08	7.2
March.....	47.6	87	4	5.20	2.67	6.09	2.1
April.....	55.5	91	17	3.60	1.43	4.46	1
May.....	63.2	92	28	3.60	1.63	3.03	(³)
Spring.....	55.4	92	4	12.40	5.73	13.58	2.2
June.....	70.4	97	36	4.00	1.49	3.71	0
July.....	73.5	99	43	4.20	2.80	4.35	0
August.....	72.7	96	38	4.00	.74	4.32	0
Summer.....	72.2	99	36	12.20	5.03	12.38	0
September.....	68.5	92	31	3.50	.67	2.90	0
October.....	57.5	88	15	2.70	3.35	6.14	(³)
November.....	46.3	79	5	2.20	2.85	2.92	8
Fall.....	57.4	92	5	8.40	6.87	11.96	8
Year.....	56.5	99	-11	44.30	62.36	761.00	10.2

BRYSON CITY, ELEVATION 2,000 FEET

December.....				5.60	4.26	2.83	3.8
January.....				4.70	3.72	7.38	2.7
February.....				4.93	3.72	6.41	3.3
Winter.....				15.38	11.70	16.62	9.8
March.....				6.06	6.64	7.78	0
April.....				4.47	3.42	4.81	(³)
May.....				4.42	2.19	7.77	0
Spring.....				14.95	12.25	20.36	9
June.....				4.91	1.76	9.11	0
July.....				5.13	5.53	3.81	0
August.....				4.72	3.67	.74	0
Summer.....				14.76	10.96	13.66	0
September.....				3.48	.64	8.78	0
October.....				3.11	.30	2.62	(³)
November.....				3.13	3.49	7.25	1.2
Fall.....				9.72	4.43	18.65	1.2
Year.....				54.81	83.34	69.29	11.9

¹ Temperature data for Bryson City not available² Records from U. S. Weather Bureau³ Trace⁴ July 1930⁵ December 1917.⁶ In 1925⁷ In 1932.⁸ In 1904.⁹ In 1929

WATER SUPPLY

The general slope of the county is westward. Creeks and small streams give the upland complete surface drainage and lands on the first bottoms a fair to good surface drainage in most places. Every

farm is connected with one or more drainageways, and the springs, branches, and creeks furnish an ample supply of water for work animals and cattle. Some of the land next to the upland or in slight depressions or low flat positions near streams has poor surface and internal drainage.

VEGETATION

As late as 1895 in the mountain hollows and on sheltered slopes in the region in which Swain County is situated were to be found enormous yellow poplar (tuliptree), ash, hemlock, white basswood (locally called linn), buckeye, oak, red maple, chestnut, and walnut trees and on the upper mountain slopes and summits, wild cherry, oak, maple, birch, and beech trees. Clingmans Dome was then covered by a dense growth of balsam fir and rhododendron. The walnut timber had been cut in all but the most remote places, as had also the choicest of the valley timber, but much still remained. The mountain timber had been cut only in the most accessible places and was for the most part virgin forest.

Since that time the forests have been exploited of almost all their virgin timber, and the trees that cover a large part of the county are mostly of second growth. In the mountain forests they include white oak, chestnut, chestnut oak, scarlet oak, birch, hickory, dogwood, sourwood, cherry, red maple, honey locust, water oak, black gum, yellow poplar, white basswood, hemlock, cucumbertree, and buckeye. In places on the higher slopes are red spruce and balsam. In some places on ridges in the mountains and on rough stony areas where the soil is thin, pitch pine, post oak, scrub oaks, and table-mountain pine are the principal trees. In the mountains the undergrowth includes rhododendron and mountain-laurel. Galax grows in many places. The high mountain balds, or treeless tracts, are covered by a dense growth of grass and small hazel bushes.

On the valley upland and on terraces in the valleys the trees consist largely of small pines, various oaks, sourwood, dogwood, hickory, and locust. The original trees in these places were mainly pine and different species of oak. On colluvial slopes near the base of mountains the trees include chestnut, chestnut oak, black walnut, butternut, honey locust, yellow poplar, red maple, and buckeye. Those that remain on the bottom lands are mainly birch, sycamore, water oak, elm, and ironwood, and a few hickory trees. The chestnut trees in the forests have been killed by blight, although the dead trees have commercial value for lumber, telephone poles, fence posts, and tannic acid.

The Nantahala National Forest covers 5,716 acres. On a few of the highest points are lookout stations equipped with telephones with which to summon help in case of fires. The Cherokee Indian Reservation is within a 3,200-acre tract. The Great Smoky Mountains National Park, which comprises 169,126 acres, is practically all in forest. This vast park includes nearly all the northern part of the county and each year is visited by a great many people who enjoy its ruggedness and scenic beauty.

ORGANIZATION AND POPULATION

Swain County was formed in 1871 from a part of Jackson County and a part of Macon County. The first settlers of the territory, for the most part of English, Irish, and Scotch descent, came mostly from Virginia, Georgia, and eastern North Carolina, and located near the Tuckasegee, Little Tennessee, and Oconaluftee Rivers, the Connelly, Hazel, and Alarka Creeks, and some of the other streams along which smooth and productive land could be found. Some settled in mountain coves, where the soil was fertile.

The 1940 Federal census gave the population of the county as 12,177, all classed as rural. A small part of the population consists of Negroes, many of whom live in Bryson City. The average density of the population is 22.4 a square mile.

The population is unevenly distributed, the greatest density being near the streams and on the lower slopes of mountains, where most of the arable land lies. Nearly all the people who lived in the Great Smoky Mountains moved elsewhere when that area was made a national park. Much of the mountainous country was never settled for agricultural use because of the steepness, stoniness, and roughness of the land.

Bryson City, the largest town, has a population (1940 census) of 1,612. This town is also the principal local market for agricultural products and the chief buying center of the county. It is situated on a railroad, as is also the next largest town, Almond, in the southwestern part.

TRANSPORTATION

Practically all the agricultural areas of the county are in easy distance of a railroad shipping point. The Asheville and Murphy branch of the Southern Railway crosses the central and southwestern parts, and the Carolina and Tennessee Southern division extends from Bushnell to Fontana in the western part.

Most of the county is served by hard-surfaced highways, and nearly all the farms are in easy reach of an improved road. United States Highway No. 19 crosses the southern part in an east-west direction. A State highway extends westward from Bryson City along the Tuckasegee River and the Little Tennessee River to Deals Gap, where it joins United States Highway No. 129, which leads to Knoxville, Tenn. The State and Federal highways not only serve the local transportation needs but are also used by through motorbuses and motortrucks. Other roads are difficult to travel for some time after rains and in winter, but in the more prosperous localities some are graveled and kept in good repair. In 1940, 181 farms were on hard-surfaced roads, 213 on gravel roads, 445 on improved dirt roads, and 728 on unimproved dirt roads.

CULTURAL DEVELOPMENT AND IMPROVEMENT

The county has adequate bus service to convey pupils to and from the many consolidated schools. Small, well-built schoolhouses are also placed conveniently for the pupils, and there are churches in many sections. Rural mail service extends into all parts and 12 farms

have telephone connection and 101 farm dwelling houses are lighted by electricity.

The farm buildings and farm equipment vary according to the productivity and workability of the land. The farm dwellings on the better soils in the valleys are kept painted and in good repair (pl. 3, *A*); whereas those in the mountainous parts are in most places small and in only fair repair (pl. 3, *B*). The larger farms on the nearly level to gently sloping and rolling land in the valleys have modern farm machinery, and the small ones on narrow bottom lands near streams and on mountain slopes have light machinery, as one-horse plows and cultivators. Binders and tractors are in use on a few of the larger farms that have smooth land for their operation. Horses and mules are used on the broader and smoother lands in the valleys, and mules and oxen on the steep mountain slopes and in the mountain coves.

In 1939, according to the 1940 census, 131 farms had a total of 138 automobiles; 49 farms, 55 motortrucks; and 5 farms, 5 tractors. The amount spent on the 144 farms for which the purchase of farm implements and machinery, including automobiles, trucks, and tractors, was reported was \$7,250.

INDUSTRIES

Only a small part of Swain County can be considered as suitable for field crops. According to the Forest Relations Division of the Tennessee Valley Authority about 90 percent of the county is covered by forest, and of this about 67 percent is in hardwoods and the rest mostly in mixed pine and hardwoods. About 19 percent of the forested area is classed as saw-timber forest (more than 500 board feet gross volume to the average acre in saw-timber-size trees) and 42 percent as cordwood forest (less than 500 board feet gross volume to the average acre in saw-timber-size trees and 4 cords or more to the average acre in cordwood-size trees.) A considerable part of the cash income is derived from the sale of lumber, acid-extract wood, pulpwood, tan-bark, and railroad ties (pl. 4). In addition to these sources of income, some of the people derive income from work in a copper mine in the western part of the county, a wood-turning plant in Bryson City, a kaolin and feldspar mine near Bryson City, and a limestone quarry near Nantahala. Limestone from this quarry is crushed and used as road gravel, although at one time it was burned for lime.

Nantahala, Almond, Judson, Wesser, Bushnell, Forney, Noland, Ela, Whittier, and Fontana are local trading places and also are shipping points for acid-extract wood, pulpwood, and other forest products. Cherokee is a trading center for the Cherokee Indians.

AGRICULTURE

EARLY AGRICULTURE

Long before white men settled in the territory now included in Swain County the Cherokee Indians were engaged in agriculture on a small scale. These Indians grew their crops on patches of bottom land—chiefly corn, beans, peas, pumpkins, and tobacco. The white

settlers selected the richer and more easily cultivated soils, and their crops consisted mainly of corn, wheat, rye, oats, and hay. They also raised cattle and hogs. Before railroads were built in this part of the State, the farmers sold and bought little, because of the great distance to markets and the poor condition of the roads, though some cattle and hogs were driven to markets in the South. Cattle had free range for many years after the county was formed; farmers marked their cattle for identification and turned them loose to graze on the mountain ranges.

No crop grown is strictly a cash crop. Although corn has been the leading crop since the beginning of the agriculture, a large part of it was used as subsistence for work animals, cattle, and hogs, and a small part was ground into meal for domestic use. For many years some cash revenue has been obtained from the sale of forest products. As the county is located in a steep, rugged, mountainous country, the aggregate area of arable land is comparatively small; hence, no great expansion of agriculture was ever possible. For many years lumbering was done on a rather large scale, and this contributed somewhat to the wealth of the county.

CROPS

In 1879, according to the 1880 census, the leading crops were corn, wheat, oats, and rye; and the aggregate acreage of these was 9,554. The minor crops were hay, sweetpotatoes, and tobacco; and the aggregate acreage of these was 160. The acreage of crops grown in certain years, as compiled from United States census reports, is shown in table 2.

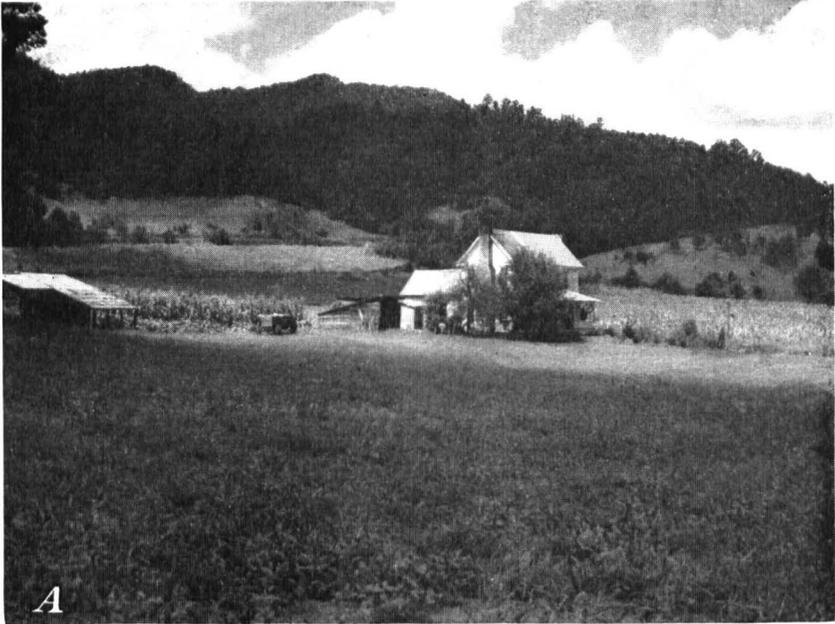
TABLE 2.—*Acreage of principal crops and numbers of fruit trees in Swain County, N C., in stated years*

Crop	1879	1880	1899	1909	1919	1929	1939
Corn, for grain..... Number of acres.	6,809	8,569	13,576	11,744	11,396	7,467	7,766
Wheat.....do.....	1,473	1,526	2,445	1,026	1,508	156	105
Oats, threshed.....do.....	757	1,200	813	573	328	8	20
Rye.....do.....	515	183	235	356	278	244	165
Potatoes.....do.....		195	236	329	416	500	511
Sweetpotatoes.....do.....	21	97	119	154	146	204	214
Tobacco.....do.....	11	93	30	5	3	8	1
Hay and forage.....do.....	128	381	360	1,456	5,738	1,415	1,200
Apples..... Number of trees	13,167	36,491	44,596	37,437	34,216	25,294	
Peaches.....do.....		6,154	10,039	5,919	10,467	9,009	4,591

¹ Hay only

It will be observed from table 2, that the acreages of hay and sweetpotatoes increased steadily from 1879 to 1939; that the acreages of wheat, rye, and oats decreased greatly during the same period and that the acreage in corn increased from 6,809 in 1879 to 13,576 in 1899 and has steadily decreased to 7,766 acres in 1939. Fruit growing has never been on a very large scale, and only one commercial orchard is in the county. The number of apple trees decreased from 44,596 in 1909 to 25,294 in 1939.

The value of agricultural products by classes, as compiled from the Federal census for certain years, is shown in table 3.



A. In the broader valleys substantial houses are characteristic of the farms, each of which has at least a moderate acreage of fertile arable land
B. Homes and farm buildings are unpretentious in the small narrow stream valleys associated with extensive areas of nonarable land. Most of these farms are of a subsistence type, with corn and hay the chief crops



A. A high percentage of the population of Swain County derives its cash income from forest products, chiefly lumber, pulpwood, railroad ties, acid-extract wood, and tanbark. Many sawmills are in operation.
B. Modest home of an Indian farmer on the Cherokee Indian Reservation.

TABLE 3—*Values of agricultural products, by classes, in Swain County, N. C., in 1919, 1929, and 1939*

Product	1919	1929	1939	Product	1919	1929	1939
	<i>Value</i>	<i>Value</i>	<i>Value</i>		<i>Value</i>	<i>Value</i>	<i>Value</i>
Crops				Livestock and products			
Cereals.....	\$383,048	\$171,354	\$110,019	Cattle, swine, and sheep sold or slaughtered.....	(?)	(?)	\$73,114
Other grains and seeds.....	4,135	90	1,152	Dairy products sold.....	\$15,360	\$25,443	10,251
Hay and forage.....	77,000	31,654	20,267	Wool and mohair.....	† 750	137	† 279
Vegetables (except potatoes and sweetpotatoes).....	172,023	78,163	150,354	Poultry and eggs.....	81,048	111,036	60,486
Potatoes and sweetpotatoes.....		65,763	45,505	Honey.....	‡ 4,991	1,365	1,728
Fruits and nuts.....	14,054	18,452	31,758				
All other crops.....	17,627	4,230	2,957				
Forest products.....	(?)	88,129	32,843				

† Includes potatoes and sweetpotatoes

‡ Not reported.

§ Wool only.

¶ Includes value of wax.

Corn led in total acreage in 1939, and was grown on 7,825 acres, of which 7,766 was for grain. The number of farms that reported growing corn was 1,490, or nearly all in the county. Corn produced an average yield of 16.6 bushels an acre. Most of it is used as subsistence for livestock, although a small part is ground into meal for use in the home.

In 1939 the growing of oats on 23 farms was reported, rye on 57, and wheat on 24. Oats were harvested from a total of 89 acres, and most of the crop was cut and fed unthreshed. Rye was grown on 165 acres, the average yield being 10.4 bushels an acre. Wheat was planted on 105 acres, the average yield being 817 bushels an acre. Most of the wheat grown is ground into flour for local use. Potatoes occupied 511 acres on 1,355 farms and sweetpotatoes 214 acres on 961 farms. They produced an average of 77.0 and 83.9 bushels an acre, respectively. Potatoes and sweetpotatoes are grown mainly for home consumption.

In 1939 sweet sorghum, or sorgo, for sirup was grown on 66 acres, yielding an average of 64 gallons an acre. Sorghums for silage, hay, or fodder were grown on 79 acres.

In 1939 the growing of farm garden vegetables for home use only was reported on 1,543 farms. These do not include potatoes and sweetpotatoes. Nearly every farm had a vegetable garden which included beans, peas, tomatoes, cabbage, sweet peppers, carrots, and turnips. Strawberries were grown on 14 farms.

The number of fruit trees and grapevines of bearing age in 1939 was as follows: Apple trees, 25,294, on 1,320 farms; peach trees, 4,591, on 514; cherry trees, 1,024, on 282; plum trees, 1,259, on 206; pear trees, 255, on 115; and grapevines, 3,094, on 557.

The value of forest products sold amounted to \$32,843. A great many farmers have mountain forests from which they sell chestnut poles, acid-extract wood, pulpwood, railroad ties, tanbark, and other forest products, ample transportation for which is furnished by railroad. Most of these products are shipped to Andrews, Sylva, or Canton for the manufacture of paper and wallboard and for the tanning of leather. Chestnut poles are shipped to points in Pennsylvania and other States.

AGRICULTURAL PRACTICES

In 1939, for 769 (47.6 percent) of the farms of the county, the purchase of fertilizer was reported. The quantity of commercial fertilizer purchased was 439 tons and the expenditure, \$12,281, or an average of \$15.97 per farm. These fertilizers, which come ready mixed, are mostly the following: 3-8-5,⁷ 5-7-5, 4-8-4, 2-10-4, 4-10-4, and 16-percent superphosphate. Applications of fertilizer to the fertile and productive bottom lands are in most places light and those to the less fertile lands on the red uplands rather heavy. Fertilizers of fairly high analyses are usually applied to land planted to truck crops. Stable or barnyard manure is applied to cropland in such quantities as are available, and green manuring is practiced on a few farms. For 71 farms 449 tons of liming materials, costing \$933, was purchased in 1939.

LIVESTOCK AND LIVESTOCK PRODUCTS

The number of cows and heifers 2 years old or older reported by the 1940 census on farms as of April 1, 1940, was 2,000. Cows of all kinds milked during all or any part of 1939 on 1,262 farms numbered 1,780. The milk produced was 758,209 gallons, and the butter churned on 1,214 farms was 211,940 pounds. Most of the farms have at least one cow that supplies milk and butter for domestic use. There is one dairy in the county, and its products are sold in Bryson City and at other places nearby. The cows are all of grade stock.

Chickens are raised on nearly every farm for meat and eggs for domestic use. On farms having more chickens and eggs than needed, the surplus is sold. On April 1, 1940, 1,364 of the 1,617 farms in the county reported a total of 26,971 chickens over 4 months old. The total number of all chickens raised in 1939 on 1,280 farms reporting was 64,629. In the same year 136,574 dozen eggs were produced on 1,284 farms reporting. The chickens in the county are Plymouth Rocks, White Leghorns, and Rhode Island Reds.

On April 1, 1940, the number of swine (over 4 months) on the farms was 1,495. Many of the farms raise one or more hogs to supply home needs for pork. Almost all the hogs are Poland Chinas.

A little more than half the work animals are horses and the rest mules. On April 1, 1940, the number of horses (over 3 months old) on 635 farms was 463 and the number of mules (over 3 months old), 355.

Although much corn and hay are grown in the county, the expenditure for feed in 1939 was \$36,944 on 1,188 farms, or 73.5 percent of those reported on, and the average expenditure was \$31.10. The feed included hay, grain, and millfeed for feeding domestic animals and poultry. Some of the feed purchased may have been grown in the county by farmers who sold it to other farmers.

LAND USE

The farm population on April 1, 1940, was 8,660, 7,521 of whom were whites, 19 Negroes, and 1,120 Indians. The total number of occupied dwellings was 1,698; 73 dwellings were unoccupied. The number of

⁷ Percentages of nitrogen, phosphoric acid, and potash, respectively

persons working on farms on March 24 to 30, 1940, was as follows: Family labor, 2,274; hired help, 75.

Of the approximate land area of the county, 26.2 percent was in farms in 1939. All land in farms in 1940 comprised 91,323 acres, and the number of farms was 1,617.

Farm land according to use in 1939 was as follows: Cropland harvested, 11,289 acres; crop failure, 86; and idle or fallow land, 4,338. The total plowable pasture land was 10,332 acres and woodland 59,647. All other land in farms included 5,631 acres. The aggregate acreage of cropland, plowable pasture land, woodland, and all other land in farms was 91,323. The remaining 256,837 acres, or 73.8 percent of the area, was probably forest land, including Government reservations and individual holdings.

FARM TENURE

Of the farms reported on by the 1940 Federal census, 64.6 percent were operated by owners, 35.3 percent by tenants, and 0.1 percent by managers. All land in farms, by tenure, was as follows: Full owners 59,363 acres; part owners, 4,344; and tenants 27,244, of which 19,624 was by tenure of cash tenants and 7,620 by tenure of other tenants. Of the 1,617 farms in the county in 1940, 1,410 were operated by white people, and 207 by nonwhite.

Hired labor was used on 342 farms, or 21.2 percent of the farms, in 1939. The cash spent for farm labor, exclusive of housework, was \$14,065, or an average of \$41.13 for each farm reporting.

FARM INVESTMENTS

According to the Bureau of the Census the value of all farm property per farm increased from \$572 in 1880 to \$1,287 in 1940. The average value per acre, including buildings, was \$33.80 in 1930 and \$19.71 in 1940. In 1940, of the average of \$1,287 invested in all farm property, 86.5 percent was in land and buildings, 2.1 percent in implements, and 11.4 percent in domestic animals, poultry, and bees.

SOIL SURVEY METHODS AND DEFINITIONS

Soil surveying consists of the examination, classification, and mapping of soils in the field and the recording of their characteristics, 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 are made, and exposures, such as those in road and railroad cuts, are studied. Each excavation exposes a series of distinct soil layers, or horizons, called collectively the soil profile. Each horizon of the soil, 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.⁸ The

⁸The 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 reaction of the soil. The presence of lime is detected by the use of a dilute solution of hydrochloric acid.

drainage, both internal and external, and other external features, as the relief or lay of the land, are taken into consideration, and the interrelation of the soil and vegetation is studied.

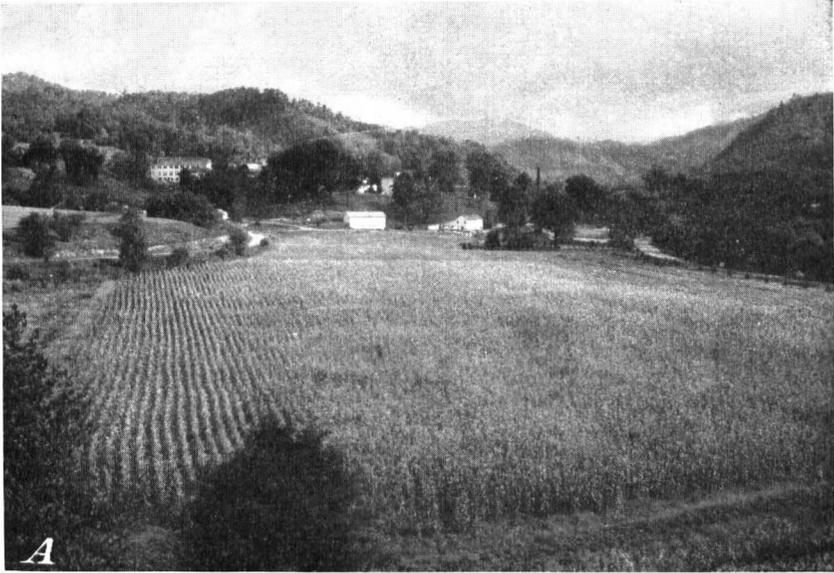
The soils are classified according to their characteristics, both internal and external, with special emphasis upon the features that influence the adaptation of the land for the growing of crop plants, grasses, and trees. On the basis of these characteristics the soils are grouped into classification 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—as riverwash and rough stony land—that have no true soil are called (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 soil profile and having similar parent material. Thus, the series comprises soils having essentially the same color, structure, natural drainage conditions, 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. Congaree, State, Hiwassee, Hayesville, Talladega, Ramsey, and Porters are names of important soil series in Swain County.

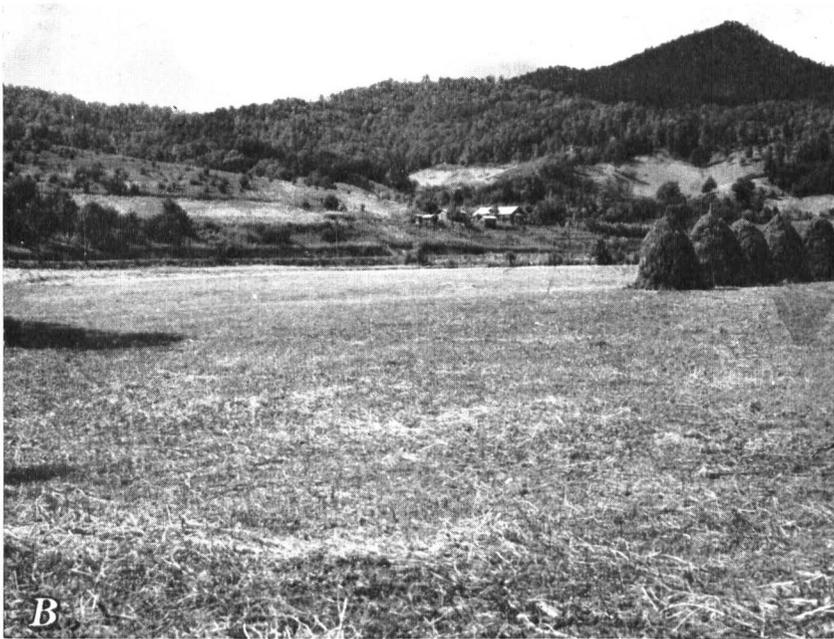
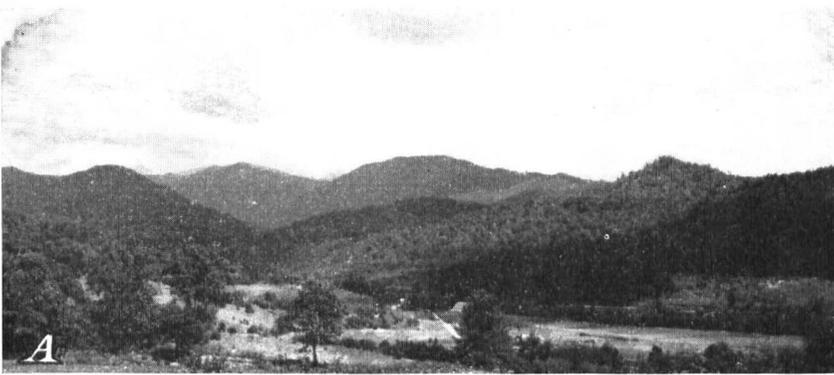
Within a soil series are one or more types, defined according to the texture of the upper part of the soil. Thus, the class name of this texture, as sand, loamy sand, sandy loam, silt loam, clay loam, silty clay loam, or clay, is added to the series name to give the complete name of the soil type. For example, Congaree silt loam and Congaree fine sandy 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.

A soil phase is a variation within the type, differing from it in some minor feature, generally external, that may be of special practical significance. For example, within the normal range of relief for a soil type some areas may be adapted to the use of machinery and the growth of cultivated crops and others may not. Differences in relief, stoniness, and degree of accelerated erosion may be shown as phases. Even though no important differences may be apparent in the soil itself or in its capability for the growth of native vegetation throughout the range in relief, there may be important differences in respect to the growth of cultivated crops. In such instances the more sloping parts of the soil type may be segregated on the map as a sloping or a hilly phase. Similarly, some soils having differences in stoniness may be mapped as phases even though these differences are not reflected in the character of the soil or in the growth of native plants.

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.



- A.* The Cherokee Indian Reservation school affords grammar and high school facilities to Indian children. This institution raises truck crops and produces dairy products for its own needs. The truck crops in the foreground are on Congaree silt loam.
- B.* A subsistence type of farming is practiced on many of the farms in creek valleys where the acreage of tillable land is limited. Corn and hay crops predominate on the Congaree and State soils of the nearly level bottom lands and low benches. The low hills are Hayesville soils formerly tilled but now used for permanent pasture. The dark trees on these low hills are pines, established on abandoned areas. The forested mountains in the background are on Ramsey and Ranger soils.



A. Ramsey and Porters soils occupy a large part of the mountainous area of Swain County, and approximately 95 percent of their acreage is covered by forest.
B. Soybean hay is on Toxaway silt loam in the foreground, and Hayesville loam occupies rolling areas in the background. Soybeans do well on Toxaway silt loam where drained and on Congaree silt loam.

SOILS

SOIL SERIES AND THEIR RELATIONS

The soils of Swain County are typical of the extremely mountainous part of North Carolina. Although agriculture has been the chief pursuit of the people since the county was settled, it has been restricted to rather limited areas largely because of the steepness and stoniness of the land. In 1939 (1940 census), 26.2 percent of the area was in farms, slightly more than 3 percent in cropland, and slightly less than 3 percent in plowable pasture land.

About 250 square miles, or about half the total area, is in the Great Smoky Mountains National Park; about 9 square miles is in the Nantahala National Forest; and 50 square miles is in the Cherokee Indian Reservation (pl. 5, *A*). About three-fifths of the area, therefore, is occupied by these three reservations. Most of the land occupied by the first two of these is steep and stony; and the greater part of the virgin timber had been cut before any of the land was acquired for a park or a forest reserve. Considerable cash revenue, however, is derived from the sale of forest products harvested from privately owned forest land.

Practically all the cultivated land consists of soils on first bottoms, on terraces near streams, and on moderate slopes near the foot of mountains (pl. 5, *B*). Soils used for crops include Congaree silt loam, Congaree fine sandy loam, and alluvial soils, undifferentiated, on first bottoms; State loam and Hiwassee silt loam, on terraces; and Tusquitee loam and Tusquitee stony loam, on moderate slopes near the base of mountains. Attracted by soils that were fertile and easy to cultivate, the early settlers established their homes on or near them. These still remain the choice soils and have maintained their productivity well through the years.

A large area of Talladega-Ramsey loams, hilly phases, is developed in the vicinity of Maple Springs. On the map this unit includes many areas of different soils so small and so intricately associated that it is not feasible to separate them individually. Over all this area the slopes range from 15 to 30 percent or slightly more. As this soil is less stony and is deeper than some other hilly soils in the low mountainous country, it has been cleared more extensively than any other on the low mountain upland. It was found to be deficient in natural fertility, however, and difficult to conserve; consequently, most of it was finally abandoned.

The good physical qualities and inherent fertility of the Congaree soils make them especially well adapted to corn and potatoes. Alluvial soils, undifferentiated, are well suited in many places to corn and in nearly all places to hay and pasture. State loam and Hiwassee silt loam, which are developed on terraces and therefore are higher than the soils on first bottoms, have a wider range in adaptation to crops than any of the other soils. Their wide adaptation is due to favorable external features, good internal physical condition, and fairly good natural fertility. A diversified agriculture that includes all the crops grown is practiced on these two soils. The Tusquitee soils, because of good physical qualities and natural fertility, are also well suited to

corn, potatoes, and garden vegetables, and a large part of these soils is used for these crops.

The soils on the valley and mountain uplands have formed directly from weathered material of the underlying rocks. The soils of the Hayesville series on the valley uplands are mostly hilly and steep and are naturally less fertile than those on bottom lands and terraces. They also are deficient in organic matter and erode easily unless correct management is practiced. The soils on the mountains, which include members of the Porters, Ramsey, Talladega, and Burton series, are mostly steep and very steep, and in many places stony. Although some of the soils are naturally fertile and apparently contain considerable decomposed organic matter, they are generally not suitable for cultivation, but in places areas of some of them are used as pasture land. Farms that have been established in the mountains are small. Many of the soils on the mountains are well suited to apple growing, although only one apple orchard has been developed for commercial production. Their best use is in forestry (pl. 6, 11), even though it is possible for some areas to be used for crops and for pasture. On many of the ridges in the lower mountain country, the soil is very shallow, dry, and poor; and the forest that grows on it consists mainly of small pitch pines.

The soils on the first bottoms and on the terraces appear to be high in organic-matter content. All the soils are acid in reaction, some more than others. In most places they are friable and also permeable to moisture and plant roots. All the arable soils except Hayesville clay loam, severely eroded phase, work to a good tilth. The county has no large areas of leached sandy soils or of heavy plastic clay soils. Many stones are present on the surface and in the soil, especially on or at the foot of mountains. A large part of the soil is on steep or very steep land, and the slopes occupied range from about 30 to 60 percent or more.

About 95 percent of the county is poorly suited to cultivated crops because of stoniness and steep relief and the problem of conservation when the land is cleared. Slightly less than 2 percent of the areas are nearly level, and these are practically all on first bottoms along streams.

In some of the soils three layers have formed, which differ somewhat in color, texture, consistence, structure, and thickness. The first, or surface layer, is 6 to 12 inches thick. The second layer, or the subsoil, ranges from a few inches to about 30 inches in thickness. The third layer, which is the substratum or parent material, ranges in thickness from a few inches to many feet. In some of the soils on the mountains and on first bottoms very little difference is to be found between the surface and subsoil layers.

In general, the soils have light-brown, brown, or almost black surface layers and brown, reddish-brown, or red subsoils. The surface layer is usually a friable loam, although in some places in the first bottoms and in many other places on the mountains it is a silt loam. Covering the soil in forested areas is a dark-colored organic layer 1 to 3 inches thick, consisting of material derived from decayed leaves and twigs. The first few inches of the surface layer is brown or dark brown; the dark color being caused by the decomposed organic matter present.

The subsoil consists of friable or firm loam to clay, and the substratum of soft decomposed rock material, which in some places is more friable than the subsoil material. The substratum, in places, contains weathered fragments of the parent rock. Frequently the substratum is absent and the subsoil lies directly on bedrock. In some places the soil is so shallow that the surface layer passes immediately into soft decomposed rock or lies on bedrock.

The soils of Swain County differ in a number of characteristics, on the basis of which they have been classified in nine series. Some of these series are of relatively little importance because of small extent, unsuitability, or both. In order to use the survey to the best advantage, however, it is necessary to become familiar with the series of soils, particularly the main ones. Perhaps this can be done most readily by associating the soils of each series with the position they occupy on the broad landscape or, in other words, by associating them with prominent physical land features. The soil series, therefore, are placed in four groups: Those that occur on (1) uplands, (2) colluvial lands, (3) terrace lands, and (4) bottom lands. By uplands is meant areas lying above the stream bottoms, stream terraces, and accumulations of colluvium and local wash. Colluvial lands refer to areas where soil material has accumulated at the foot of slopes and in depressions. Terrace lands and bottom lands are made by water. The bottom lands comprise areas along streams that are subject to flooding, whereas the terrace lands are benchlike areas that border the bottom lands but occupy higher positions and are not subject to flooding. The associations of the soil series with these land features and the chief characteristics of the soils of each series are given in table 4.

In addition to the nine soil series recognized in the county, five miscellaneous land types are mapped—alluvial soils, undifferentiated; stony colluvium (Ramsey and Porters soil materials); rough stony land, peaty phase; rough stony land (Ramsey and Porters soil materials); and rock outcrop.

GROUPING OF SOILS ACCORDING TO RELATIVE PHYSICAL SUITABILITY FOR AGRICULTURAL USES⁹

The 14 soil types, 9 soil phases, 2 soil complexes, and 5 miscellaneous land types are classified on the basis of physical characteristics that can be observed in the field. Some of these characteristics, as color, may be considered internal; others, as slope, are external. Both internal and external characteristics may be of significance in determining the physical capabilities of the soil unit.

The soils are grouped in five classes on the basis of their relative physical suitability¹⁰ for agricultural use, in order that their relation to agriculture may be discussed more conveniently. These classes, in the order of decreasing desirability for use in the present agriculture, are First-class, Second-class, Third-class, Fourth-class, and Fifth-class soils. Although the soils of no one class are ideal for

⁹This same grouping is discussed in the section on Productivity Ratings and Land Classification

¹⁰Physical suitability is used in the sense of suitability for specific uses, considering only the productivity, workability, and conservability of the soil and without reference to other considerations, as location, size or shape of areas, association with other soils, or economic considerations of the feasibility of any specific use

the existing agriculture, the First-class soils more nearly approach the ideal than do the Second-class soils. Likewise, the soils of each succeeding class are farther from the ideal than those of the preceding class (p. 49).

The physical suitability of a soil unit for agricultural use is determined by the characteristics of that unit. Many soil characteristics contribute to the productivity, workability, and conservability of the soil unit. Productivity, as used here, refers to the capacity of the soil to produce crops under prevailing farm practices. The soil may be productive but not well-adapted to a crop because of poor workability, conservability, or both. Workability refers to the ease of tillage, harvesting, and other field operations. Texture, structure, consistence, organic-matter content, moisture conditions, stoniness, and slope affect workability. Conservability refers to requirements for maintenance or improvement of the productivity and workability of the soil or both, including control of erosion. The degree to which the soil responds to management practices is reflected in the requirements for conservation. These three conditions determine the physical suitability of the soil for agricultural uses. No simple method of evaluating the three conditions and applying these values toward determination of physical suitability of a soil can be used. An ideal soil for crop production is one that is very productive, easily worked, and capable of being conserved with the minimum of effort. All the soils of Swain County fall short of the ideal, but they differ widely in the degree of departure.

The relative physical suitability of the soil units for agricultural use are determined from the experience of farmers, fieldmen, and others who work with the soil. For example, a farmer knows that some soils on his farm are more desirable than others. By comparisons within farms and between farms, the soil units may be ranked in the order of their desirability for the agriculture of the area under present farming practices. Where information based on experience is lacking, the gaps may be filled by comparisons with soils of similar characteristics for which the information is available. Arbitrary limits are then chosen for separation into five physical land classes within this ranking. In the ranking of the soils and in choice of limits of the physical land classes, it is generally assumed that a soil well suited only to pasture or forest is less desirable than one well suited to crops but rather poorly suited to pasture. Similarly, it is assumed that a soil well suited only to forest is less desirable than one well suited to pasture. On any one farm, these assumptions may be in error, but it is thought that they will hold in the majority of cases in this county.

Under present conditions, First-class soils are physically good to excellent cropland; Second-class soils, fair to good cropland; Third-class soils, poor to fair cropland; Fourth-class soils are poorly suited to crops but are fairly well suited to pasture; and Fifth-class soils are poorly suited to either cultivated crops or pasture and are better suited to forest, although some areas may be used for crops or pasture.

This grouping is not to be taken as a recommendation for use. Its purpose is to provide information as to the relative physical suitability of the various soils for the present agriculture of the locality. Information on a number of additional factors is necessary to make

even general recommendations for land use; and knowledge of a great many factors applying to a specific farm is necessary in making recommendations for land use on that farm.

In the following pages the soils are described in detail, and their agricultural relations are discussed. Their location and distribution are shown on the accompanying soil map. Their acreage and proportionate extent are given in table 5.

TABLE 5—Acreage and proportionate extent of soils mapped in Swain County, N. C.

Soil type	Acre	Per cent	Soil type	Acre	Per cent
Alluvial soils, undifferentiated . . .	1,024	0 3	Ramsey silt loam	960	0 3
Burton stony loam			Ramsey stony loam	122,112	35 4
Shallow phase	2,308	7	Hilly phase	1,600	5
Steep phase	2,560	7	Rock outcrop	192	1
Congaree fine sandy loam	1,024	3	Rough stony land		
Congaree silt loam	2,816	8	Peaty phase	27,392	8 0
Hayesville clay loam			Ramsey and Porters soil materials.	0,472	2 7
Severely eroded phase	384	1	State loam	512	1
Hayesville loam	4,096	1 2	Stony colluvium		
Steep phase	2,176	6	Ramsey and Porters soil materials.	3,520	1 0
Hiwasee silt loam	448	1	Talladega-Ramsey loams	6,976	2 0
Hill phase	768	2	Hilly phases	832	2
Porters loam	7,168	2 1	Talladega silt loam	3,008	9
Hilly phase	896	3	Talladega stony loam	3,392	1 0
Very steep phase	29,568	8 6	Tusquitee loam	5,248	1 5
Porters stony loam	15,744	4 6	Tusquitee stony loam	2,368	7
Ramsey loam	81,928	24 6			
Hilly phase	1,408	4			
			Total	344,960	100 0

FIRST-CLASS SOILS

First-class soils constitute good to excellent cropland. They differ in degree of profile development, character of parent materials, color, structure, and in other respects, but they are relatively similar in general physical suitability for agricultural use. All are fairly well supplied with plant nutrients if compared with other soils of the county, but even the most fertile is responsive to additions of needed amendments for some crops. These soils are medium to strongly acid. All are well drained, yet their physical properties are such that moisture is well retained, tending to insure an equitable supply for plant growth. Good tilth is easily maintained, and the range of moisture conditions for tillage is comparatively wide. The soils are well supplied with organic matter that is well combined as an integral part of the soil, and the physical properties favor normal circulation of air and moisture. Roots penetrate all parts of the subsoil freely.

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

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

The First-class soils are Congaree silt loam, Hiwasee silt loam, State loam, and Tusquitee loam. Their aggregate area is 9,024 acres.

SECOND-CLASS SOILS

Second-class soils constitute fair to good cropland under present farming practices. Like the First-class soils, the group includes soils with a great diversity of physical characteristics—a diversity greater however, than in the First-class soils. They are relatively similar in their physical suitability for use in the agriculture of the county, but they may differ in productivity, workability, or conservability within a limited range. Each soil is moderately deficient in one or more of these respects, and the detrimental effect upon 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. In general, the Second-class soils are at least moderately productive for most crops. Their physical properties are at least moderately favorable to tillage, maintenance of good tilth, and normal circulation and retention of moisture. None occupy strong relief, and none are extremely stony or severely eroded.

The Second-class soils, in the approximate order of desirability, are Congaree fine sandy loam, Tusquitee stony loam, and alluvial soils, undifferentiated. Their aggregate area is 4,416 acres.

THIRD-CLASS SOILS

Third-class soils constitute poor to fair cropland under present farming practices. Each is characterized by workability, productivity, and conservability, one of which, by itself, or in combination, is sufficiently adverse to limit definitely the physical suitability of the soil for the production of the commonly cultivated crops, but not so limiting that the soil is definitely unsuited physically for cultivated crops. In the Third-class soils one or more of the following undesirable features are prominent: Poverty of plant nutrients, poverty of organic matter, shallowness to bedrock, strong slope, stoniness, or eroded condition.

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

The Third-class soils, in approximate order of desirability, are Porters loam, hilly phase; Hiwassee silt loam, hill phase; Hayesville loam; and Talladega-Ramsay loams, hilly phases. Their aggregate area is 6,592 acres.

FOURTH-CLASS SOILS

Fourth-class soils are poorly suited to cultivated crops under present farming practices, but are at least moderately productive of pasture plants. Each is so difficult to work or to conserve, or both, that it is generally not feasible 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, these soils are physically suitable for pasture. They are generally used for pasture where an adequate area of fair to good cropland is available, but the largest acreage is now probably used for forest, largely in localities where there is little or no fair

to good cropland. A considerable acreage is used for crops, chiefly on farms where soils better suited to crops occur in acreages too small to meet the needs of the farm unit.

The Fourth-class soils, in approximate order of desirability, are Porters loam; Hayesville loam, steep phase; Hayesville clay loam, severely eroded phase; Ramsey loam, hilly phase; Ramsey stony loam, hilly phase; stony colluvium (Ramsey and Porters soil materials); and Burton stony loam, shallow phase. Their aggregate area is 18,624 acres.

FIFTH-CLASS SOILS

Fifth-class soils are poorly suited either to cultivated crops or to pasture under present farming practices. Each is so difficult to work or so difficult to conserve, or both, that it is generally not feasible to cultivate it; and each is so low in plant nutrients or has such poor moisture relations, or both, that common pasture plants produce very little feed. Although forest trees of any particular species probably grow more slowly on these soils than on any of those of the other classes under similar climatic conditions, the Fifth-class soils are physically better suited to forest than to any other use. Existing conditions, however, either of the locality or of the farm unit, may require the use of some of these soils for pasture or crops, despite the fact that they are poorly suited to these uses in their natural condition.

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

Although Fifth-class soils are similar in physical suitability for agricultural use, they differ widely in a great many physical characteristics. Some of these differences, therefore, may cause differences in suitability for forest between the individual soil units.

The Fifth-class soils are Porters loam, very steep phase; Porters stony loam; Ramsey loam; Ramsey stony loam; Ramsey silt loam; Talladega silt loam; Talladega stony loam; Talladega-Ramsey loams; Burton stony loam, steep phase; rough stony land, peaty phase; rough stony land (Ramsey and Porters soil materials); and rock outcrop. Their aggregate area is 306,304 acres.

DESCRIPTIONS OF SOIL UNITS

Alluvial soils, undifferentiated.—This land type consists of a mixture of several soils that occur on first bottoms near streams. In some places the soil is brown friable silt loam to a depth of 8 to 12 inches, underlain by dark-gray rather heavy silty clay loam that passes at a depth of about 32 inches into mottled gray and brown friable sandy clay material. Such areas appear to have been at some time Toxaway silt loam, a nearly black soil; but from much local wash deposited on

the soil and from sediments deposited by floods, a brown surface layer similar to that of Congaree silt loam formed on the black soil. In some places the soil is Congaree silt loam; and here the surface layer is brown mellow silt loam, 8 to 12 inches thick, and the subsoil is light-brown or yellowish-brown friable clay loam to a depth of 30 inches or somewhat more. In still other places the surface layer is grayish-brown friable fine sandy loam, about 10 inches thick, and the subsoil is yellow friable fine sandy clay, fine sand, or clay. As alluvial soils, undifferentiated, occupies positions in low first bottoms, it is subject to the addition of new materials; and therefore, to change in texture by the addition of sand and mud when the streams overflow. This type is formed from alluvial materials, consisting of sand, silt, and clay, deposited near the streams and from soil material washed from slopes nearby and deposited on the bottoms. On the whole, it is not so well drained as most soils on the first bottoms.

The mixed miscellaneous land type lies near many streams in all parts of the county. The larger areas are along Alarka Creek near Alarka School; near Shepherd Creek about 2 miles southeast of Bryson City; and along Johnson Branch, Betts Branch, and Buckner Branch. The smaller areas are along many of the other streams. The aggregate area is 1.6 square miles.

Although this soil is not so extensive as some on the uplands, it is important in the agriculture of the county. About 95 percent of it is used for crops and pasture. The principal crops are corn and hay, and the yields in the more favorable places are about as high as on Congaree silt loam. A light application of fertilizer is given the land for corn. Pasture is fair.

Included with alluvial soils, undifferentiated, are areas of Toxaway silt loam, the surface layer of which consists of dark-brown or almost black mellow silt loam 10 to 20 inches thick. The surface soil apparently contains a large quantity of well-decomposed organic matter. The subsoil is steel-gray or grayish-brown variable-textured material to a depth of about 30 inches, where it passes into gray fine sandy clay material, in which are mottles of yellow and brown. Some finely divided mica flakes are present in the lower part of the subsoil and in the soil material. In some small areas the subsoil is yellowish-brown friable silt loam or silty clay loam, and in others it is light-gray heavy silty clay, locally known as pipe clay. Such pipe clay areas are less productive than the areas having the brownish-yellow subsoil.

Toxaway silt loam has a total extent of about 70 acres within alluvial soils, undifferentiated, the largest area near Ravensford. The soil occupies flat areas on first bottoms, which in most places lie next to the uplands. Both external and internal drainage are poor, and the soil has to be drained for crops to give the best yields. All the soil is cleared and is used for crops and pasture. The principal crops are corn and hay (pl. 6, *B*), and the yields are somewhat lower than on Congaree silt loam. The soil is acid.

Included also with alluvial soils, undifferentiated, are areas of Toxaway silt loam, light-colored phase. This included soil differs from the normal silt loam in that its 8- to 12-inch surface layer is gray or light brown and its subsoil is light-gray or bluish-gray heavy clay to a depth of about 36 inches. The aggregate area of this phase is about 70 acres, and the largest areas are near Governors Island and

Deep Creek south of the Swain County Home. This soil is closely associated with areas of Congaree silt loam and is developed on high first bottoms between areas of Congaree silt loam and the uplands. The soil is nearly level, although slight depressions appear here and there. External and internal drainage are poor, and open ditches are necessary to obtain best results from the soil. On areas that have been drained by open ditches the yields of corn and hay are almost the same as those on Congaree silt loam. Most of the soil, however, is in pasture, and the yields are fair.

Burton stony loam, shallow phase.—Because of the presence of a large quantity of organic matter derived from decayed leaves, bark, grass, and moss, the 3- to 8-inch surface layer of this stony soil consists of dark-gray or almost black loam or mucky loam. The subsoil is brownish-yellow or yellowish-brown friable clay loam. At a depth of 12 to 18 inches, the subsoil is underlain by bedrock, consisting of conglomerate, slate, and graywacke. In some places there is no subsoil and the surface layer rests directly on bedrock. Many angular rock fragments 4 to 10 inches or more in diameter are on the surface and in the soil. In areas near the North Carolina-Tennessee line east of Double Spring Gap, the surface soil consists of a thin layer of peat and muck covered with moss. In some places a thin layer of brown mineral soil appears beneath this dark-colored organic material, and in other places bedrock underlies this layer. The soil remains in a moist condition most of the time.

This phase occupies positions in comparatively smooth areas on the tops of high mountains in the Great Smoky Mountains, and the slopes on which the soil appears range from 7 to 15 percent. The largest areas are on Hughes Ridge, Welch Ridge, Proctor Ridge, Thomas Ridge, Shot Beach Ridge, Bearpen Ridge, Katalsta Ridge, the Noland Divide, Andrews Bald, Clingmans Dome, Bunches Bald, and along the North Carolina-Tennessee line between Mount Kephart and Silers Bald. The aggregate area is 3.7 square miles.

None of this stony soil is cleared. On areas along the northern boundary west of Double Spring Gap, the forest consists of oak, birch, and a few maples. Balsam and red spruce are the principal trees east of this gap and in many other places. This soil also occupies most of the balds on some of the mountain summits, and a dense growth of grass and hazel bushes covers these treeless tracts. The balds probably were forested some time in the past, but for some unknown cause no trees now grow on them. The grass there makes good pasture, and the areas were considered good range for cattle before this mountain region became a national park.

Burton stony loam, steep phase.—To a depth of 20 to 32 inches this soil is dark-brown or almost black mellow loam containing a large quantity of organic matter derived from decayed leaves, twigs, and bark. This dark-colored layer is underlain by brownish-yellow or yellowish-brown friable permeable loam or clay loam to a depth of 35 to 45 inches, where it passes into weathered rock material; or this layer is underlain by bedrock consisting of conglomerate, slate, and graywacke. The 8- to 36-inch surface layer varies in thickness from place to place. In some places no subsoil layer is present, and the surface layer rests directly on bedrock. Angular rock fragments a few inches

to several feet in diameter are on the surface and are mixed with the soil in varying numbers. In some areas on the steeper ridges, known as heath balds, or slicks, the soil is black, slick, and slightly waxy, and is somewhat deeper than any of the surrounding soils.

This soil usually occurs in remote and almost inaccessible places, and none of it has been cleared for crops. The largest areas are on Welch Ridge, along the Swain-Haywood County line from Black Camp Gap nearly to Beech Gap, at Pin Oak Gap, and on the east slope of Hyatt Ridge. The aggregate area is 4.0 square miles.

This steep soil has slopes of 30 to 45 percent or more; both external and internal drainage are good. Because of the dense undergrowth, the soil stays moist the greater part of the year.

Naturally productive, much of this soil is covered with a dense growth of rhododendron and mountain-laurel, and areas on the balds, or treeless tracts on top of some of the higher mountains, support a heavy stand of grass that makes excellent pasture. Some areas are forested with oak, buckeye, and sugar maple. On areas in the north-eastern part are some red spruce and balsam.

Congaree fine sandy loam.—Associated in many places with Congaree silt loam, this soil is somewhat lighter in color in some places, contains considerably more sand, and is generally slightly lower in the production of corn, hay, and pasture, although it ranks high in the production of wheat, oats, truck crops, and sorgo. It requires somewhat heavier fertilization under similar management for good crop yields. Because of the fine sand present, the soil is somewhat easier to work than the silt loam. It is a good soil for the production of the crops commonly grown, and for this reason it is important in the agriculture, although its aggregate area is small in comparison with that of some of the soils on the uplands.

To a depth of 10 to 20 inches this soil is grayish-brown, brown or light-brown friable mellow and loose fine sandy loam or loamy fine sand, which, in places, contains many fine mica flakes. This layer is underlain by light-brown or yellowish-brown fine sandy clay, fine sandy loam, or micaceous loamy sand, and near small streams by mottled-brown, dark-gray, and grayish-blue loam. This material continues to a depth of 40 to 50 inches and is underlain by a layer of medium sand and gravel, usually in a moist condition. Narrow bands of brown fine, medium, and coarse sand are present nearly everywhere. Near the place where this soil joins areas of Congaree silt loam and Toxaway silt loam and in small low spots, the texture of the surface soil is silt loam or very fine sandy loam.

Along most of the streams this soil is present in narrow strips on first bottoms, the larger areas along the Little Tennessee and the Tuckasegee Rivers, and the smaller on first bottoms along most of the smaller streams. The soil has formed from material consisting chiefly of sand, silt, and clay washed from loam, fine sandy loam, and sandy loam areas on the uplands and deposited near the streams by running water. It can be cultivated under a wide range of moisture conditions, and modern farm machinery can be used on it successfully. An aggregate of 1.6 square miles is mapped.

The relief ranges from nearly level to slightly undulating. Most areas are so low that they are subject to flooding. Areas that lie next to the streams are in most places higher than those of the associated

Congaree silt loam, on which crops are more subject to damage by flooding. On the whole, this soil has better natural drainage than any of the other soils on the first bottoms.

Practically all of this soil is cleared for crops—probably 80 percent for corn, 10 percent for truck crops, 5 percent for rye and sweet-potatoes, and 5 percent for sorgo, with small areas in watermelons. Corn produces 15 to 30 bushels an acre; truck crops, watermelons, and sorgo give good returns; rye yields 8 to 15 bushels an acre; and sweet-potatoes 75 to 100 bushels. Land for corn, sorgo, rye, and sweet-potatoes is usually given an application of 200 to 400 pounds an acre of 3-10-4 fertilizer, and land for truck crops and watermelons 400 to 600 pounds of 3-6-6 fertilizer.

Included with this soil are areas of Congaree silt loam and of alluvial soils, undifferentiated, which are too small to be separated on the soil map.

Congaree silt loam.—The 8- to 12-inch surface soil is a brown or dark-brown friable silt loam or very fine sandy loam. The subsoil is light-brown or yellowish-brown friable silt loam or fine sandy clay, becoming lighter in color and texture with depth. At a depth of 28 to 40 inches, it passes into variable soil material. Many small finely divided mica flakes appear in both the surface soil and the subsoil.

Areas a few feet to nearly half a mile wide are on first bottoms along practically all the streams, the larger in the vicinities of Governors Island, Ravensford, Cherokee, Birdtown, and Bryson City and many small ones near streams elsewhere. The aggregate area is 4.4 square miles.

This soil contains a fair quantity of decomposed organic matter well incorporated with the mineral material of the surface layer. It is fairly easily tilled, is easy to maintain in good productivity, is not susceptible to erosion, and gives good to high yields of corn, hay, and pasture. Being relatively high in available plant nutrients, it produces good yields of crops without artificial fertilization or with a minimum of such applications. The soil is well drained except in some small, low, flat places that require ditches. In places it is associated with State loam and occupies somewhat lower positions near the stream. It is flooded occasionally in parts of the broad bottoms and nearly all the narrow bottoms, but fine sediments that enrich the soil are usually left when the floods recede. This soil has formed from alluvial deposits consisting mainly of sand, silt, and clay from upland slopes underlain by granite, gneiss, slate, and mica schist, some of the minerals of which contain potash.

One of the most important soils in the agriculture of the county, it is practically all used for crops and pasture. Modern farm machinery can be used on the larger areas. The tree growth on the few uncleared areas consists mainly of birch, sycamore, water oak, elm, and ironwood. Some hickory trees grow in places. Corn, hay, beans, cabbage, and potatoes are the main crops grown, and wheat, rye, field peas, and soybeans are minor crops (pl. 7, A). Corn generally yields 30 to 45 bushels an acre, hay 1 to 2 tons, and wheat and rye 10 to 15 bushels, although in places rye yields slightly more than wheat. Field peas and soybeans make good returns. Land in corn, wheat, and rye is generally given light applications of fertilizer, and that in truck crops heavy

applications, usually consisting of 1,000 pounds of 5-7-5. Pasture yields are good.

Mapped with this soil are small areas of Toxaway silt loam, which are conspicuous by their almost black color. The surface layer is dark gray or very dark gray, and the subsoil is gray. Small areas of Congaree fine sandy loam and of alluvial soils, undifferentiated, also are included. Congaree fine sandy loam contains much fine sand and is somewhat more friable and looser than Congaree silt loam. Alluvial soils, undifferentiated, vary in color, texture, and condition of drainage. All the areas of these included soils are so small that it is not practicable to map them separately.

Hayesville clay loam, severely eroded phase.—This eroded soil includes areas of the typical loam, from which about three-fourths to all of the surface soil has been removed by erosion. The present surface soil consists of brownish-red or red clay loam 2 to 5 inches thick. The subsoil is light-red, red, or dark-red stiff brittle clay or friable clay loam to a depth of 20 to 30 inches, where it grades into soft decomposed rock material.

The largest areas are near Cherokee, Thomas Chapel, Arlington Church, and Bryson City. The aggregate area is 0.6 square mile.

This phase is hilly, the slopes ranging from 15 to 30 percent. Internal drainage is good and external drainage is excessive, particularly in places where there is no protective cover of vegetation or proper tillage.

All this soil is cleared and at one time was used for crops; but through wrong use and improper management much of it became so sheet-eroded and gullied that it was no longer suited to crops or pasture. As this soil is subject to further erosion, it would be good practice to grow only close-growing crops on cleared areas. Areas that are unsuitable for such crops, however, or for pasture could be allowed to reforest with old-field pine; and those areas that are suited to crops could be rebuilt and maintained by proper management. In order to reestablish productivity, the gullies need to be filled in, strip cropping practiced, and winter cover crops grown so as to hold the soil in winter. Rye, vetch, and clover are good winter cover crops, and lespedeza would be a good summer cover crop. Much of the soil could be brought back to a fairly good condition of productivity under good management.

Only small areas are used for crops and these are planted to corn, wheat, rye, and field peas, the yields of which are low in most places.

A few small areas of extremely severely eroded soil are mapped with this severely eroded phase, including areas in which the surface layer is entirely eroded and in which many gullies have formed. These areas are near Deep Gap Church, Brush Creek School, and Bryson City.

Hayesville loam.—The surface layer is 4 to 6 inches thick and consists of yellowish-brown or slightly reddish-brown friable loam. The subsoil is light-red or red stiff fairly friable clay that breaks easily into a soft mass when crushed between the fingers. At a depth of 25 to 40 inches the subsoil passes into reddish-yellow or mottled red and yellow fine sandy clay or clay loam material that grades into reddish-yellow soft weathered rock material at a depth of 40 to 50 inches.



- A.* Congaree silt loam is one of the most desirable soils for crops, and practically all of it is used in short rotations
- B.* Hiwassee silt loam, adapted to practically all the crops generally grown, is productive and easily worked and conserved



Hayesville loam is used to some extent for crops, but now a considerable acreage is used either for permanent pasture or is reverting to forest.

A. When row crops are grown, the yields almost invariably diminish from year to year and the soil suffers from erosion.

B. As pasture, this soil affords grazing of variable quality. The central slope, fertilized with 200 pounds of 45-percent phosphate fertilizer and seeded to redtop, bluegrass, and lespedeza, in 2 years afforded abundant grazing of good quality.

This gives way to gray partly weathered rock or lies directly on bed-rock at variable depths. The parent rock consists mainly of granite and gneiss. The variations in color, texture, structure, and consistence evident in the soil are attributed to variations in the underlying rock.

This soil is developed on intermountain valleys and in semi-mountainous areas in the central part of the county. The larger areas are in the vicinity of Bryson City, Governors Island, Thomas Chapel, Cherokee, Ela, Jackson Line Church, Birdtown, and Whittier. Smaller areas occur throughout the eastern and central parts. The aggregate is 6.4 square miles.

The slopes range from 15 to 30 percent. External and internal drainage are good, but in cleared areas not protected by a cover of grass or other close-growing crops the runoff is excessive. Erosion is active on practically all the cleared soil, and sheet erosion and gullies appear in many places. Although none of these eroded areas are separated on the soil map, many are indicated by symbols.

Probably 80 percent of this soil is cleared, but somewhat less than 50 percent of the area cleared is used for field crops and pasture. The remainder is either idle or reverting to forest (pl. 8). The original forest consisted chiefly of oaks and pines. The more gently sloping areas are suitable for corn, wheat, oats, rye, clover, lespedeza, and soybeans, provided good soil management is practiced. The steeper areas are best suited to pasture and forestry (pl. 9), because erosion cannot be controlled by crop rotations, strip cropping, winter cover crops, good tillage, or other practical methods.

Corn, wheat, and clover are the principal crops, and lespedeza, cowpeas, and rye are grown to some extent. Truck crops are grown in places on some of the gently sloping areas. Corn produces 10 to 15 bushels an acre on land treated with 200 pounds an acre of 4-8-4 fertilizer and without the benefit of a legume in the rotation. Somewhat higher yields are obtained when corn follows clover or lespedeza and the land is given a light application of superphosphate. Wheat yields 8 to 12 bushels an acre under the usual management if the wheatland is treated with a small quantity of commercial fertilizer. Clover produces about 1 ton of hay an acre, lespedeza gives good yields of hay, and cowpeas and rye make fair returns. Because of the hilly areas occupied by the soil, heavy farm machinery cannot be used advantageously.

Included with this soil are two areas about half a mile east of Jackson Line Church that have slopes of 7 to 15 percent and a total extent of about 40 acres. The surface and subsoil layers are somewhat thicker than in the soil developed on steeper slopes.

Included also with mapped areas are small areas about half a mile north of Governors Island and near Bryson City in which the soil consists of grayish-yellow sandy material. This partly formed soil seems to be weathered rock material from which the soil processes have not formed a complete soil.

Hayesville loam, steep phase.—In forested areas the first inch or two of the surface layer is grayish-brown or dark-brown friable loam containing a considerable quantity of organic matter derived from decayed leaves and twigs. Under this is yellowish-brown friable loam resting on a subsoil of brownish-red or red fairly heavy stiff

brittle but friable clay loam or clay, which passes into partly disintegrated rock or lies on solid bedrock at a depth of 15 to 25 inches. Outcrops of the bedrock appear in places. Where this soil adjoins Porters loam, the subsoil is not so red and is more friable than in other places. The soil varies in color, texture, and structure and also in thickness of surface and subsoil layers. In some small areas it consists of grayish-yellow friable sandy material, which at a rather shallow depth is underlain by bedrock. In these areas the soil is merely decayed rock material from which soil processes have not formed a definite soil.

Areas of this steep phase are developed in the eastern part of the county, the larger ones in the vicinity of Cherokee, Birdtown, Rock Hill Church, Ela, Thomas Chapel, Holly Spring Church, and Franklin Grove Church. The aggregate area is 3.4 square miles.

This soil comprises the steepest areas of the typical loam and is associated with areas of that soil and of Porters loam. It is similar to the normal loam in physical characteristics, but in many places differs in having steeper slopes and thinner soil layers. The slopes range from 30 to 60 percent, compared with 15 to 30 percent for Hayesville loam.

Probably 20 percent of this soil is cleared, but on account of steepness of slopes, shallowness of soil, and problems of conservation, very little of the cleared soil is used for cultivated crops. Some areas produce fair to poor pasture. Areas on the less steep places would probably be suited to apple orchards, provided favorable sites with respect to air drainage and exposure are selected.

The areas when first cleared were used for cultivated crops but were so easily eroded that the soil soon became depleted. When areas of this steep soil are cleared, it would be good practice to seed them to pasture immediately. Many areas already cleared and eroded probably would be best conserved if allowed to reforest.

Hiwassee silt loam.—The 8- to 12-inch surface soil is brown or reddish-brown mellow friable silt loam, changing to dark reddish brown when wet. The subsoil consists of red, brownish-red, or maroon friable silty clay loam to a depth of 40 to 60 inches. Beneath the subsoil, mixed with red clay, are many rounded quartz and quartzite rocks 4 to 6 inches or more in diameter.

Most of this soil occurs 1 mile or less from Bryson City, with small areas in the vicinity of Cherokee, Whittier, Bushnell, Mount Zion Church, Governors Island, and the county home. The aggregate area is 0.7 square mile.

This soil is distributed on high well-drained terraces near streams. The terraces are higher and apparently much older than those on which State loam occurs. Many water-worn rocks are present in the material underlying the soil, and in the process of weathering many of these have broken down and formed soil material, although some are still on and in the soil.

As the relief ranges from 3 to 8 percent, or somewhat more, the soil lies well for cultivation, and under proper management it can be maintained in a good condition of productivity. The control of erosion offers some problem in the more sloping areas. External and internal drainage are good. The surface soil is strongly acid.

This is one of the best soils of the county for general farming: it is easy to handle; under proper management the soil material is

easily conserved; and because of the moderate slopes, improved farm machinery can be used successfully.

All the soil is cleared and used for crops (pl. 7, *B*), chiefly corn, wheat, clover, and lespedeza, with rye, field peas, soybeans, oats, sorgo, and potatoes as minor crops. Under usual management, corn yields 30 to 40 bushels an acre, wheat 12 to 20 bushels, rye 16 to 20 bushels, clover and lespedeza 1 to 2 tons of hay. Field peas and soybeans give excellent returns. Only light applications of commercial fertilizer are necessary with other common practices.

Included with this soil are a few areas of State loam that are so small that it is not practicable to separate them on the map. These areas have a grayish-brown surface soil and a light yellowish-red or brownish-yellow subsoil.

Hiwassee silt loam, hill phase.—The 4- to 8-inch surface layer consists of brown or reddish-brown friable silt loam. The 15- to 25-inch subsoil is red or maroon friable silty clay loam underlain by gravel and cobblestones. Gravel 1 to 4 inches in diameter and some cobblestones are strewn over the surface in many places. The subsoil rests on bedrock in many places where the gravel layer is entirely absent. Where erosion is very active, the surface layer is gone and the red clay subsoil exposed. In a few very small areas erosion has removed both the surface soil and the subsoil. In places a few gullies have formed.

This hill phase occupies rather strong slopes between areas of the normal silt loam and of nearly level bottom land. The largest areas are near Bryson City, and the total extent of the soil is 1.2 square miles.

This soil is similar to the typical Hiwassee silt loam in color, texture, and structure and differs from it in that it occupies somewhat steeper slopes and has slightly thinner surface layer and subsoil layer. This phase occurs on slopes of 15 to 30 percent, whereas the typical soil has slopes of 7 to 15 percent. External and internal drainage are good. Owing to its somewhat steeper slopes, the soil is not so well suited to cultivation and is more subject to erosion than is the typical soil.

About 40 percent of this soil is cleared and as pasture land gives fair yields. The rest is in forests of small pines and sourwood, dogwood, hickory, oak, and locust. Some areas could be cultivated, provided good management is practiced. The runoff from the steeper slopes would be excessive in cultivated areas that are not protected by cover crops and good tillage, and under poor management the surface layer would soon be washed away. With good management the soil could be used for small grains, lespedeza, and clover (pl. 10, *A*).

Porters loam.—The surface layer consists of brown or dark grayish-brown mellow loam 8 to 12 inches thick. The subsoil is brown or reddish-brown friable permeable loam or clay loam to a depth of 25 to 35 inches and is lighter in color and more friable in the lower part than in the upper. This layer is underlain by parent rock, consisting chiefly of gneiss and granite. In some places a layer of decomposed rock material lies between the subsoil and bedrock. Fragments of bedrock are on the surface and mixed through the soil, but these are not very numerous.

In most places the color and texture of the surface and subsoil layers are very similar. In forested areas the surface layer to a depth of 2 to 4 inches is dark brown or almost black, the dark color apparently being caused by organic matter derived from decayed leaves and twigs. In mountain coves this layer is thicker than on steep slopes, and on southern slopes it is thinner than elsewhere.

This soil, developed on steep mountainsides in the southern part of the county, has formed from the residual products of weathered gneiss and granite. It is brown and mellow, and, because of its friable consistence, rain water soaks in readily and plant roots penetrate easily to all parts. When cleared of forest the soil is subject to erosion, except where this is held in check by a cover of grass or some other close-growing crop. In places it is associated with Ramsey loam, but differs from it in being of darker color, more productive, and easier to conserve, and in that it is derived from weathered products chiefly of gneiss and granite instead of conglomerate, graywacke, sandstone, slate, and schist. With slopes of 30 to 60 percent, the soil is too steep in many places for feasible cultivation, although the less steep slopes could be cultivated if good practices of management, as strip cropping, were employed. The aggregate area is 11.2 square miles. Because of its permeable surface soil and subsoil, rain water soaks readily into the soil although runoff in places is excessive.

Most of this soil is in forest, and the trees include various oaks, and hickory, locust, maple, dogwood, sourwood, cucumbertree, buck-eye, silverbell, linden or basswood, and a few scattered shortleaf pine. Dead chestnut trees appear among the other trees of the forest. The undergrowth consists mainly of rhododendron and mountain-laurel. Galax is an undergrowth in many places. In general, trees on the north slopes and in the mountain coves are larger than elsewhere.

Patches of the soil have been cleared on some of the gentler slopes and are used for corn, rye, garden vegetables, cabbage, and pasture. The areas of 35 to 60 percent slope seem best suited to pasture or forest, as the soil is too steep to make cultivation feasible, although in places corn gives good yields even without the use of fertilizer. Because of the steep slopes, only light work animals can be used.

Areas of this soil are used for pasture in Haywood and Watauga Counties and in other counties in the mountains of the State. In Watauga County, it is considered excellent pasture land and is also good for potatoes and cabbage. In the cultivation of this loam, strip cropping is regarded as good practice, as it helps to prevent soil erosion.

Mapped with Porters loam are areas of Porters stony loam and Ramsey loam so small that it is not feasible to separate them. In the places where Porters loam adjoins areas of the Ramsey soils, both its surface and subsoil layers are lighter in color than is typical.

Porters loam, hilly phase.—In color, texture, consistence, and structure, this soil is similar to the normal loam, differing mainly in occupying gentler slopes and in having a somewhat thicker subsoil. The slopes on which this soil is developed range from 15 to 30 percent, so that it is better suited to cultivation and less subject to erosion than the typical loam, which occupies slopes of 30 to 60 percent.

The individual areas of the soil are small and widely scattered over the southern part of the county, where they occupy positions on the



- A. An area of Hayessville loam in various stages of abandonment. The dark clump of pine left of the center field is on land that has been out of cultivation for many years; to the left of these trees the grassed part has been out of cultivation for a somewhat shorter time, the darker more extensive fields with scattered brushy growth have not been cropped during the last few years, and the small field with the light-colored weed growth has been cultivated within the last year or two.
- B. Much of Hayessville loam has a volunteer grass cover that affords some pasture, the quality and capacity of which can be improved by proper fertilization, seeding, and the suppression of brushy growth.



A. Some Hiwassee silt loam hill phase, has been tilled, but through poor management much of it has been changed to pasture land. Properly fertilized and seeded these areas could produce better pasture, and many of the less steep areas could probably be used for small grains and hay crops in long rotation.

B. Bluegrass and white clover make up a considerable part of the stand on this hillside pasture, to which lime and phosphate were recently applied. Porters loam, very steep phase, is on the hillside, and Congaree silt loam is in the foreground.

smoother parts of the mountain slopes. The largest areas are in the vicinity of Ela, Swain County Home, Antioch Church, Piney Grove Church, Peavine Church, Mount Vernon Church, Alarka, Cochran Church, places near the Swain-Macon County line, and Caler Knob. The aggregate area is 1.4 square miles.

Because of the comparatively gentle slopes occupied, this phase was the first of the Porters soils to be cleared and farmed in the county. The soil, however, lost a great deal of its original plant nutrients through exacting use and much of its surface layer through erosion.

Probably 40 percent of this soil is in corn, rye, potatoes, and garden vegetables for use on the farms on which they are grown. Corn yields 20 to 40 bushels an acre under usual management practices. The higher yields are obtained when planted on clover land or on land treated with green manure, and when the land in either case is given a good treatment of fertilizer. Rye yields are fair, and potatoes and garden vegetables give good returns.

Possibly 60 percent of this hilly soil has at some time been cleared and cultivated or used as pasture land; but probably 30 percent of the cleared land was converted into pasture of low productivity or allowed to reforest with old-field pine and honey locust.

Under good management the surface drainage can be controlled, but under poor management it is rapid and causes considerable sheet erosion. With suitable management this soil can be built up and kept in a good condition of productivity. Strip cropping and the incorporation of organic matter are considered good practices.

Porters loam, very steep phase.—This phase is associated with the typical loam and with Porters stony loam. It has formed chiefly from weathered material of gneiss and granite. The surface soil and subsoil differ very little in color and consistence. The depth to bedrock is less in places than on the typical soil. A few stones, consisting of fragments of the bedrock 4 to 10 inches in diameter, are on the surface and in the soil in some places. Areas of the typical loam, too small to show separately, are included with this phase on the map.

The soil is distributed in fairly large tracts that are confined almost entirely to the mountainous area in the southern part of the county. The aggregate area is 46.2 square miles.

This very steep phase differs from the typical soil mainly in the steepness of the slopes, which are 60 to 80 percent or more, compared with 30 to 60 percent for the typical loam. Forests on the south slopes are more subject to fire than elsewhere owing to dryness caused by longer exposure to sunshine. Both external and internal drainage are good, although in some places the runoff is excessive.

The steep slopes make this soil unsuitable for cultivation. A few small areas are cleared for pasture (pl. 10, *B*), but forest seems to be its best use. The forest trees are various oaks and hickory, honey locust, red maple, dogwood, sourwood, cucumbertree, buckeye, silver-bell, white basswood, and a few shortleaf pines. Dead chestnut trees still stand in many places. Rhododendron and mountain-laurel constitute a common undergrowth. Galax appears as an undergrowth in many places.

Porters stony loam.—Formed mainly from the products of weathered gneiss and granite, these soils occur in association with the other Porters soils mapped and occupy similar positions in the steeper

mountainous areas. The surface layer consists of brown or dark-brown mellow loam 8 to 14 inches thick. The subsoil is brown or reddish-brown very friable and permeable loam or light clay loam to a depth of 25 to 35 inches, where it passes into soft decomposed rock material or lies on bedrock. Many angular fragments of bedrock 4 to 12 inches or more in diameter are strewn over the surface and mixed with the surface soil and subsoil.

This stony loam occurs in fair-sized areas in the southern part of the county, with an aggregate area of 24.6 square miles. The slopes are usually 60 to 80 percent, although some areas are included in which they are 30 to 60 percent. Even though the slopes are steep, the runoff is not so great as on most soils of similar slope, for the soil is loose and open, and rain water soaks in readily and roots penetrate easily.

As this soil is so stony and so steep, it is not suitable for cultivation, but in places it can be used for pasture. The soil is used almost entirely for forestry, for which it seems to be best adapted. In some other counties in the mountainous part of the State, however, some of it is cleared and used as pasture land.

The forest growth includes various oaks and honey locust, hickory, yellow poplar, red and sugar maple, dogwood, linden, buckeye, cucumbertree, and hemlock. Dead chestnut trees are among the other trees in the forest. Rhododendron, mountain-laurel, and galax appear in places as an undergrowth.

Small areas of Porters loam, very steep phase, and rough stony land (Ramsey and Porters soil materials) are included with this soil as mapped.

Ramsey loam.—This soil differs from Porters loam in that it is somewhat lighter in color and of different parent material; Porters loam having formed largely from the weathered products of gneiss and granite, whereas Ramsey loam has formed from the less well developed weathered products of conglomerate, graywacke, sandstone, slate, and schist.

In forested areas the surface layer is dark-brown or nearly black friable loam to a depth of 2 or 3 inches and apparently contains much organic matter derived from decayed leaves and twigs. The thickness of this dark-colored layer is somewhat greater on the north slopes and in the mountain coves than elsewhere. Underlying this is a thin layer of friable loam stained brown by the organic material, which at a depth of about 6 inches gives way to brownish-yellow friable loam that passes into the subsoil at a depth of 8 to 10 inches. This material is yellow, brownish-yellow, or yellowish-brown friable loam or light clay loam at a depth of 15 to 38 inches. In some places the subsoil is reddish-brown friable clay loam, but in most places it is lighter in color in the lower part. This layer is underlain by light yellowish-brown friable fine sandy loam or fine sandy clay material in some places and by bedrock in others. A few loose stones are present on the surface and in the soil. The soil is permeable to plant roots, moisture, and air.

Ramsey loam occurs throughout the county, principally in the north-central and northeastern parts in association with Ramsey stony loam. Of the aggregate area of 132.7 square miles about 105 square miles are on slopes of 60 to 80 percent and about 10 square

miles on slopes of 30 to 60 percent. Both external and internal drainage are good, although in some places external drainage is excessive.

This soil is almost entirely in forest, as it is too steep for feasible cultivation. The soil on some of the less steep slopes, however, makes fair pasture land (pl. 11).

The trees in the forested areas are mainly various oaks, yellow poplar or tuliptree, hickory, maple, black gum, dogwood, cucumber-tree, birch, and a few white and shortleaf pines, with occasional dead chestnut trees. The undergrowth consists of dense stands of rhododendron and mountain-laurel. Galax is common in many places. Practically all of the forests have been cut-over, and the present trees are mainly of second growth.

Ramsey loam, hilly phase.—In color, texture, structure, and consistence and in thickness of the soil layers, this phase is similar to the typical loam, differing from it mainly in relief, but the reaction, content of organic matter, and permeability to plant roots, air, and moisture are essentially the same.

This phase is closely associated with Ramsey loam and Ramsey stony loam, hilly phase. This hilly soil is not extensive and not very important in the agriculture of the county. In some places, however, it constitutes the only arable land, and here small homesteads depend on it for subsistence. Its aggregate area is 2.2 square miles.

The slopes range from 15 to 30 percent; whereas, the typical loam is steep, with slopes ranging from 30 to 60 percent. External and internal drainage are good, although runoff is fairly rapid on slopes that are not protected by a cover of vegetation or by proper tillage.

About 25 percent of this soil is cleared and used for crops, consisting mainly of corn, rye, and potatoes, which make good yields. The rest is forested, mostly with hardwoods. With proper use and good management the soil can be productive, but it is not easy to work, because of the hilly slopes. Only light work animals and light implements can be used in its cultivation.

Ramsey silt loam.—Because of steep slopes, shallowness, and low fertility, the best use for this soil seems to be forestry, although trees that grow on it are not so large as those on the Porters soils.

The surface layer is grayish-yellow friable silt loam 4 to 10 inches thick. The subsoil consists of yellowish-brown, brownish-yellow, or greenish-yellow friable silt loam or silty clay loam to a depth of 8 to 20 inches, where it gives way to slate or partly decomposed slate. In some places no subsoil occurs and the surface layer rests directly on slate, in others the slate bedrock outcrops. Many small slate fragments are present on the surface and in the soil, and in some places slate fragments are so large that the soil is slaty or stony.

Slate is near the surface in places on mountain ridges northeast and northwest of Judson and along the Swain-Graham County line about 2 miles west of Judson. Another area is near Deals Gap. The total area is 1.5 square miles.

The soil is on steep to very steep slopes ranging from 30 to considerably more than 60 percent. External drainage is good on the gentler slopes but excessive on the steeper slopes. Internal drainage is good.

In most places the soil is shallow, low in organic-matter content, and naturally low in productivity. None has been cleared, and the forest growth consists chiefly of white oak, post oak, scarlet oak, chestnut oak, water oak, chestnut, hickory, dogwood, and a few pines.

Ramsey stony loam.—This soil has formed largely from the residual products of weathered conglomerate, graywacke, sandstone, slate, and schist. In forested areas the surface layer, to a depth of 3 to 5 inches, consists of gray or nearly black mucky loam, beneath which is a brownish-yellow friable loam to a depth of 8 to 10 inches, where it passes into the subsoil. The upper inch or so of this layer is stained brown by the organic material in the overlying layer. The subsoil is brownish-yellow or yellowish-brown friable loam or light clay loam to a depth of 15 to 30 inches, where it passes into decomposed rock or lies on bedrock. On the surface and in the soil, fragments of bedrock 4 to 10 inches in diameter are numerous. Even though the soil is stony, it is permeable to plant roots, air, and moisture and has good moisture-holding capacity.

The most extensive in the county, this soil occurs in large areas in the northern, southern, and central rougher mountainous parts. In its aggregate area of 190.8 square miles it is associated with Ramsey loam; Ramsey stony loam, hilly phase; rough stony land, peaty phase; and rough stony land (Ramsey and Porters soil materials).

The soil is predominantly very steep, with slopes of 60 percent or more. An aggregate of about 2 square miles is less steep, the gradient ranging from 30 to 60 percent. Drainage is good, although the runoff is fairly rapid from some of the steeper slopes.

Practically all this soil is in forest, consisting mostly of hardwoods and in places of hemlocks and pitch pines. The forests have been cut-over, and the present stand is mostly of second growth. There are many red spruce trees in the places where this soil adjoins rough stony land, peaty phase. The soil is too steep and stony for cultivation and in most places for pasture.

Included with it on the map are small areas of rough stony land (Ramsey and Porters soil materials) and rough stony land, peaty phase.

Ramsey stony loam, hilly phase.—This phase has formed from weathered material of conglomerate, graywacke, sandstone, slate, and schist. It is similar to the typical soil in color, thickness of layers, friability, reaction, content of organic matter, and permeability to moisture and air, and differs from it principally in that it occupies gentler slopes and contains many stones. The stones, so numerous that cultivation usually is not feasible, consist of fragments of bedrock 4 to 8 inches in diameter, both on the surface and in the soil.

Associated with the typical stony loam, this soil is developed in small and widely scattered areas in the north-central part of the county. Several important areas are in the vicinity of Piney Grove Church, Nantahala, Deep Gap, Hubbard, Bryson Place, Mount Zion Church, and Proctor. The aggregate is 2.5 square miles.

The soil is well drained but not so susceptible to erosion as some of the others. In times past, patches were cleared and cultivated, but the cleared areas are now used mainly for pasture. Most of the soil is so isolated or so remote from habitation that it is almost useless for farming. Its best use is for forest.



Ramsey loam makes fair pasture land

A, Pasture on a steep north-facing slope. The area was treated with phosphate fertilizer and following the removal of the forest cover was seeded to redtop, orchard grass, lespedeza, and white clover. On soils having a slope as steep as this, care must be taken to maintain a good cover and to avoid overgrazing and damage by excessive runoff.

B, Gentler slopes on which a good grass pasture has been established. This area, used for pasture since it was cleared, has been seeded to lespedeza and orchard grass for 15 years.



A High fertility, good permeability, and low susceptibility to erosion make State loam capable of producing large yields of corn and other row crops in short rotations.

B Corn is the predominant crop on the less stony areas of stony colluvium (Ramsey and Porters soil materials).

Rock outcrop.—This land type includes bare exposures of bedrock. A few scrub trees and bushes grow in crevices and on ledges where a thin soil has formed. Rock outcrop has no agricultural value. Areas are mapped east of Noland Creek School, about half a mile east of Paint Mountain, about half a mile west of Nantahala, and about a fourth mile west of Wesser. The aggregate area is 0.3 square mile.

Rough stony land, peaty phase.—In the areas of this phase a heavy growth of moss covers a thin layer of peat, and this in turn covers a thin layer of muck. The moss, peat, and muck compose a dark-colored layer 3 to 8 inches thick, underlain by broken conglomerate and hard blue slate. In some places a thin layer of greenish-yellow or yellowish-brown silty clay loam material underlies the dark-colored surface layer. Strewn over the ground are many fallen moss-covered spruce trees. Many outcrops of bedrock are present.

Occupying positions at high elevations in the Great Smoky Mountains, this phase covers an unbroken area of 42.8 square miles, from Double Spring Gap eastward to Balsam Corner on the eastern boundary of the county. The land is steep in some places and very steep in others, and the slopes on which it lies grade from 30 to more than 60 percent. Shaded by dense forest, the surface layer is wet throughout the year.

Nearly all this phase is in forests of red spruce and balsam, which are confined largely to this rough stony land. Red spruce is the principal tree at an elevation of about 4,000 feet, although balsam composes a fairly large part of the forest at about 6,400 feet. The spruce trees are large, and their stand is dense. The high elevation, cool climate, and abundance of organic material derived from the dense forests are the chief factors in the formation of the soil.

The underlying rocks are broken, and roots entering the cracks obtain a sure foothold for the trees. In many places, however, the roots are on top of the rocks, and here the trees are easily blown over. In cut-over areas, fire has burned off most of the surface mantle, leaving only a thin layer of mineral soil. Such burned-over areas, called fire scalds, support a thick stand of wild cherry bushes. It is probable that they will not reforest to spruce or any other tree of value for a long time. This rough stony land apparently is suited only to forestry.

Mapped with this soil are small areas of Burton stony loam, shallow phase, mainly in flat and gently sloping places on mountain tops; and a few small areas, locally known as heath balds, which are covered with rhododendron and mountain-laurel.

Rough stony land (Ramsey and Porters soil materials).—This rough stony land includes areas having very steep and rough slopes and containing many large boulders and large rock outcrops. The soil among the rocks is generally shallow and belongs to the Ramsey and Porters series. It is not suitable for crops or pasture, but supports a thin growth of trees, consisting mainly of scrub oak, pitch pine, and table-mountain pine. In some places boulders and rock outcrops may not be present, but the bedrock is only a few inches below the surface. The slopes are 60 percent or more, and external drainage is good to excessive. The largest areas of this soil unit are north and south of Nantahala Gorge, west of the Little Tennessee

River near its juncture with the Tuckasegee River, north and south of the Tuckasegee near Epps Springs and Noland, about 1 mile northeast of Alarka, on Una Mountain, and on Shuckstack Ridge. The aggregate area is 14.8 square miles.

Included with mapped areas of this land are some rather large rock outcrops and also small areas of Ramsey stony loam and Porters stony loam.

State loam.—This brown mellow soil, occupying positions on terraces near streams, is associated in many places with Congaree silt loam and Congaree fine sandy loam, and, like these two soils, it ranks high for farming. The soil has formed from alluvial deposits consisting of sand, silt, clay, and gravel washed largely from upland slopes underlain by granite, gneiss, mica schist, and slate, all of which contain potash-bearing minerals. Because of its rather high position above streams, the soil is not subject to flooding.

The 8- to 14-inch surface soil consists of dark grayish-brown mellow heavy loam, with apparently a fair quantity of decomposed organic matter. The subsoil is brownish-yellow, light yellowish-red, or brownish-red heavy clay loam or fine sandy clay. At a depth of 28 to 45 inches, the subsoil grades into light yellowish-brown friable fine sandy clay mottled with gray and red. This gives way to light-gray material mottled with brown at a depth of 45 to 70 inches, below which the material is extremely variable.

This soil is moderately fertile, has favorable physical properties and gentle slopes, and is one of the most desirable for general farming in the county. Its productivity can be easily maintained, and erosion can be held at a minimum under good management. With slopes of 3 to 8 percent it has good external and internal drainage, and farm machinery is easily used.

State loam is distributed on terraces near the Tuckasegee and Oconaluftee Rivers. The larger areas are in the vicinity of Governors Island, Birdtown, Ravenstord, Patterson Springs, Cold Springs Church, Bryson City, and Ela. The aggregate area is 0.8 square mile.

Nearly all of this soil is cleared and in crops, including corn (Pl. 12, A), wheat, rye, clover, lespedeza, field peas, soybeans, sorgo, potatoes, and truck. Corn, small gram, and hay crops occupy the greater acreages.

Under good management practices, the yields of corn, small grains, and hay are rather high. Corn usually yields 30 to 40 bushels an acre, wheat 12 to 20 bushels, rye 16 to 20 bushels, and clover and lespedeza 1 to 2 tons. The returns from field peas and soybeans are high, and from potatoes and truck, good. These yields are obtained from the various crops with only light applications of fertilizer and other normal management practices.

Included with this soil are small areas of Altavista loam, so small that it is not feasible to separate them on the map. They are characterized by a gray friable surface layer and a yellow friable subsoil.

Stony colluvium (Ramsey and Porters soil materials).—This miscellaneous land type is a soil condition rather than a definite soil type and consists of rock fragments and soil material derived from areas of Ramsey and Porters soils deposited by gravity on lower slopes and near streams. It also includes sand, silt, clay, and gravel de-

posited by the streams during overflow. To a depth of 6 to 12 inches the soil consists of light-brown or brown friable fine sandy loam, loam, or silt loam. This material in some places passes into brown mellow loam that continues to a depth of about 18 inches; in others it is underlain by gravel and larger water-worn rock fragments. A great many angular, subangular, and water-worn rock fragments, 3 to 10 inches or more in diameter, are strewn over the surface and mixed with the soil. They are so numerous that the soil in most places cannot be cultivated until they have been removed. A considerable quantity of organic matter derived from decayed leaves and twigs is present in the first few inches of the soil. A few small areas remain wet most of the time, and they are indicated on the soil map by symbols.

The larger areas of this stony colluvium are along Deep Creek, Alarka Creek, Raven Fork, Bradley Fork, and Beech Flats Fork of the Oconaluftee River, and along the Nantahala River. The largest area of riverwash included with mapped areas of this soil is along Raven Fork about 3 miles northeast of Ravensford. Other areas are on islands in the Little Tennessee River near Fontana. The aggregate area of this type and the included riverwash is about 5.5 square miles.

The slope is nearly level in some places and gently sloping in others. Both external and internal drainage are well established in most places.

Only a very small part of the soil is cleared and used for crops. Corn (pl. 12, *B*), potatoes, and sorgo are grown on a few areas where the rock fragments have been removed from the surface. In these places corn yields 15 to 30 bushels an acre when the cornland is given an application of 200 to 400 pounds of a 3-10-4 fertilizer. Potatoes and sorgo produce good yields. Some areas are in pasture, and the yields are fair.

In forested areas the trees are chiefly yellow buckeye, poplar, chestnut, and oaks. The many rock fragments on and below the surface make the soil difficult to cultivate, and only small farming implements can be successfully used for tillage. Because of the many stones present and their hindrance to cultivation, the best use for this soil is for pasture or forest.

Included with this soil type as mapped are a few small areas of riverwash, consisting mainly of sand, pebbles, gravel, cobblestones, and some subangular rock fragments deposited in places near streams. This material is mixed, and in no place has a definite soil formed from it. As the areas are frequently flooded, the material is subject to movement or to the addition of new material each time the streams overflow. Riverwash is generally bare of vegetation and is practically useless for cultivation. Sand and gravel from some of the areas, however, have economic value and are used for road building and in concrete mixtures.

Talladega-Ramsey loams.—This is a complex of several soils, including Talladega silt loam, Ramsey loam, Chandler loam, and Hayesville loam. The areas occupied are intricately associated and are so small as to make it impracticable to separate them on the soil map.

Talladega silt loam has a brownish-yellow friable silt loam surface layer a few inches to about 10 inches thick and a reddish-yellow, red, or purplish-red friable clay loam or silty clay subsoil to a depth of 20 to 36 inches, where it grades into soft decomposed mica schist and

purplish-red fine-grained sandstone. This decayed rock material appears in many places at a depth of 6 to 20 inches. In some places finely divided mica flakes give the soil a smooth slick feel.

The surface layer of Ramsey loam consists of brownish-yellow or light brownish-gray mellow loam about 10 inches thick. The subsoil is yellow or light brownish-yellow friable loam or clay loam to a depth of 30 to 35 inches, where it grades into yellow or grayish-yellow very friable fine sandy clay material. This material is underlain at a depth of 35 to 40 inches by bedrock, consisting mainly of sandstone, slate, and graywacke.

Chandler loam has a yellowish-gray friable loam surface layer and a yellow or brownish-yellow friable loam or clay loam subsoil, with many finely divided mica flakes in the surface soil and subsoil, which give the material a greasy feel.

The surface layer of Hayesville loam consists of grayish-brown friable loam 4 to 10 inches thick. The subsoil is brownish-red fairly heavy but friable clay loam to a depth of about 30 inches, where it passes into soft decomposed rock. In some places the soil consists of gray slaty silt loam, which, at a depth of about 6 inches, is underlain by slate or fine-textured sandstone. Such areas usually appear on slaty ridges.

Talladega-Ramsey complex is mapped in rather large areas on the low, thoroughly dissected intermountain uplands. The larger areas are between Almond and Lauada, near Maple Springs, Franklin Grove Church, southwest of Whittier, and just east of Davis Gap. The aggregate area is 10.9 square miles.

The soils of this complex are inherently poor and in most places deficient in organic matter. Only a few rock fragments appear on the surface and in the soil. Nearly all the cleared areas are badly sheet eroded, and the surface layer is thin in such places. The soils are steep, with slopes of 35 to 45 percent. External drainage is good to excessive and internal drainage is good.

About 60 percent of the complex is cleared; the rest is forested, chiefly with various oaks and pine. Only a small part of the cleared land is used for crops, and most of the rest is idle. Crops probably yielded well for a few years after the soil was cleared; but when the organic matter was lost through cultivation and the natural fertility of the soil declined, much of the soil was abandoned. Perhaps the reason that so much was cleared is that the soils are accessible, are not stony in most places, and are easy to clear of forest.

The principal crops grown are corn, wheat, rye, and field peas; the minor crops, clover, lespedeza, soybeans, sorgo, potatoes, and garden vegetables. Small orchards for a domestic supply of fruit, mainly apples, are in a few places. The yields of all crops are very low. As the soils are inherently poor, the use of fertilizer on the land is necessary to produce even low yields.

This complex cannot be cultivated without risk of serious erosion. Reforestation is perhaps the most feasible use, as it would doubtless be more effective than any other measure of erosion control. Some of the gentler sloping areas could probably be seeded to permanent pasture and fair returns expected.

Included with Talladega-Ramsey loams are small areas in which the surface soil consists of yellowish-brown or brownish-yellow friable

silt loam 6 to 9 inches thick covered in forested areas with a layer of leafmold an inch or two thick. The subsoil is yellowish-brown, reddish-brown, or light-red friable silty clay loam to a depth of 20 to 40 inches. The material in this layer grades into gray partly decomposed slate. Small slate fragments are on the surface and in the soil. In some places the decomposed slate material is only a few inches below the surface layer. Most of this inclusion occurs in places near the Swain-Graham County line, and the aggregate area is about one-third of a square mile. With slopes of 30 to 60 percent, the external drainage is good to excessive, and the internal drainage is good.

Nearly all of the inclusion is in forests of hickory, sourwood, dogwood, pine, and different kinds of oaks. Some very small areas on the gentler parts of the slopes are used for crops, chiefly corn, wheat, rye, potatoes, and garden vegetables. Corn yields 8 to 12 bushels an acre, wheat 6 to 8 bushels, and rye 7 to 12 bushels. The land for these crops is usually given an application of 200 to 300 pounds of an acre of a 3-8-3 fertilizer, although in some places it is treated with an application of 200 to 300 pounds of 16-percent superphosphate. In some places no fertilizer is applied. The fields on this soil contain only 1 or 2 acres, and light-farming implements are used in cultivation.

Talladega-Ramsey loams, hilly phases.—This soil complex includes areas of the hilly phases of Talladega silt loam, Ramsey loam, Chandler loam, and Hayesville loam, so closely associated that it is not practicable to map them separately. This complex is similar to Talladega-Ramsey loams in color, texture, and structure and differs mainly in having gentler slopes and somewhat thicker surface layers and, in places, thicker subsoil layers. The slopes range from 15 to 30 percent, but in most places are about 22 percent.

Areas of this complex are near Bushnell, Whittier, East Alarka Church, Governors Island, and Sawmill Hill Church and a few smaller areas are elsewhere in the intermountain upland. The aggregate area is 1.3 square miles.

Probably 75 percent of this hilly complex is cleared, but only a small part is used for crops. The yields of corn, wheat, rye, and sorgho are slightly higher than on Talladega-Ramsey loams, and yields of truck crops are low. Fertilization is required for all crops. Because of its gentler slopes, this complex is less subject to erosion if cultivated and is easier to handle than the Talladega-Ramsey complex, which occupies much steeper slopes.

Included with mapped areas of Talladega-Ramsey loams, hilly phases, are areas in which the surface soil consists of yellowish-brown or brownish-yellow friable silt loam 7 to 10 inches thick, covered in forested areas with a layer of leafmold 1 or 2 inches thick. The subsoil is yellowish-brown, reddish-brown, or red friable silty clay loam to a depth of 24 to 40 inches, where it passes into decomposed gray slate or lies on slate bedrock. In some places bedrock comes within a few inches of the surface layer, and in others it is immediately underlying. Small slate fragments are strewn over the surface and are present in the soil.

The areas of this inclusion are near the Swain-Graham County line; and the total extent is about one-third of a square mile. The soil is hilly, the slope ranging from 15 to 30 percent. Drainage

is good, although external drainage is excessive on some of the steeper slopes.

A large part of the included soil is forested with various oaks, hickory, sourwood, dogwood, and pine. Although the soil is inherently poor, small areas are used for corn, wheat, rye, potatoes, and garden vegetables. Corn yields 8 to 12 bushels an acre, wheat 6 to 8 bushels, and rye 7 to 12 bushels. Land for these crops is generally given a fertilizer treatment of 200 to 300 pounds an acre of 3-8-3 or 16-percent superphosphate. In some places no fertilizer is used. The fields are small, and the farming implements commonly used are light.

Talladega silt loam.—Areas of this soil are distributed on mountains and occupy narrow ridges, rather sharp knobs, and steep slopes. Although some red is in the soil, it is not so red as the Hayesville soil. The soil has formed largely from weathered products of mica schist and talc schist, the fine particles making the surface soil and subsoil materials slick when rubbed between the fingers. Most of the soil is forested, but on the gentler slopes some areas are used for corn, wheat, and rye, the yields of which are low. Erosion becomes severe when clean cultivated crops are grown.

The 4- to 9-inch surface layer is brown, reddish-brown, or light-red silt loam or loam. The subsoil consists of brownish-red, light-red, or salmon-red silty clay loam or clay to a depth of 20 to 36 inches. Here it grades into yellowish-brown, brownish-yellow, or purplish-red soft decomposed micaceous material, consisting of weathered mica schist and talc schist. This weathered rock material appears in some places at a depth of 6 to 20 inches. Both the surface soil and subsoil have a slick feel and are friable and smooth, because of the presence of many finely divided mica scales and small talc particles. Small mica schist and talc schist fragments are in the surface in many places but not in sufficient quantities to give the soil a gravelly character. In small areas, too small to separate as stony loam on the soil map, many schist fragments 4 to 8 inches in diameter are on the surface.

In places where the soil has formed from the weathered products of fine-grained sandstone and slate it does not possess the characteristic slick feel of the weathered material of mica and talc schists.

This soil is developed on ridges in low mountainous parts of the county, the larger areas in the vicinity of Ravensford, Judson, Collinwood, Ecola, Dorsey, Thomas Chapel, and Franklin Grove Church. The aggregate area is 4.7 square miles. Steep slopes of 30 to 60 percent make the surface drainage good to excessive and the internal drainage good.

Only a few small areas are cleared, and these are used principally for corn, wheat, and rye, the yields of which are low. Erosion may become very active when the soil is plowed. Practically all of it is forested, and because of the steepness of the slopes and the susceptibility to erosion when cleared, forestry seems to be its best use. The forest trees consist mainly of pitch pine, white oak, post oak, scarlet oak, black gum, hickory, and dogwood.

Talladega stony loam.—The 4- to 7-inch surface layer is grayish-yellow or light-brown friable loam passing into reddish-brown, purplish-red, or salmon-red friable loam or sandy loam. Numerous mica

flakes give the soil a greasy feel in many places. At a depth of 10 to 15 inches, this material grades into partly decayed mica schist, fine-textured sandstone, slate, or graywacke. In many places the surface layer passes directly into the partly decomposed rock or lies on bedrock. Many schist, slate, and conglomerate fragments about 4 to 8 inches in diameter are strewn over the surface, and outcrops of bedrock appear.

Almost all of this soil is north of the Little Tennessee River, but some areas are in the vicinity of Hubbard, Fairview School, Fontana, New Fairfax School, and on Welch Ridge. The aggregate area is 5.3 square miles.

With positions on steep, very steep, and rough mountainsides, the slopes grade from 30 to 60 percent or more, so that surface drainage is good to excessive, and internal drainage is good.

None of the soil is cleared, and the trees that cover the soil are mostly pitch pines, among which are a few table-mountain pines, scrub oaks, and sourwoods.

Included with this soil are areas of Talladega silt loam and Ramsey loam that were so small that it was not feasible to separate them on the soil map.

Tusquitee loam.—This soil is developed near the bases of slopes and in mountain coves from the weathered products of rock fragments, other rock waste, and soil materials washed from adjacent higher slopes. In places a few rock fragments appear on the surface and in the soil. The soil is brown, mellow, easily worked, porous, and well-drained and ranges from nearly level to gently sloping; it offers practically no problem of erosion control, as the runoff is slow and rain water, owing to the open texture of the soil, soaks in readily. The soil is used largely for crops, which yield well without the use of fertilizer, or with only small applications, but other management practices are generally followed.

The surface layer of grayish-brown or brown friable loam is 12 to 18 inches thick, and in some places as much as 30 inches. The subsoil consists of yellowish-brown or brown friable porous clay loam or loam to a depth of 48 inches or more. In many places the brown mellow permeable loam shows no difference in color, texture, or structure from the surface to a depth of 36 inches or more. Though small angular rock fragments are present on the surface and in the soil, these are so few as not to interfere materially with cultivation. In some forested areas to a depth of 2 to 4 inches the surface layer consists of a large quantity of decomposed organic matter in which is a relatively small quantity of mineral material, and below it the surface soil is brown mellow loam. In other places in forests an 8- to 12-inch surface layer is composed of dark-brown mellow loose loam.

The areas are rather small though so widely distributed that they serve a large number of people, especially farmers who cultivate only small tracts of land deep in the mountains. Because no other good smooth farming soils are available in many of these parts, many farmers depend on this productive and easily handled soil for their main subsistence. Although the 3- to 7-percent slopes are favorable to the use of heavy farm machinery, the areas are usually so small that only light farming implements are practicable. The aggregate area is 8.2 square miles.

About 90 percent of this soil is cleared, mostly for corn, potatoes, cabbage, sorgo, garden vegetables, and orchard fruits, mainly apples. All these crops and some tobacco are grown principally for consumption on the farm, although small quantities may be sold. The yields are good and are obtained with the addition of only small quantities of fertilizer with other proper management practices, or, in some places, without the use of fertilizer. Trees in forested areas include chestnut, chestnut oak, black walnut, butternut, locust, yellow poplar, maple, and buckeye.

Included with this soil are a few small gently sloping areas of Porters loam, in which the surface layer is brown mellow loam about 8 inches thick and the subsoil is light-brown or faintly reddish-brown friable clay loam to a depth of 32 inches, where it grades into decomposed bedrock. Also included are small areas that are the same as the included Porters loam, except that they contain many finely divided mica flakes in both the surface soil and the subsoil. These areas of micaceous soil are to be found near Maple Springs, Sawmill Hill Church, Needmore, and Bryson City.

Tusquitee stony loam.—This soil differs from Tusquitee loam principally in having a large number of angular rock fragments on the surface and in the soil, but also in occupying somewhat stronger slopes. These slopes range from 7 to 15 percent; whereas those occupied by Tusquitee loam range from 3 to 7 percent.

The soil has formed from rock fragments and other rock waste and from soil materials brought down from mountainsides and deposited near the foot of slopes. The surface layer is mellow brown loam, 10 to 18 inches thick. The subsoil consists of yellowish-brown friable clay loam to a depth of 48 inches or slightly more. Angular rock fragments are strewn over the surface and are mixed with the surface soil and the subsoil.

The areas are widely distributed in the mountainous parts of the county. The larger ones are near Indian Creek, Hazel Creek, Peachtree Creek, Proctor Creek, Jonas Creek, Bearpen Creek, and on the north side and south side of Una Gap. The many smaller areas are near other small streams. The aggregate area is 3.7 square miles.

Tusquitee stony loam has good external and internal drainage. Although the slopes are moderate, the soil is not so easy to cultivate as Tusquitee loam, because of the many rock fragments; and because of stoniness, certain kinds of farm machinery cannot be used satisfactorily.

Most of this stony soil is cleared and used in the production of crops and for pasture. Corn, wheat, grass, and potatoes are the principal crops grown and rye is grown in places. Corn yields 15 to 25 bushels an acre, wheat and rye 8 to 12 bushels, and potatoes 50 to 75 bushels. These yields are generally made without an application of commercial fertilizer, although small quantities are sometimes applied. The pasture yields are fair.

PRODUCTIVITY RATINGS AND LAND CLASSIFICATION

The soils of Swain County are rated according to their productivity for the various crops grown and grouped according to their physical suitability for agricultural use in table 6.

The rating compares the productivity of each of the soils for each crop to a standard of 100. This standard index represents the ap-

proximate average acre yield obtained without the use of fertilizers and other amendments on the more extensive and better soil types of the regions of the United States in which the crop is most widely grown. An index of 50 indicates that the soil is about half as productive for the specified crop as is the soil with the standard index. The standard yield for corn, wheat, lespedeza hay, and potatoes is given at the head of the respective columns. Soils given amendments, as lime and commercial fertilizers, or special practices as irrigation, and unusually productive soils of small extent, may have productivity indexes of more than 100 for some crops.

In table 6 three indexes are given for most of the crops on each soil to which the crop is suited, corresponding to expected yields under three different kinds of treatment. Yields may be expected to vary widely on most soils according to the way the soil and crop are managed. Management itself differs greatly from farm to farm.

In column A the figures refer to expected yields without special practices to rehabilitate, maintain, or increase productivity. No manure, commercial fertilizer, lime, or other amendments are used. No special effort is made in the selection and rotation of crops to maintain the organic-matter and nitrogen content of the soil or to prevent rapid runoff of water.

In column B, the figures represent expected yields under the prevailing practices of soil management. These practices are not the same on all soils. The present general practice in the uplands is to make moderately heavy to heavy applications of complete commercial fertilizers for vegetables and potatoes and light applications for corn and for small grains to be followed by hay crops. Moderate to light applications of phosphate alone or a complete fertilizer are generally used on corn and small grain. Lime is used in moderate quantities, usually insufficient on the more acid soils to satisfy the requirements of crops, as alfalfa or clover. Crops are rotated, the rotation varying considerably with steepness of slope. More close-growing or sod-forming crops are generally used on the steep slopes than on the more gently undulating land, but usually neither the selection nor the rotation of crops is well adjusted to soil needs. Neither terracing nor contour tillage is the common practice, although tillage may be approximately on the contour on the steep slopes through necessity. On soils of the bottom lands the prevailing practices for many crops are the same as for those for column A, although some crops, as vegetables, are given moderate applications of complete fertilizers.

The figures in column B are based on observations and the local experience of farmers and agricultural workers. Specific crop-yield data by soil types over a long period of years are generally not available. It is thought that the summation of local experience will give moderately reliable yield expectations under the management commonly practiced. In most instances the figures in this column summarize local estimates and not established yields.

In column C the figures represent the expected yields of crops under good management. The term "good management" refers to the proper choice and rotation of crops; the correct use of commercial fertilizers, lime, and manure; proper tillage methods; the return of organic matter to the soil, and mechanical means of water control, where necessary, to maintain or to increase soil productivity within practical limits.

TABLE 6—Productivity ratings of the soils of Swain County, N. C.
FIRST-CLASS SOILS—GOOD CROP AND PASTURE LAND

Soil (soil type, phase, complex, or miscellaneous land type) ¹	Crop productivity index ² for—												Vegetables ³	Pasture ³	Remarks
	Corn (100=50 bu)			Wheat (100=25 bu)			Espedeza (100=1½ ton ⁴)			Potatoes (100=200 bu)					
	A	B	C	A	B	C	A	B	C	A	B	C			
Congaree silt loam.....	80	80	100	50	50	80	90	90	100	60	80	100	Very good.....	Very good.....	Of high fertility, very easily worked, subject to occasional overflow. Of medium fertility, but responsive to good management, easily worked, only slightly erodible. Good soil for wheat and espedeza. Medium in fertility, responsive to good management, easily worked, little or no erosion. Medium in fertility, responsive to good management, easily worked, areas are small, only slightly eroded. Excellent soil for potatoes.
Hilwassee silt loam.....	60	70	95	60	70	90	70	80	100	40	70	100	Good.....	Good.....	
State loam.....	60	70	95	60	65	85	70	80	100	40	90	110	Very good.....	Very good.....	
Tusquitee loam.....	65	75	85	50	60	70	70	75	90	40	85	110do.....	Good.....	
SECOND-CLASS SOILS—FAIR CROP AND PASTURE LAND															
Congaree fine sandy loam.....	60	60	80	35	35	60	60	60	80	55	75	95	Good.....	Good.....	Of medium to low fertility, responsive to good management, very easily worked, subject to occasional overflow. Of medium fertility, responsive to good management, contains many loose stones and is less easily worked than Tusquitee loam. Medium to low in fertility, easily worked, requires artificial drainage in some places.
Tusquitee stony loam.....	50	65	80	—	—	—	50	60	80	40	65	80do.....do.....	
Alluvial soils, undifferentiated ⁴	40	50	80	30	35	50	40	50	70	—	—	—	Poor.....	Fair.....	
THIRD-CLASS SOILS—POOR CROPLAND, FAIR PASTURE LAND															
Porters loam, hilly phase ⁵	30	40	70	—	—	—	60	70	80	30	50	80	Good.....	Very good.....	Of medium fertility, too steep for use of ordinary farm machinery, moderately erodible if cleared. Very good soil for pasture. Medium to low in fertility, responsive to good management, very erodible, difficult to till because of slope and erosion. Of rather low fertility, responsive to good management, easily worked, moderately erodible. Of low fertility, responsive to good management, very erodible, difficult to handle because of slope and erosion.
Hilwassee silt loam, hilly phase.....	—	—	—	40	50	70	50	60	80	30	40	70	Fair.....	Good.....	
Hayesville loam ⁶	20	25	60	25	40	70	50	65	90	30	40	70	Good.....do.....	
Talladega-Ramsey loams, hilly phases.....	—	—	—	10	20	30	20	35	50	—	—	—	Fair.....do.....	

Although present information on good management requirements for specific soils for specific crops is limited, some of the deficiencies of the soils are known with a reasonable degree of certainty. From these fragmentary data, some of the requirements are discussed for individual soil types and phases in the section on Soils and in the section on Land Use and Soil Management. Just as the requirements of various crops on the same soil may differ, so also may requirements of the same crop on different soils. Moreover, the point at which it is no longer profitable for a farmer to intensify the practices that make for good management depends not only on the soil and the crop but also on other soils and other crops of the farm, the combination of enterprises on the farm, prices, and numerous other considerations. The practical limits are not defined rigidly anywhere in this report, therefore, because of lack of information and of constancy of those limits.

Not only is it impossible to define good management rigidly for each soil and crop, but data are very scarce on crop yields obtained under conditions that are thought to approach good management. The expected yield estimates in column C, therefore, are based largely on the best judgment of men who have had experience with the soils and crops with respect to responses these crops are expected to make over and above the yields usually obtained, if the known deficiencies of the soils are corrected to an extent thought to be practical. These yields are subject to errors of judgment, not only with respect to the response of crops to corrective practices on specific soils but also with respect to the intensity of application of corrective management practices that may be feasible. They are also subject to errors because of lack of knowledge of deficiencies that might be corrected, as deficiencies of minor elements.

The figures in column C are intended as production goals that might generally be reached by feasible good management practices. The same goal can probably be reached by several different combinations of the management practices mentioned for any one soil and crop. Some of these practices may supplement or replace others; some are essential to good management. The best choice depends upon the farm business as a whole. On one farm it may be practicable to manage the soil in such a way that yields exceed the goal, but not on others. The best practical management for a farm unit may give yields in excess of the goal for one crop and soil and yields below the goal for another crop on the same soil. Comparing the figures in column C with those in columns A and B gives some idea of the responses that may be expected from good management.

Only ratings for situations unprotected from flooding have been given to the soils of the flood plains, because no areas are definitely protected by dikes or levees. As floods usually occur in winter and early in spring, they affect only the winter crops to any great extent.

In the column headed Physical Land Classification, the soil types, phases, complexes, and miscellaneous land types are grouped according to their relative physical suitability for use in the present agriculture. This grouping is not to be considered a recommendation for use. Many factors must be taken into consideration in addition to that of the physical capability of the soil, before recommendations for use can be made for a specific farm unit or for broader areas. The

purpose of the grouping is to provide information as to the relative physical suitability of the soils for use in the present agriculture.

The groups, in descending order of desirability, are called First-, Second-, Third-, Fourth-, and Fifth-class soils. In general, under present conditions: First-class soils are physically good to excellent cropland; Second-class soils, fair to good cropland; and Third-class soils, poor to fair cropland; Fourth-class soils are poorly suited physically to cultivated crops but are suited to permanent pasture, and range from fair to good in pasture production, though areas of some of the soils may be used as cropland; and Fifth-class soils include those soils best suited to forest, although some areas may be used for crops or pasture.

Productivity tables do not present the relative roles that soil types, because of their extent and the pattern of their distribution, play in the agriculture of the county. The tables give a characterization to the productivity of the individual soil types. They cannot picture the total quantitative production of crops by soil areas without the additional knowledge of the acreage of the individual soil types used for each of the specified crops.

Economic considerations have played a minor part in determining the productivity indexes, so the latter cannot be interpreted directly into land values, except in a very general way. Distance to market, relative prices of farm products, and other factors influence the value of land.

GENERALIZED PHYSICAL LAND CLASSIFICATION MAP

The soil map of Swain County shows graphically the extent and distribution of the 14 soil types, 9 phases, 2 soil complexes, and 5 miscellaneous land types of the county. As these 30 units of mapping are differentiated on the bases of both internal and external characteristics influencing land use, each possess individuality in land use capabilities and management requirements for agriculture. With such detailed physical land data graphically shown, a large number of simple land classification maps for specific purposes can be readily interpreted.

Figure 3 is an example of a physical land classification map made directly from the soil map, but generalized because of its small size. The lands of the county are divided into three types, designated as land types 1, 2, and 3. These generalized land types are differentiated on the basis of the physical soil class, or classes, that predominate over rather broad areas. They represent associations of soil classes, each of which is defined in terms of physical suitability for use in the present agriculture.

Land type 1 includes chiefly the First-, Second-, and Third-class soils. Although small areas of Fourth- and Fifth-class soils are included because of the generalized character of the map, a very large part of the land of this type is physically suited to crops that require tillage. Probably not more than 5 percent of the total area of the county is of this land type, nearly all of it in the central and eastern parts of the county, where it lies on first bottoms, stream terraces, and smoother valley uplands. Most of the larger farms consist largely or wholly of land of this type, and practically all the field crops are grown on it.

Land type 2 consists chiefly of Fourth-class soils. A considerable part of it is used for pasture, some is in forest, and a small part is cropped. So far as physical character is concerned, most of it could be used as pasture land, where consistent with feasible farm management. This land type is confined chiefly to the east-central and southern parts of the county, occupying positions mainly on hilly and steep valley uplands and on mountain slopes and comprising probably not more than 5 percent of the total area.

Land type 3, composed almost entirely of Fifth-class soils, is nearly all in forest, and the physical character of most of it indicates that this is the most feasible use under present conditions. It consists almost wholly of soils of moderate to low fertility and of steep or

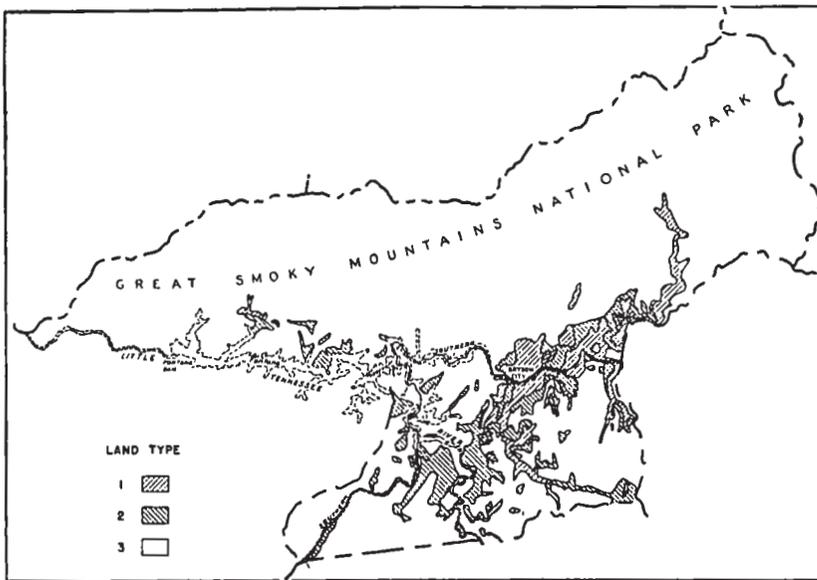


FIGURE 3—Generalized physical land classification map of Swain County, N. C. 1, Predominantly First-class, Second-class, and Third-class soils; 2, predominantly Fourth-class soils; and 3, predominantly Fifth-class soils

broken relief. A large number of loose rock fragments are on the surface and are embedded in the soils in many places. Because of the generalized character of the land-type map many small areas of Second-, Third-, and Fourth-class soils are included with this type, but these contained relatively little land physically suited to pasture or crops. This type lies on mountains in all sections and covers probably 90 percent of the area of the county. The Great Smoky Mountains National Park comprises a large part of this land type.

The foregoing discussion deals with the predominant physical character of the land types delineated. The land-classification map is not to be interpreted directly as recommendations for land use—for factors other than those of physical character are involved in such recommendations.

LAND USE AND SOIL MANAGEMENT

Properly adjusted land use and soil management are basic problems in the agriculture of Swain County. The term "land use" as used in this section refers to the broad uses of land of the farm, as for (1) tilled crops, (2) permanent pasture, and (3) forest. The term "soil management" refers to such practices as (1) the choice and rotation of crops, (2) application of amendments, (3) tillage methods, and (4) mechanical means of water control. Although other factors play a part in land use, the physical character of the soil largely determines its use capabilities. In the section on Productivity Ratings and Land Classification the soil types, phases, and other soil separations have been grouped according to physical suitability for use.

The vast stretches of steep and rough mountain land are generally unsuitable for cultivation (pl. 13, A), and smooth land is almost the exception rather than forming a considerable part as in many other counties of the State. The agricultural land, therefore, is restricted, being confined to comparatively narrow belts in the valleys near streams and to small areas in mountain coves and in places at the foot of mountain slopes. According to the 1940 Federal census, 26,045 acres were potential cropland, but only 11,289 acres, or 3.2 percent produced crops, the remainder consisting of crop failure land, idle land, fallow land, and plowable pasture land.

In general, the use and management of the soils have been guided with considerable regard for their capabilities and needs. Most of those physically suited to crop production have been so used; much of the soil not suitable for crop production, but suitable for pasture, has been used for pasture; and likewise most soils suitable for neither crop production nor for pasture have been used for forest.

In the past some soils apparently were misjudged as to their suitability for crops and as to their conservability, which resulted in soil depletion and soil erosion (pl. 14). A good example of depleted and eroded land is to be found in the east-central part of the county, where the relief is hilly and steep and the soils are very susceptible to erosion. The soils are Hayesville clay loam, severely eroded phase, and Hayesville loam, steep phase. Their run-down condition is due to improper adjustment of use and management to physical character, frequently for reasons beyond the control of farmers. These soils, being less stony than soils in other hilly parts of the county, were farmed until they became depleted, when for the most part they were given up as cropland.

In their forested state, the soils were fairly deep, contained an appreciable quantity of organic matter in the first inch or two of the surface layer, were practically free from stones, and were not heavily forested. It was probably these considerations that led the farmers to clear so much land for cultivation. When the soils were cleared and cultivated, the organic matter of the surface layer soon became mixed with the plow layer and disappeared; then they became eroded and were abandoned.

Most areas of these soils are no longer planted to crops, although some are used as pasture land. Their best use, judged by the results when the land is cleared and planted to clean-cultivated crops, is for forest, or when cleared the next best use is for pasture, as pasture grasses help to hold erosion in check. Consequently, soils that were

originally good for forests and grass were made almost worthless by a few years of cultivation. Such land use and management is not uncommon and has resulted in depletion of the soils in many places.

Insofar as physical potentialities are concerned, the productivity of nearly all the soils could be increased and maintained at a higher level, (1) by adjustment of the use of each soil to its physical limitations, where this has not already been done; and (2) by adjustment of management needs of each soil under the selected use. The soils of the county, however, are used and managed on individual farms by individual farm operators, and any adjustments in use and management must be made through and by farm operators within individual farm units. As these readjustments are interrelated and interdependent with a great many other factors in farm operation, they must be brought about gradually and with full consideration of all the factors concerned.

One of the important soil management requirements is proper and adequate fertilization, including liming. As all the soils are probably deficient in available phosphorus, and have a low nitrogen and potash content as well as a deficiency in lime, proper fertilization is of primary importance. For the efficient use of fertilizers, it is necessary that the fertilization be adjusted to the demands of the crops to be grown and the extent to which the soil must be supplemented in order to supply these demands, as well as to other management practices, as choice and rotation of crops, additions of manure, and cultivation practices.

In table 7, are shown fertilizer recommendations as given by the North Carolina Agricultural Experiment Station for the principal crops grown on many of the soils.

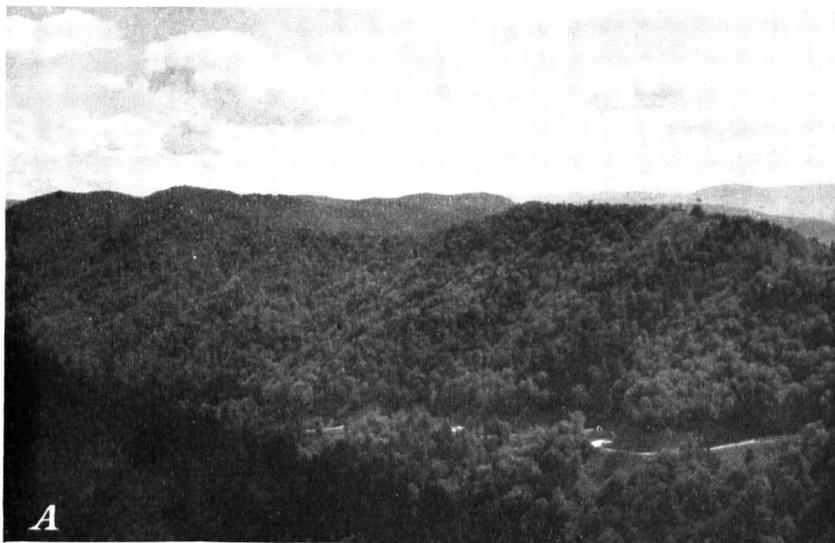
TABLE 7—Recommended quantity and kind of fertilizer to use to the acre for the principal crops on some of the soils in Swain County, N. C.¹

Soils	Corn	Small grains	Hay	Tobacco	Potatoes	Vegetables
	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds
Congaree silt loam	300-400 of 3-10-4	200-300 of 3-10-4	200-300 of 3-10-4	-----	800 of 3-6-6.	600-800 of 3-8-6
Hilwassee silt loam	300-400 of 4-10-4	200-300 of 4-10-4	200-300 of 4-10-4	1,000 of 2-12-6	800-1,000 of 3-8-6	800 of 5-8-6
State loam	300-400 of 4-10-4	200-300 of 4-10-4	200-300 of 4-10-4	1,000 of 2-12-6	800-1,000 of 3-8-6	800 of 5-8-6
Alluvial soils, undifferentiated	-----	-----	200-300 of 3-10-4	-----	-----	-----
Hayesville loam	300-400 of 4-10-4	200-400 of 4-10-4	200-400 of 4-10-4	1,000 of 2-12-6	800-1,000 of 3-8-6	600-800 of 5-8-6
Porters loam	200-400 of 4-10-4 ²	200-300 of 4-10-4 ²	200-300 of 4-10-4 ²	800-1,000 of 4-10-4	800-1,000 of 3-8-6	800 of 5-8-6
Talladega - Ramsey loams, hilly phases	300-400 of 4-10-4	200-400 of 4-10-4	200-400 of 4-10-4	1,000 of 2-12-6	800-1,000 of 3-8-6	600-800 of 5-8-6
Ramsey silt loam	300-400 of 4-10-4	200-400 of 4-10-4	200-400 of 4-10-4	1,000 of 2-12-6	800-1,000 of 3-8-6	600-800 of 5-8-6

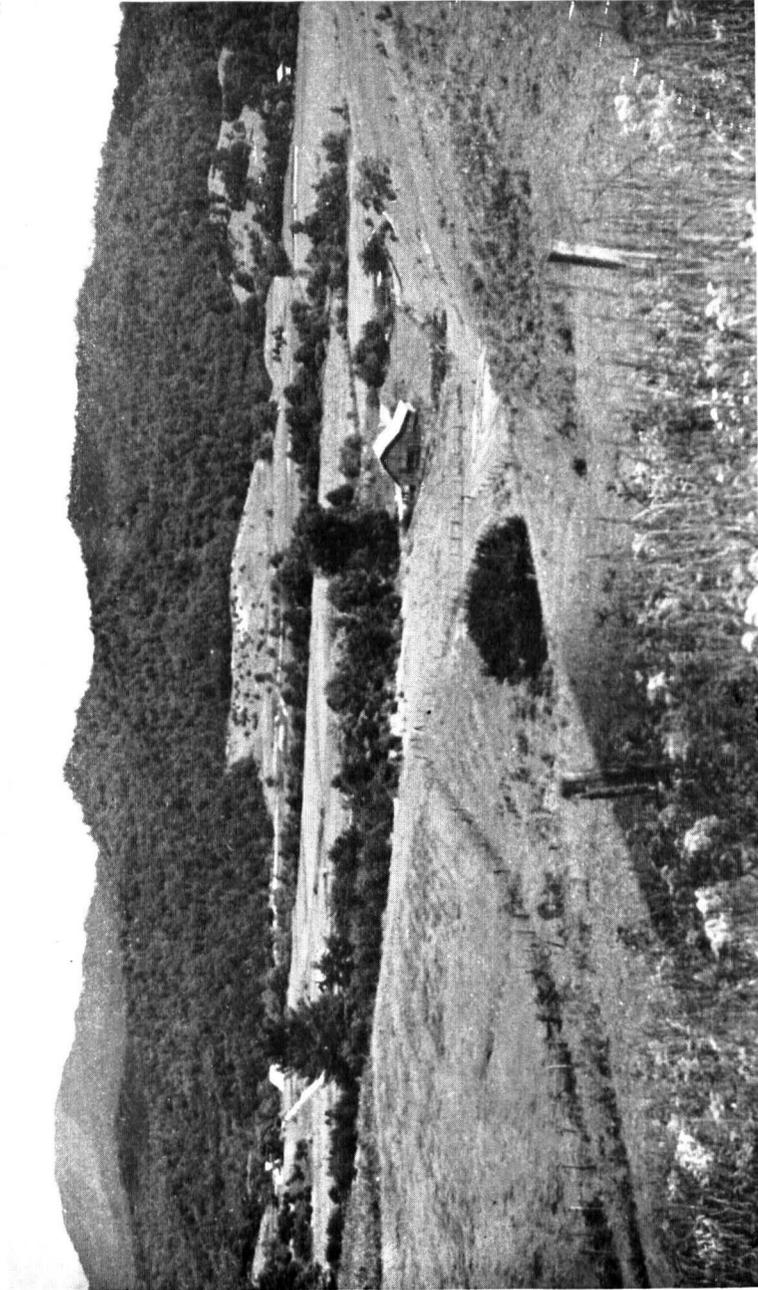
¹ North Carolina Agricultural Experiment Station. FERTILIZERS FOR DIFFERENT CROPS INCLUDING THE BEST PERCENTAGES OF WATER-SOLUBLE NITROGEN OF TOTAL IN FERTILIZER MIXTURES. Agron. Inform. Cir. 95, 13 pp. 1935.

² 10 pounds an acre of soluble nitrogen as a side dressing.

One soil may vary somewhat from another in fertilizer requirements under similar use and management. Information concerning the specific fertilizer requirement of each soil is incomplete, and continued investigation can be expected to reveal significant differences in the requirements of some soils. It is recognized also that many factors other than the content of natural mineral nutrients in the soil influence



A, A large part of the steep and rough mountain land of Swain County is forested
B, Shortleaf pine is being planted on many of the most severely eroded areas



View across a lowland or intermountain area of Hayesville soils and soils of first bottoms and low benches to a mountainous area occupied by Ramsey soil.

the fertilizer requirement for the production of any particular crop in any particular season. Especially important among such factors is the management of the soil in the past. The recommendations given in table 7, should prove helpful in bringing about a more efficient use of commercial fertilizer.

The following publications contain helpful information that will apply to the cultivation and proper care of the soils of Swain County:

North Carolina Agricultural Experiment Station Agronomy Information Circulars—

- 68 The Part Legumes Play in Maintaining the Productiveness of North Carolina Soils
- 69 Soil Fertility—A Most Important Factor in Making Richer Farm Homes and Community Life
- 91 Corn Varieties for North Carolina 1925-34
- 93 Some Facts about Legumes as Soil Improvers
- 96 Fertilizers for Different Crops Including the Best Percentages of Water-Insoluble Nitrogen of Totals in Fertilizer Mixtures
- 103 Suitable Fertilizer Mixtures for Different Crops Including the Functions of Chief Plant Nutrients

North Carolina State College of Agriculture and Engineering Extension Circulars—

- 178 Winter Legumes for Soil Improvement
- 187 Winter Hay Crops
- 202 Pastures in North Carolina
- 208 Agricultural Program for North Carolina

WATER CONTROL ON THE LAND

Water control on the land involves practices having to do with the regulation of runoff and with the maintenance of favorable soil-moisture conditions. These practices may be grouped as follows: (1) Control of runoff and erosion, (2) protection from floods, (3) drainage, and (4) irrigation. In Swain County the control of runoff and of consequent erosion is the most important of these water-control measures, although artificial drainage and protection from overflow are important on some areas. Irrigation is of little if any importance at the present time, though doubtless it would increase production in dry seasons. Its use to supplement rainfall might be economically feasible at times, especially on gardens and on small areas of vegetables, fruits, tobacco, and other high-value crops.

Soil erosion may be either normal or accelerated. Normal erosion is that erosion characteristic of the land surface in its natural environment, undisturbed by human activity, as under the protective cover of the native vegetation.¹¹ Accelerated erosion refers to that erosion of the soil or rock over and above normal erosion brought about by changes in the natural cover or ground conditions, including changes due to human activity and those caused by lightning or rodent invasion.¹¹ As water is the chief active natural agent of soil erosion in Swain County and as the primary concern is with accelerated or man-induced erosion, the simple term erosion, as here used, refers to accelerated erosion by water.

One of the problems that confronts the farmer is the proper use, conservation, and control of water on the fields, pastures, and wood

¹¹ UNITED STATES DEPARTMENT OF AGRICULTURE SOILS AND MEN U. S. Dept. Agr. Yearbook 1938, p. 1167 1938

lots. Proper use and control of water where it falls is an effective measure for conserving the soil. One purpose of water control on land is to check erosion; others are to insure a more uniform and adequate supply of moisture to grow crops; to improve tillage conditions or working properties of the soil, particularly during periods of low rainfall; to make conditions better for biological activity; and to improve conditions for the formation and conservation of humus. These desirable effects, in turn, facilitate the problem of further conservation and control of water on the land.

Probably 90 percent of the county is covered by forest from which most of the merchantable timber has been cut. The remaining trees are mostly of second-growth and cover practically all the mountainous country and much of the hilly and steep country in the intermountain valleys. These second-growth forests apparently protect the soils on the mountain slopes and on the steep hillsides in the intermountain valleys from severe erosion, although some erosion is taking place. The growing of trees on these areas is the cheapest and most effective measure for the protection of these lands from erosion. In the intermountain valleys much erosion is evident; and much land apparently has been converted from cropland to forest land, because of the destructive effects of erosion on land either too steep for cultivation or not managed well when in cultivation. Many old fields that are covered with second-growth pine attest to the damaging work of erosion on land cultivated many years ago.

Hayesville clay loam, severely eroded phase, is separated on the soil map because of its eroded condition. Hayesville loam; Hayesville loam, steep phase; Talladega-Ramsey loams; and Talladega-Ramsey loams, hilly phases, all bear marks of more or less severe erosion. Although no eroded areas of these soils are separated on the soil map, many small eroded areas are present, and many of these are indicated by symbols that indicate the character and extent of erosion. Even though these areas are small, they are warnings of more extensive erosion to follow unless proper precautions are taken to check the erosion in its initial stages.

Although erosion in Swain County is not so widespread as in some of the counties in the Piedmont Plateau of the State, it has, nevertheless, advanced to such a condition in a number of places that it requires serious consideration. Erosion is not an isolated problem and cannot be treated or dealt with as such. It is a conspicuous symptom of more deep-seated disorders in land use and soil management.

Uncontrolled water on the land and consequent soil erosion are the result of failures to adjust land use and soil management to the physical capabilities of the soils. That such adjustments have not been made is evidenced by the presence of erosion.

As the land is subdivided into relatively small operating units, and each unit is controlled and operated by an individual farmer, any readjustments must be effected on these individual farms, and the approach is through the individual operator. It may be said, therefore, that the problem of erosion control is one of farm management.

The farmer who attempts to readjust the use and management of his land to effect water and erosion control is confronted with a number of problems over some of which he, as an individual, has no control. Among these are the size and type of farm; the physical character of

the land, including the soil pattern of the farm; the surrounding social and economic conditions, as transportation, market, church, and school facilities; the immediate cash demand on the farm income for such items as taxes, indebtedness, and support of family; the relation between prices of farm products and other commodities; the farm operator's facilities and resources for operating purposes, including buildings, farm equipment, seed, kind and number of livestock, cash, and credit; the farm operator's ability, aptitude, versatility, and preferences; community cooperation, labor, farm machinery, drainage, water disposal, marketing, and buying; and farm tenure and labor conditions.

Important as it may be to adjust the use and management of the soils to their physical capabilities, it is apparent that such adjustments cannot be effected rapidly on all farms under existing conditions. On some farms the physical use capabilities and management requirements of the soil are in conflict with immediate requirements of the farm that are determined by other factors. On many such farms compromises are not only expedient but inevitable. Readjustments of land use and management to effect better water control and thus check erosion are involved and complicated undertakings, and thorough familiarity with all factors involved is essential to any rational approach.

As erosion control is one among other results of proper control of water on the land where it falls and as such water control is effected through the adjustment of land use and management to the physical capabilities and character of the soils, the problem is reduced to correcting land use and management. Certain mechanical means of controlling runoff and erosion, such as contour tillage, terracing, or strip cropping, should be resorted to if steep erodible land is to be cultivated, but wherever feasible such land should be used for close-growing crops, pasture, or trees (pl. 13, *B*).

MORPHOLOGY AND GENESIS OF SOILS

Soil is the product of the forces of weathering and soil development acting on the soil materials 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 soil material; (2) the climate under which the soil material has accumulated and existed since accumulation; (3) the plant and animal life in and on the soil; (4) the relief or lay of the land; and (5) the length of time the forces of soil development have acted on the material. The climate, and its influence on soil and plants, depends 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 influence drainage, aeration, runoff, erosion, and exposure to sun and wind.

ENVIRONMENT AND GENERAL MORPHOLOGY

Swain County is situated partly in the Great Smoky Mountains, a division of the Appalachian Mountains and one of the highest ridges in eastern United States. About 90 percent of the county ranges in elevation from 2,500 to 6,600 feet¹² and includes mostly mountains.

¹² See footnote 3, p. 3.

The rest is from 1,100 to 2,500 feet and comprises nearly level to slightly sloping first bottoms near streams, gently sloping terraces, and hilly and steep valley upland. The valley upland has been thoroughly dissected by drainageways, which have cut channels 200 to 500 feet below the general level of the upland. External and internal drainage are good in nearly all parts. In some flat places in first bottoms drainage through the soil is slow, and in many places on steep upland slopes runoff is rapid.

The rocks that underlie the county are mainly conglomerate, sandstone, graywacke, slate, schist, gneiss, marble, and quartzite,¹³ belonging to the Cambrian and the Archean systems. The Cambrian system is represented by Great Smoky conglomerate, Nantabala slate, Brasstown schist, the Valletown formation, Murphy marble, and Tusquitee quartzite, and the Archean system by Carolina gneiss. Great Smoky conglomerate is the most extensive of these rocks and is composed of conglomerate, coarse gray sandstone, and graywacke, with many beds of black slate and schist. Nantabala slate, consisting of black slate with garnet-staurolite schist at the bottom, appears in fairly wide belts in the southwestern part of the county. Brasstown schist, consisting of blue- and black-banded ottrelite schist and slate, appears in comparatively narrow belts in the southwestern part. The Valletown formation includes graywacke, garnet, ottrelite schist, and slate and is present in a narrow belt near areas of Brasstown schist. Murphy marble, consisting of white and blue marble, occupies small areas in the southwestern part near Nantabala and Hewitt. Tusquitee quartzite, a white quartzite, is present in narrow belts in the southwestern part near Wesser and Hewitt. A belt of Carolina gneiss begins near Needmore in the southwestern part and extends northeastward. This rock consists of mica gneiss and mica schist. Clingman conglomerate, Hazel slate, and Thunderhead conglomerate as mapped in the northern part are considered to be Great Smoky conglomerate. In addition to these rocks, granite, or a granitoid rock, appears in places in the south-central part of the county.

The outcrop of slate usually shows little effect of weathering, but long exposure reduces it to a condition resembling yellow micaceous schist or slate. Its extreme resistance to weathering makes slate form some of the sharpest divides in the entire mountain region. Several of these are along the North Carolina-Tennessee line and are too narrow to allow the passage of even a trail. The conglomerate formation is probably 3,000 feet thick and is the heaviest in the Appalachian province. It is to the hardness and great mass of this formation that the mountains owe their great height.

Throughout the eastern Appalachian province metamorphism increases toward the southeast, and a bed entirely unaltered at the border of the Great Valley can be traced through greater and greater changes until it has lost every original character. The structures resulted chiefly from compression that acted in a northwest-southeast direction, at right angles to the trend of the folds and of the cleavage planes. The compressive forces, however, affected only a narrow zone. Other forces, acting in a vertical direction, repeatedly raised and lowered the surface and affected the whole Appalachian province.

¹³ See footnotes 2 and 4, pp. 1 and 4 respectively.

The conglomerate has been altered somewhat, and during folding schistosity developed, producing mica from the material of the feldspar. The new mica increases in quantity toward the east to such a degree that the slates on the south side of the great Smoky Mountains become fine mica schists.

Swain County is part of the Gray-Brown Podzolic soil region; but streams in its rugged mountains have carved comparatively low and narrow valleys in which soils of the Red Podzolic soil region apparently have formed. These soils resemble very much the Red soils that have developed in the Piedmont Plateau physiographic belt.

The soils of the county range in color from light brown to brown, reddish brown, and almost black in the surface layers, and from light brown to reddish brown and red in the subsoils. The surface layers are prevailingly of fine texture and consist mostly of loams. Many angular fragments of the bedrock are on the surface and in the soils over a large part of the mountain country. The subsoils are nearly everywhere friable, and unlike the subsoils of the Iredell series in the Piedmont Plateau, none are heavy and plastic. In many places, particularly on steep mountain slopes and on the first bottoms of streams, there are only slight differences in textures of surface soils and subsoils. In some places on the less steep uplands, colluvial lands, and high terraces, the subsoils are of heavier texture than the surface soils. In most places the surface soils are darker in color than the subsoils, apparently because of the presence of moderate quantities of humus. In forested areas the humus of most soils is largely concentrated in the upper 2 inches; in cultivated areas it is mixed with the plow layer.

FACTORS OF SOIL FORMATION

Although the climate of Swain County is temperate and humid—mean annual temperature at Cullowhee, Jackson County, 56.5° F.—considerable variation exists in the mean seasonal temperatures, and the ranges in elevation result in differences in the temperatures of low-lying valleys and of high mountains. The rainfall—mean annual at Bryson City, 54.81 inches—is well distributed throughout the year, but it is somewhat less in fall than in any other season. Although soil leaching due to rainfall varies somewhat, it is sufficient to remove a large part of the bases that were originally present in the parent rock; hence, the soils are acid.

Climatic differences in valleys and high mountains produce some differences in the character of their soil profiles. On the mountains the rainfall is greater than in the well-drained soils in the valleys on similar relief; the temperature is lower; snow remains on the ground and winter weather continues for a longer period; the soils are frozen to greater depths and for a longer time; and the accumulation of organic matter in the soil is greater. These conditions have brought about soil color, consistence, and structure on the mountains different from those at lower altitudes. The soils on the mountains generally are younger than in the lower lying parts and contain much more organic matter, possess lighter textured B horizons, and have surface soils and subsoils that are more friable and porous. Some

of the differences are partly due to differences in climate; others, to differences in relief.

The soils have developed under a forest cover of deciduous trees and pine and, on the higher mountains, red spruce and balsam. Although most of the virgin forest has been exploited for timber, a very large proportion of the county is forested, mainly with second-growth trees.

Practically all the forested soil is covered with a 1- to 5-inch layer of organic matter, composed of partly decayed leaves, twigs, and roots. The first few inches of the surface layer contains an appreciable quantity of organic matter that is not a permanent part of the soil but is merely mixed with the minerals of the surface layer. When the soil is cleared and cultivated, the organic material is mixed through the plow layer and tends to disappear. On the tops of the highest mountains, however, and in shaded coves on the north sides of mountains are comparatively small areas of soil that, to a depth of 8 to 36 inches, contain a large quantity of decomposed organic matter that gives the soil an almost black color. The organic matter has accumulated through the decay of vegetation and is in various stages of decomposition.

Except on the highest mountains, climate and vegetation may be considered as relatively constant throughout the county and not therefore the major factors that have caused the great differences that exist in the morphology of the soil. Parent material, relief, and age, therefore, are the factors of soil formation that have brought about most of the differences in the morphology.

On the basis of source, the parent material of the soils consists of two classes: (1) Residual material derived from the decomposition of rocks in place; and (2) transported material, or material removed from its original position and deposited on valley uplands and near streams. The first class consists of weathered products of the underlying rocks. The second class includes rock fragments and other rock waste moved by gravity and water and deposited at the foot of mountain slopes and alluvial material derived from upland slopes and deposited by running water near streams on terraces and on first bottoms.

Some of the soils that have developed from residual material derived through the weathering of rocks in place are on the undulating to rolling uplands and have developed characteristics that are common to soils of similar relief and age throughout the general region. These are the mature zonal soils. Other soils of the uplands have slopes so steep that much material is removed by normal erosion, and much of the rain water runs off instead of moving downward through the soil. The normal effects of climate and vegetation are modified by the relief, and the soils stay young and develop few of the characteristics of the mature zonal soils. These are azonal soils. Within the groups of both the zonal and the azonal soils of the uplands are major differences that result from differences in the rocks from which the parent materials were derived.

Some of the transported materials have been in place a long time and some a very short time. Soils developed from materials that have been in place a long time have many of the characteristics of the mature soils of the uplands, and the differences among them may be

attributed largely to the texture, consistence, and mineral composition of the parent material. The materials that have been in place a short time have developed few of the characteristics of the mature soils of uplands and high terraces, a condition that is due largely to age. Differences among the young soils derived from these materials, however, may be due either to the character of the parent material alone or to the effect of relief or parent material on drainage. These young soils are azonal soils.

In some places soils developed from both residual materials and transported materials have well-developed profiles, but they have been influenced by the extreme character of the parent material, extremes of relief that inhibit drainage, or extreme age. These soils, although well developed, possess few characteristics of the zonal soils and are called intrazonal soils.

NORMAL SOIL PROFILE

Normal soil profiles have developed in only a small part of the county and are confined to places on the valley upland and on terraces. The profile of the normally developed soil is characterized by a fairly light-colored and light-textured surface layer; a uniformly colored and rather heavy-textured subsoil layer; and lighter colored and lighter textured parent material. The soils on the mountains are immature, and their profiles do not show as sharp divisions between the layers as do those of the normal soil on valley uplands and terraces.

GREAT SOIL GROUPS

Descriptions of the soil series are presented according to established great soil groups. In table 8 (p. 65), the soil series are listed by order and great soil group and for each are given the relief, drainage, parent material, and soil age. The great soil groups are (1) Red Podzolic soils, (2) Gray-Brown Podzolic soils, (3) Brown Forest soils, (4) Lithosols and shallow soils, and (5) alluvial soils. The Red Podzolic soils are found in the intermountain valleys, the Gray-Brown Podzolic soils in mountain coves and near the foot of mountains, the Brown Forest soils on the higher mountain slopes and crests, and the alluvial soils near streams. The Lithosols and shallow soils cover practically all the mountains and comprise a large part of the county.

RED PODZOLIC SOILS

Red Podzolic soils are a zonal group having thin organic and mineral-organic layers over a yellow-brown leached layer that rests on an illuvial red layer. They are developed under deciduous or mixed forest in a warm temperate climate. The processes of formation are podzolization and laterization. In Swain County the soils of this group are members of the Hayesville, Talladega, and Hiwassee series.

Hayesville loam probably represents best the normal profile of the valley upland. The following profile description of the soil was taken half a mile southeast of Jackson Line Church in an area having about an 18-percent slope:

- A₁. 0 to 1 inch, dark-gray friable light loam containing considerable organic matter derived from decayed leaves, twigs, and roots.

- A₂ 1 to 6 inches, grayish-yellow friable loam
- B₁ 6 to 9 inches, brownish-red friable clay loam This is a gradational layer between the A₂ and the B₂ horizon
- B₂ 9 to 23 inches, brownish-red clay, firm but moderately friable The material breaks into rather large angular lumps that break easily into angular aggregates ranging from 1/8 to 1/4 inch in diameter Plant roots penetrate the material This is the horizon of illuviation
- C₁ 23 to 45 inches, light-red friable clay loam with some soft weathered rock
- C₂ 45 inches +, gray, streaked with black, soft friable disintegrated gneiss

Hayesville loam is similar in many respects to Cecil loam, which is on the Piedmont Plateau, but differs in that its subsoil is not so red, is more open and friable, and is not so susceptible to erosion.

Hayesville loam, steep phase, and Hayesville clay loam, severely eroded phase, also are mapped. Practically all the original surface layer and in some places part of the subsoil have been removed by accelerated erosion from the severely eroded phase.

Soils of the Talladega series have formed on narrow ridges, sharp knobs, and steep slopes in mountain country, mainly from decomposed mica schist. A great many finely divided mica flakes are mixed through the soil and give it the greasy feel characteristic of the Talladega soils.

In Talladega silt loam the 5- to 8-inch surface layer is brown, reddish-brown, or light red friable silt loam, underlain by a brownish-red, light-red, or salmon-red friable silty clay or clay layer, to a depth of 10 to 15 inches. This layer is underlain by yellowish-brown, brownish-yellow, or purplish-red friable micaceous material.

Talladega stony loam, also mapped, differs from Talladega silt loam mainly in texture and in having many rock fragments on the surface and in the surface layer.

Soils of the Hiwassee series, perhaps the reddest soils in the county, have formed on high terraces from old alluvium that consists mainly of sand, silt, clay, and water-worn quartzite rock, Hiwassee silt loam and its hill phase are mapped.

The following profile description of Hiwassee silt loam was taken in a field 1 mile north of Bryson City in an area having a 5-percent slope:

- A 0 to 10 inches, reddish-brown friable mellow silt loam, apparently containing some decomposed organic matter well mixed with the mineral material
- B 10 to 50 inches, deep-red or maroon friable clay loam
- C 50 inches +, red friable fine sandy clay and clay, mixed with water-worn quartzite and other rock fragments

Hiwassee silt loam, hill phase, differs from the typical soil mainly in having steeper slopes and thinner horizons.

GRAY-BROWN PODZOLIC SOILS

Gray-Brown Podzolic soils are a zonal group having a comparatively thin organic covering and organic-mineral layers over a grayish-brown leached A horizon that rests on an illuvial brown B horizon. Developed under deciduous forest in a temperate moist climate, they have a surface covering of leaf litter, usually of deciduous trees, a dark, thin, mild (only slightly or moderately acid) humus, somewhat mixed with mineral soil; a grayish-brown, crumb-structured loamy A horizon and a light grayish-brown or grayish-yellow loamy A₂ horizon; and a moderately heavy nut-structured yellowish-brown, brown, brownish-yellow, or reddish-brown B hori-

zon, becoming lighter colored with depth. The total depth of the solum varies considerably but seldom exceeds 4 feet. Podzolization is the main process of development. In Swain County the soils of this group are members of the Tusquitee and the State series.

The soils of the Tusquitee series occupy colluvial slopes and have formed from weathered material of angular and subangular rock fragments and other rock waste and soil material moved by the action of gravity and water and deposited near the foot of mountain slopes.

The Tusquitee series includes Tusquitee loam and Tusquitee stony loam. These soils have considerable range in age and are subject to change by the addition of new material from nearby slopes. The A horizon of well-developed Tusquitee loam is brown mellow loam, 10 to 20 inches thick, underlain by a 10- to 20-inch light-brown friable clay loam B horizon, resting on light-brown friable soil material in which are many angular rock fragments, 6 to 10 inches or more in diameter. Tusquitee stony loam is similar to Tusquitee loam, except that many angular rock fragments are on the surface and in the soil.

Although the well-developed Tusquitee soils are Gray-Brown Podzolic soils, the mapping unit includes some areas of young soils that should be considered alluvial. In this county the Gray-Brown Podzolic soils predominate in the mapping unit. The alluvial soil inclusions have little difference in texture between surface soil and subsoil.

The State series has only one member in the county—State loam. As this soil occupies low terrace positions above overflow by streams, it has more definite profile development than do soils of the Congaree series, which occupy first-bottom positions. The soil has formed from alluvium consisting of sand, silt, clay, and gravel washed largely from lands underlain by metamorphic and igneous rocks.

A sample of State loam from a nearly level area $\frac{1}{4}$ mile west of Governors Island has the following profile description:

- A. 0 to 12 inches, brown mellow loam containing some decomposed organic matter incorporated with the mineral soil
- B₁ 12 to 42 inches, light yellowish-brown friable clay loam
- C₁ 42 to 70 inches, yellowish-brown friable clay loam, mottled with gray and red.
- C₂ 70 to 100 inches, light-gray loamy sand, in which are brown mottlings
- C₃ 100 inches +, gravel bed

A small area in the southwestern part near Nantahala is underlain by marble. If this soil had been more extensive, it would have been mapped as Hagerstown silt loam or loam of the Gray-Brown Podzolic great soil group. The soil has a reddish-brown friable A horizon, about 8 inches thick; and a brownish-red heavy silty clay or clay B horizon, about 30 inches thick.

BROWN FOREST SOILS

Brown Forest soils comprise an intrazonal group with very dark-brown surface horizons, relatively rich in humus (mull), grading through lighter colored soil into the parent material, and characterized by slightly acid reaction, little or no illuviation of iron and alumina, and a moderately high content of calcium in the soil colloids. They are developed under deciduous forest in temperate humid regions from parent material relatively rich in bases. In Swain County, the only soils of this group are in the Burton series. The Burton

series is represented by Burton stony loam, steep phase, and Burton stony loam, shallow phase. The surface layers of these soils are very dark and contain a large quantity of organic matter derived from decomposed vegetation. The soils have formed chiefly from weathered products of conglomerate, sandstone, and slate.

Burton stony loam, steep phase, is dark-gray or almost black loam to a depth of 8 to 20 inches or more. Beneath this dark-colored material is a brownish-yellow or yellowish-brown friable loam or clay loam layer, ranging from a few inches to 38 inches in thickness. This layer is underlain by decomposed rock or by bedrock. In some places this layer is absent, and the dark-colored layer lies directly on bedrock. Many rock fragments are on and in the soil. In places, this steep stony soil appears on balds, or treeless tracts, where it is covered with a thick stand of grass.

Burton stony loam, shallow phase, has a dark-gray or almost black loam or mucky-loam surface layer 3 to 8 inches thick. This is underlain by a 4- to 15-inch brownish-yellow or yellowish-brown friable clay loam layer lying on bedrock. In some places the surface layer rests directly on bedrock, as no subsurface layer has developed. Angular rock fragments 4 to 10 inches in diameter are on the surface and in the soil.

LITHOSOLS AND SHALLOW SOILS

Lithosols and shallow soils include immature shallow soils over rock formations under conditions of ample to excessive moisture. The parent material, derived from a great number of igneous, sedimentary, and metamorphic rocks, varies widely in composition, as do also the soils. The soils vary in productivity as a result of this variety of parent material and the difference in local conditions that govern the decomposition of rocks and the formation of soil. A comparatively small part of the land is cultivated. In Swain County the soils of this group belong to the Porters and Ramsey series,¹¹ and in addition to three land types: Stony colluvium (Ramsey and Porters soil materials); rough stony land, peaty phase; and rough stony land (Ramsey and Porters soil materials). These land types, probably true Lithosols, consist of rock fragments or rock outcrops and soil material in which no clearly expressed soil morphology exists. The slopes in many places are rough and steep.

Very weak profiles have developed in the Lithosol and shallow soil group, and the soils themselves are very closely related to their parent material. On the more gentle slopes the profiles of some of the soils almost approach those of members of the zonal soil order.

Porters loam, hilly phase; Porters loam, very steep phase; and Porters stony loam are mapped. The stony Porters soils are characterized by a large number of angular fragments of the parent rock, which appear on the surface and in the soil.

The soils of the Ramsey series are confined mainly to the northern part of the county; whereas the soils of the Porters series are mostly in the southern part. The Ramsey soils resemble the Porters soils but differ in being slightly lighter in color in the subsoil and in having a different kind of parent material. The Porters soils have formed mainly from weathered material of gneiss, and the Ramsey soils from

¹¹ Although soils of the Porters and Ramsey series are in the Lithosol and shallow soil group, some areas, as mapped, possibly belong in the Gray-Brown Podzolic soil group.

weathered material of conglomerate, sandstone, graywacke, slate, and schist. The Ramsey soils, like the Porters soils, lack well-developed profiles and in most areas the texture and consistence are almost the same in all parts of the profile. In some favorable situations a semblance of a B horizon has developed.

The 2- to 5-inch upper layer of Ramsey loam in forested areas is dark brown and friable. The dark color is caused by much organic material derived from decayed vegetation and mixed with the mineral material. Beneath this layer is friable loam stained brown by organic matter. This brown layer is 3 to 12 inches thick and is underlain by brownish-yellow friable loam 8 to 15 inches thick. This layer, in turn, is underlain by yellowish-brown friable fine sandy loam material or by bedrock.

Other Ramsey soils mapped are Ramsey loam, hilly phase; Ramsey stony loam; Ramsey stony loam, hilly phase; and Ramsay silt loam. Many angular rock fragments are strewn over the surface and mixed with the soil of the stony Ramsey soils, and these fragments differentiate them from the Ramsey loam soils.

Ramsay silt loam has formed chiefly from weathered material of slate. Its 4- to 10-inch surface layer is brownish-yellow or yellowish-brown friable silt loam, underlain by a yellowish-brown, brownish-yellow, or greenish-yellow friable silty clay layer 4 to 15 inches thick. Beneath this layer is partly decomposed slate or slate bedrock. The silty clay layer in this profile appears to be completely weathered parent rock rather than an illuvial horizon.

Large areas on lower mountain slopes in the west-central part of the county consist of a complex of soils. As the individual areas are so small and so intricately associated, it is not practicable to separate them on the soil map. The surface layers are of fairly uniform brown color, and their texture ranges from silt loam and loam to fine sandy loam. The subsoils are light-red, salmon-red, or brown clay loam or fine sandy clay. The soils have formed from weathered mica schist, conglomerate, graywacke, and sandstone, and in places weathered granite, gneiss, slate, and quartzite. They belong mostly to the Talladega and Ramsey series and are mapped Talladega-Ramsay loams and Talladega-Ramsay loams, hilly phases.

Stony colluvium (Ramsey and Porters soil materials) consists of a mixture of rock fragments and soil materials that accumulated at the base of slopes and near streams through the action of gravity and water. Very little if any profile development has taken place in this mixed material.

Rough stony land, peaty phase, lies at high elevations on the Great Smoky Mountains in the northern part of the county. This land type consists principally of a dark-colored organic layer that rests in most places on the bedrock, consisting of conglomerate and hard blue slate. In this rough stony land a heavy growth of moss covers a thin layer of peat, and the peat layer, in turn, covers a thin layer of muck. The moss and the dark-colored layers range in total thickness from 3 to 8 inches. A thin greenish-yellow or yellowish-brown layer of silty clay loam material appears in places between the dark-colored layer and bedrock. The ground is covered with fallen moss-covered spruce trees and has many outcrops of bedrock.

Rough stony land (Ramsey and Porters soil materials) includes rough and stony mountain land in which the soil present consists

of Ramsey soil material and Porters soil material. Practically no soil development has taken place, and what soil has formed is mostly shallow. Only the surface layer has formed in places, and this passes into decomposed rock or lies on bedrock.

ALLUVIAL SOILS

Alluvial soils are an azonal group developed from transported and relatively recently deposited material (alluvium) characterized by a weak modification (or none) of the original material by soil-forming processes. In Swain County, soils of this group are members of the Congaree series and of a land type, designated as alluvial soils, undifferentiated.

The Congaree soils, represented by Congaree silt loam and Congaree fine sandy loam, have formed from alluvial materials derived from uplands underlain by crystalline rocks. The soils are young and subject to change in texture by the addition of new material when streams overflow. They are brown and friable to a depth of 10 to 15 inches, where they are usually lighter in color but change slightly, or not at all, in texture and consistence. At a depth of about 50 inches they are underlain in many places by sand and gravel. Small mica flakes are present in most places.

The following profile description of Congaree silt loam was taken one-fourth mile east of Governors Island, in a nearly level area:

- A₁ 0 to 10 inches, brown mellow silt loam with an appreciable quantity of very fine sand, apparently containing a moderate quantity of decomposed organic matter well mixed with the mineral material
- C₁ 10 to 40 inches, light-brown friable heavy silt loam, easily crushed to a soft mass.
- C₂ 40 to 50 inches, light-brown friable very fine sandy loam
- C₃ 50 inches +, yellowish-brown sand or loamy sand mixed with quartzite gravel.

Small finely divided mica scales appear in all parts of the profile, but they are more numerous in the lower part.

Alluvial soils, undifferentiated, occupy positions in first bottoms, associated with soils of the Congaree series. They are a mixture of several soils, the areas of which are too small to be mapped separately. The surface layers range in color from brown and grayish brown to almost black, and the subsoils from brown and yellow to gray. In some places drainage is fairly good; in others poor. The soils are subject to change by the addition of new material when streams overflow.

In table 8, classifying the soil series of Swain County into higher categories, some of the factors are given that have contributed to their morphology.

TABLE 8—Classification of the soil series of Swain County, N. C., in higher categories, and some of the factors that have contributed to their morphology

Order	Great soil group	Series	Relief	Drainage	Parent material	Soil age ¹
Zonal.....	Red Podzolic soils	Hayesville....	Rolling to steep.....	Good to excessive.	Weathered material of gneiss, granite, and mica schist having a low mica content	Old
		Talladega....	Hilly to steep.....	do.....	Weathered products of mica schist mainly, but a small proportion of weathered slate and sandstone in some places	Young to old
	Gray-Brown Podzolic soils	Hawassee....	Gently sloping to very strongly sloping	Good.....	Alluvium on terraces, which consists of materials derived from uplands underlain by crystalline rocks, appears to be very old	Old
		Tusquitee....	do.....	do.....	Brown colluvial wash derived from slopes underlain by crystalline rocks	Young
Intrazonal..	Brown Forest soils....	State.....	Very gently sloping to moderately sloping	do.....	Alluvium on terraces The material was derived from Porters, Ashe, and Hayesville soils and deposited in stream valleys at a time when the streams flowed at higher elevations	Do
Azonal.....	Lithosols and shallow soils (Gray-Brown Podzolic soils region)	Burton.....	Moderately sloping and rolling to steep	do.....	Weathered material of conglomerate, sandstone, and slate, and in places possibly of weathered gneiss and granite	Young
		Porters.....	Hilly to very steep.....	do.....	Weathered products of gneiss, granite, and a mica schist of low mica content	Do
	Alluvial soils.....	Ramsey.....	do.....	do.....	Residual material of weathered conglomerate, quartzite, and, in places, an admixture of weathered schist and slate	Do
		Congaree....	Almost level to gently sloping	do.....	Flood-plain alluvium derived from slopes underlain by crystalline rocks	Very young to young

¹ Age refers to the degree to which the soil has developed properties that are characteristic of a mature soil in equilibrium with a similar environment. The terms used are relative. As compared with a mature soil, a very young soil has few or none of the characteristics of that soil, a young soil has those characteristics weakly developed to moderately well developed, and an old soil has them well developed.

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