

Issued November 9, 1914.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS—MILTON WHITNEY, Chief.

SOIL SURVEY OF UNION COUNTY,
SOUTH CAROLINA.

BY

CLARENCE LOUNSBURY, W. E. McLENDON,
AND J. A. KERR.

HUGH H. BENNETT, INSPECTOR, SOUTHERN DIVISION.

[Advance Sheets—Field Operations of the Bureau of Soils, 1913.]



WASHINGTON:
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1914.

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS,
Washington, D. C., May 1, 1914.

SIR: I have the honor to transmit herewith the manuscript report and map covering the soil survey of Union County, S. C., one of the projects undertaken by the bureau during the field season of 1913, and to request that they be published as advance sheets of Field Operations of the Bureau of Soils, 1913, as authorized by law.

Respectfully,

MILTON WHITNEY,
Chief of Bureau.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

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MAP.

Soil map, Union County sheet, South Carolina.

SOIL SURVEY OF UNION COUNTY, SOUTH CAROLINA.

By CLARENCE LOUNSBURY, W. E. M'LENDON, and J. A. KERR.

DESCRIPTION OF THE AREA.

Union County is situated in the northwestern part of South Carolina. It is irregular in shape, and is bounded on the north by the Pacolet River, which separates it from Cherokee County, on the east by the Broad River, which separates it from York, Chester, and Fairfield Counties, on the south by the Tiger and Enoree Rivers, which separate it from Newberry and Laurens Counties, and on the west by Spartanburg County. The county has an area of 512 square miles, or 327,680 acres.

Union County lies wholly within the Piedmont Plateau. The general topography of the county is that of a moderately sloping plain

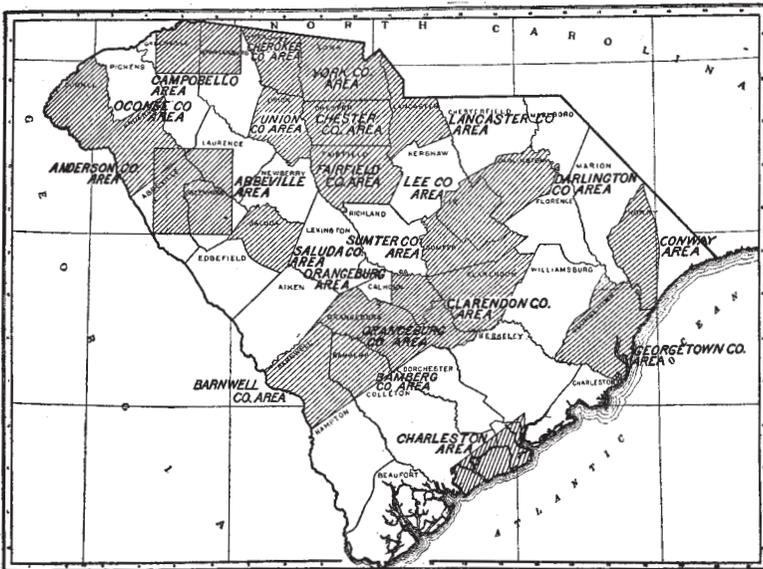


FIG. 1.—Sketch map showing areas surveyed in South Carolina.

so thoroughly dissected by stream erosion that much of the country is, when considered in detail, rolling and hilly. A main divide, roughly marked by the tracks of the Southern Railway, extends in a northwest-southeast direction through the county. Minor ridges extend across the northern part of the county, and another across the southern part between the Tiger and Enoree Rivers. Much of the

country between Fair Forest Creek and the Tiger River is comparatively low and flat. The streams have rapid currents, and but little overflow land has been developed in the wearing down of the uplands. Occasionally the slopes along streams are quite abrupt, but in most cases they are moderately sloping. Differences in elevation between the stream bottoms and the crests of the ridges vary from but a few feet at the sources of the streams to about 200 feet in the vicinity of the larger streams. Elevations above sea level vary from nearly 700 feet in the northwestern part of the county to about 300 feet at the Broad River in the southeastern part. Topographically most of the land is suitable for agricultural operations, but there are many slopes sufficiently steep to cause the soils to erode badly under cultivation, unless terraced or left in timber or grass. Some of the steepest slopes are so gullied as to be of no value for agriculture.

The county is drained toward the southeast, all of the drainage eventually reaching the Broad River. The largest tributaries of the Broad River are the Pacolet and Enoree Rivers, which, respectively, form most of the northern and southern boundaries of the county, and the Tiger River, flowing through the southern part of the county nearly parallel with and about 5 miles from the Enoree River. The principal stream flowing into the Tiger from the south is Padgets Creek, and the largest from the north is Fair Forest Creek, which, like the Tiger, has its source in Spartanburg County, to the northwest. The principal tributaries of Fair Forest Creek are Sugar Creek on the west and Buffalo, Rocky, Mitchell, and Beaverdam Creeks on the east. Tinker, Johnsons, and Cane Creeks enter the Tiger east of the mouth of Fair Forest Creek.

These streams carry the larger part of the drainage of the county, and all of them empty into the Tiger River, which joins the Broad River at the extreme southeastern corner of the county. In the northern part of the county Mill Creek, Sandy Run, Peterhawk, and Gault Creeks and Reedy Branch enter the Pacolet River. Emptying directly into the Broad River along the eastern boundary of the county are Fanning, Browns, Neals, and Hobsons Creeks.

At two points along the Broad River in Union County water power is being developed. At Neal Shoals the river is dammed, and electric power is being supplied to mills at Union and Buffalo. At Lockhart, farther up the river, considerable power is being developed, and plans are being made to increase greatly the capacity of this plant.

Originally Union County included the territory at present forming Spartanburg, Cherokee, and York Counties, and a part of Chester County. The present limits of the county were fixed in 1897, when Cherokee County was established.

The settlement of this region began before the Revolutionary War. The early settlers were mainly of Scotch-Irish and English descent, coming from Pennsylvania, Virginia, and North Carolina.

The present white population, with the exception of a large part of the mill workers from the mountains and neighboring portions of this State and North Carolina, consists largely of the descendants of the early settlers. Over half of the total population is colored, comprising former slaves and their descendants. According to the United States census for 1910, Union County has a total population of 29,911.

Union, the county seat, is the largest town and the most important commercial center of the county. It is situated approximately in the center of the county, and has, according to the 1910 census, a population of 5,623. Jonesville, with a population of about 1,000, is located in the northwestern part of the county, and ranks next to Union in importance. Kelton, a small town in the northern part of the county, has a population of about 100. Carlisle, with a population of about 400, and Santuck are important towns in the southeastern section. Lockhart, in the northeastern part of the county, and Buffalo, about 4 miles west of Union, are large mill towns whose interests are almost entirely industrial. The other towns are small, having post offices and generally being centered about country crossroads. Of these towns Adamsburg and Mount Tabor in the northern part of the county, West Springs and Colerain in the western part, and Crosskeys and Sedalia in the southwestern part are of more or less local importance.

With the exception of the southwestern section, Union County is supplied with good transportation facilities. The main line of the Southern Railway between Columbia and Spartanburg, S. C., and Asheville, N. C., passes in a northwest and southeast direction through the center of the county. A branch of this road extends across the northern section east to Lockhart. The Seaboard Air Line Railway passes through the southeastern part of the county, crossing the Southern Railway at Carlisle. The Union & Glenn Springs Railroad extends from Buffalo through Union to Pride, at which place it connects with the Seaboard Air Line.

While the interests of Union County are chiefly agricultural, the county includes several manufacturing industries. A cotton mill and knitting mill, an oil mill, and an ice plant are located at Union, and at Monarch two cotton mills are in operation. Buffalo, Lockhart, and Jonesville each have a cotton mill, with an oil mill also at the latter place. Most of the towns and crossroads settlements have cotton gins. Nearly all of the cotton crop is bought by representatives of local cotton mills, where various cotton products are manufactured.

A part of the cotton produced in the northern part of the county is marketed at Gaffney, in Cherokee County, and some of that grown in the southern part is sold at Whitmire, in Newberry County, and at Laurens, in Laurens County. The local cotton mills are handling more than twice the total amount of cotton produced within the county.

Union County is well supplied with public roads, but these, with a few exceptions, are not kept in good condition. The ridge roads and those connecting the principal points in this and adjoining counties are generally well cared for, but the minor roads are rough and receive but little attention. During the wet weather of the winter months the roads are often practically impassable. Increasing attention, however, is being given to road improvement.

The rural mail delivery service is fair. The telephone is not in extensive use. The county is well supplied with good churches and schools.

CLIMATE.

The climate of Union County is mild and equable and admirably suited to a wide range of crops. While the variation in temperature is greater than along the seacoast, it is much less than that prevailing in the mountainous country farther inland.

The summers are long and hot; the winters short and mild. The highest summer temperatures occur between about the middle of June and the first of September. With occasional exceptions the summer weather is not oppressive. The spring season from about the middle of March to the middle of June and the fall season from the 1st of September to about the 1st of December are mild and pleasant. In the winter months occasional sleet storms and light snow flurries occur. Usually there is some freezing weather, but the ground is rarely frozen to a depth of more than 3 or 4 inches, and then not for more than a few days.

The coldest and most disagreeable weather occurs during January and February. Outdoor work is possible, however, during the greater part of the winter.

The data in the following table, compiled from the records of the Weather Bureau station at Santuck, are representative of the climatic conditions in Union County:

Normal monthly, seasonal, and annual temperature and precipitation at Santuck.

Month.	Temperature.			Precipitation.		
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year.	Total amount for the wettest year.
	° F.	° F.	° F.	Inches.	Inches.	Inches.
December.....	43.2	30	1	4.10	3.96	4.20
January.....	42.1	74	6	3.52	2.35	6.41
February.....	41.6	75	-11	5.19	3.92	5.82
Winter.....	42.3			12.81	10.23	16.43
March.....	53.8	92	12	4.23	3.03	4.49
April.....	59.3	93	24	3.61	0.98	2.88
May.....	70.1	101	36	3.04	1.75	2.86
Spring.....	61.1			10.88	5.76	10.23
June.....	76.2	100	46	3.99	2.72	4.47
July.....	79.3	104	52	4.89	7.13	4.66
August.....	78.1	105	53	5.79	9.57	14.69
Summer.....	77.9			14.67	19.42	23.82
September.....	73.0	100	39	3.41	1.00	1.75
October.....	61.0	92	26	3.24	0.38	6.26
November.....	51.2	80	13	2.90	3.19	1.86
Fall.....	61.7			9.55	4.57	9.87
Year.....	60.8	105	-11	47.91	39.98	60.35

There is an annual mean temperature of about 61° F., with a range from -11° F., the lowest temperature recorded, to 105° F., the highest recorded. The county has an average annual precipitation of about 48 inches. The precipitation is well distributed throughout the growing season and ample for the successful production of crops. Occasionally periods of drought, which cause injury to crops, occur. These, however, are usually short, and with thorough preparation of the land and careful tillage their destructive effects can be largely avoided.

The average date of the last killing frost in the spring is April 3 and of the first in the fall October 26, giving a growing season of about seven months. The latest date of killing frost in the spring recorded is April 30 and the earliest date in the fall September 30.

AGRICULTURE.

The first permanent settlers in Union County directed their attention chiefly to the raising of cattle. Farming soon became important, however, and by the time of the Revolution a large part of the

land was being cultivated. Some of the land was occupied in large holdings, often of several thousand acres, and most of these developed into typical slave plantations and were continued as such until the Civil War.

Up to the time of the Civil War, and even later, practically all materials needed for food and clothing were produced at home. Corn and wheat and various vegetables, beef, and pork were produced for home consumption. Clothing was made of the wool and cotton produced on the farm.

With the invention and perfection of the cotton gin, cotton became the principal money crop. Other general crops, such as corn, wheat, and oats, were important, being produced more extensively than at present. Owing to the cheapness and abundance of land and labor, no especial care was taken to maintain the productiveness of the soils. When a field ceased to give satisfactory yields it was abandoned, and new land was cleared and used as long as crops could be profitably produced.

After the Civil War the agriculture of the county shared in the unsettled conditions of labor and capital, and this continued during the considerable period of reconstruction. A large part of the farm land was abandoned and permitted to grow up again in brush and forest. Land values declined, and farmers in resuming their work had great difficulty in adapting themselves to the changed labor conditions, in meeting their obligations, and securing capital. The pressing need for a ready-money crop encouraged the production of cotton to the exclusion of most of the other crops, as there was a steady demand for cotton at good prices. Cotton has continued the principal crop of the county. Corn ranks next to cotton in importance, and oats, wheat, potatoes, sorghum, peas, and a few other crops are grown in a small way, and almost entirely to supply home needs.

This one-crop system, with no consistent rotation of crops, has not only impoverished much of the land, but through improper preparation of the soil and neglect in cultivation the surface of many fields is washed and gullied, so that in many places large areas have been rendered useless for agriculture. According to the 1910 census 16,953 bales of cotton were produced from 48,250 acres in 1909. A little less than half of the improved farm land is devoted to this crop, and the average yield is a little more than one-third bale per acre.

Usually in preparing land for cotton the fields are laid off in rows about 3 to 3½ feet apart and bedded up, and the planting is done on the ridge thus formed. Cotton is planted about the middle of April. The crop is cultivated with the small turn plow or "bull-tongue" plow, and sometimes with sweeps and other attachments.

The cultivation is done more with a view to pulverizing the soil and killing weeds than to conserving moisture. Commercial fertilizers are almost invariably used, being distributed in the ridge in which the seed is planted. A low-grade mixture which analyzes about 8-2-2 or 8-2-3, representing the relative amounts of phosphoric acid, nitrogen, and potash, respectively, contained in the mixture, is generally applied to the cotton crop at the rate of 300 to 350 pounds per acre. A higher grade mixture, analyzing about 10-3-4, is sometimes used.

Corn is grown to some extent by practically every farmer. On most of the rented farms it receives but little attention. In many cases the tenants do not produce enough corn for feed or to supply household needs. In general, however, this crop ranks next to cotton in importance in Union County. The 1910 census reports a production of 278,399 bushels of corn from 31,054 acres in 1909, an average of almost 9 bushels per acre.

Corn is planted during the latter part of April or the first part of May. In some cases the corn is planted on beds in a way similar to that in which cotton is grown, but probably more often it is planted in water furrows, as it is believed that the crop is more resistant to drought and more easily cultivated when thus planted. Cowpeas are sometimes grown between the corn rows, and this practice meets with excellent results. An excellent forage crop is produced, and by plowing the vines under the nitrogen and humus content of the soil is maintained.

Commercial fertilizers are generally used in growing corn. A high-grade mixture, analyzing about 10-3-4, is commonly applied. In some cases applications of sodium nitrate, at the rate of 70 to 80 pounds per acre, are made between the corn rows at the time of last cultivation.

Oats are an important crop with a few farmers, but with others, more particularly the tenant farmers, this crop does not receive much attention. The 1910 census reports a production of 50,319 bushels of oats from 3,865 acres, or an average of about 13 bushels per acre. Almost all of the heavier types of soil in the county are adapted to oats, and with greater attention to crop rotation and soil preparation the present low average yield can be materially increased. Commercial fertilizers are seldom used. Some farmers apply sodium nitrate, at the rate of 70 to 80 pounds per acre. In Union County the oats, as well as the other grains, are cut with a cradle and bound by hand, except in the case of a few leading farmers, who use self-binders. The grain is usually fed with the straw, but occasionally some farmers have their grain thrashed. Oats are generally sown during October or November. Sometimes the crop is sown a little later with good results.

Wheat was formerly about equal to oats in importance, but it is not grown to any considerable extent at present. Yields became unsatisfactory, increasing attention was given to cotton production, and some trouble was experienced with rust and the Hessian fly, so that wheat production declined. In general, fair yields are obtained from the soils of the county where proper care is given to maintaining the productivity of the soil. Practically no commercial fertilizers are used. In the 1910 census a production of 3,558 bushels of wheat is reported from 520 acres, giving an average yield of about 7 bushels per acre.

Some attention is given to leguminous crops. Besides cowpeas, a few farmers are growing crimson clover, red clover, and vetch successfully. While cowpeas are most extensively grown, as they can be produced without much trouble, the other legumes are important and are profitable wherever grown either for forage or hay, or to upbuild the productiveness of the soil.

Grains are cut green for hay from 1,979 acres, producing 2,301 tons, and tame grasses are grown on 432 acres, with a yield of 557 tons of hay. In addition a production of 81 tons of hay from 53 acres in wild grasses is reported, with 112 acres sown for forage, yielding 137 tons of hay. The farmers utilize practically all of the corn fodder gathered or "pulled" from the stalks when the ears are nearly mature.

Sweet potatoes and Irish potatoes are only grown in small patches to supply home needs. Both give satisfactory yields in the sandy uplands, and, where markets are available, they are profitable crops when grown in connection with general farming. According to the 1910 census, 601 acres were devoted to sweet potatoes, with a yield of 50,619 bushels, and a production of 4,326 bushels of Irish potatoes is reported from 51 acres.

Fruits are not produced commercially, although peaches, cherries, and apples, with a few figs and Scuppernong grapes, are grown for home use.

The sandy soils, particularly the coarse-textured Cecil soils and the Appling coarse sandy loam, are well suited to peaches, grapes, and berries. Apples do not do so well, as the elevation and climate of Union County are not favorable to their successful production. Most of the apples grown are the summer varieties. Strawberries and other varieties of berries thrive on the well-drained soils. The value of orchard products, including small fruits and nuts, is given as \$22,882 in the 1910 census.

In addition to the above crops, the 1910 census reports yields of 9,095 bushels of peas from 3,564 acres, 1,298 bushels of peanuts from 98 acres, and 125 bushels of beans from 23 acres, with a total of 1,037 acres devoted to other vegetables. A total of 92 acres is de-

voted to sugar cane and 332 acres to sorghum, producing 3,620 and 4,562 gallons of sirup, respectively. Rye is grown on a total of 35 acres, yielding 249 bushels.

Much less attention is being paid to dairying and general stock raising than the opportunities offered by these industries would seem to warrant. Nearly every farmer has a cow or two to supply his home with milk and butter, but there are very few dairy herds in the county. Such herds, comprising 20 to 30 cows each, are found mainly in the vicinity of Union, and the butter and milk products are disposed of in Union and other local markets. Most of the dairy cattle are Jerseys. They are well cared for, and some are pedigreed stock. With one or two exceptions no silos are used. The general conditions in Union County are favorable to the extension of the dairy industry. There is considerable land which, owing to the topography, is more suitable for pasturage than for cultivated crops. With little trouble Bermuda grass may be grown on these areas, and no better pasture grass can be grown, especially for dairy cows. Plenty of clean running water is available in the numerous springs and streams of the county.

The production of beef cattle also should prove a desirable and profitable industry. The Aberdeen-Angus breed is successfully raised in other parts of the South, and the Durham or Shorthorn breeds also are produced with profit.

There is an excellent opportunity in hog and sheep raising. Hogs are kept on many of the farms in this county, although in general not enough pork is produced to supply home needs. A few farmers keep small flocks of sheep. On most of the rough and broken hill-sides sheep could be raised for market with little trouble and expense. The raising of horses and mules also should prove profitable.

In 1910 the total value of live stock of all kinds was reported as \$781,832, or an average value of about \$256 per farm.

Commercial fertilizers are rarely used except for cotton and corn. Some barnyard manure or compost is used, but the supply is limited, owing to the small number of domestic animals in the county. According to the 1910 census \$138,263 was expended for fertilizers in 1909.

The systematic rotation of crops receives very little thought or attention. Cotton is the principal crop and is in most cases grown year after year on the same land. Sometimes cotton is alternated occasionally with corn. Oats when grown may follow either corn or cotton. No land is regularly seeded down, and scarcely any cover crops are grown to increase the humus supply of the soil and retard surface washing.

The land generally receives insufficient preparation, especially the heavier loam and clay loam types. This is due to the light

equipment in common use. Breaking of the land is ordinarily done with one mule or horse and light plows. As a result only about 3 inches of the surface is broken, making a seed bed which is much too shallow properly to absorb and retain the rainfall. Consequently most of the rainwater flows off of the surface, carrying with it during each downpour much of the loosened soil and leaving the surface impoverished and droughty. In the last few years a great deal has been done to check surface washing by constructing hillside terraces, and laying off the rows in contours, but in spite of this much surface washing is still in progress. Many of the more thoughtful farmers, chiefly men who are personally working their own farms, are giving more attention to the preparation of their land and subsequent tillage. Most of these farmers are getting good results both in crop yields and in the gradual improvement of their lands.

Where the farms are operated by or under the personal supervision of the owners the improvements are usually good. The houses, barns, and outbuildings are large and substantial, and are kept in good condition. As a rule on the farms operated by tenants the buildings are not so well constructed, but generally meet every requirement. Land regularly devoted to crops is rarely fenced, but the pastures, which are usually small, are inclosed with wire or rail fences.

Farm labor is fairly plentiful, but is becoming more difficult to obtain. Practically all of the hired laborers are negroes. This labor is usually efficient for working the general crops, but it is often unsatisfactory where more than ordinary care is necessary. Most of the negroes prefer to work the land on shares, as they can then control their own time. When laborers are hired by the day they are paid from 50 to 75 cents with board, and when employed by the month they receive from \$12 to \$15, house, rations, firewood, and the use of a garden and work stock. Labor is in especial demand during the cotton-picking season, when extra hands are employed and paid about 50 to 60 cents per hundred pounds of cotton picked. According to the 1910 census, \$94,152 was expended for labor in Union County in 1909.

The system of renting farm lands is variable. Under the share system the landlord furnishes the work stock, tools, half the fertilizer, and half the ginning expenses, and receives half of the crop. The more common practice, however, is for the tenant to pay a fixed rent in lint cotton or sometimes in cash, furnishing all equipment and supplies. For a farm of 20 to 30 acres, usually farmed with one horse or mule, the owner receives from 1,000 to 1,500 pounds of lint cotton, or from \$100 to \$125 in cash. For a "two-horse" farm of 75 to 100 acres a correspondingly larger rental is paid.

According to the 1910 census there are 251,316 acres in farms in Union County, of which 111,081 acres are improved. This acreage has gradually decreased since 1880, when the total area in farms was given as 359,018 acres, of which 140,504 acres were improved. During this period the average size of the farms also has decreased from 142 acres to about 82 acres.¹ There are, however, many farms of several hundred, and a few of several thousand acres which are subdivided and rented. There is also a decrease shown in the percentage of farms operated by the owners. In 1880 these constituted 33.6 per cent of the farms of the county, in 1890, 30.6 per cent, in 1900, 21.4 per cent, and in 1910, 23.1 per cent. The number of farms reported in the 1880 census is 2,524, while in 1910 a total of 3,054 farms is reported.

Land values in Union County have steadily increased. In the 1880 census the total value of land, fences, and buildings is reported as \$2,073,390. In 1910 the value of land and improvements, excepting buildings, is given as \$3,016,915, and of buildings, \$868,290. In 1910 the value of implements and machinery in Union County is given as \$195,768.

The value of farm property is still increasing, but desirable land well located can be purchased at a reasonable price. The values depend on improvements, the distance to market, the type of soil, the general state of productiveness, and the topography. In the immediate vicinity of Union and in a few other locations near the railroads land sells for \$75 to \$100 an acre. In the more undesirable locations rough, steep, or badly gullied land can be bought for \$5 to \$7 an acre.

On the farms operated by the owners agriculture has improved during recent years. Many of these farmers are prosperous and are beginning to give more careful attention to modern methods of farming and to soil improvement. This class of farmers, however, is in the minority. The tenant farmers are far more numerous, and are chiefly concerned in obtaining the greatest possible return without any care for economic farm methods.

In improving the agriculture in Union County the first requisite is the renovation of the soils. The one-crop system under which cotton is grown successively year after year and indifference in the preparation and tillage of the soil are largely responsible for the run-down condition of most of the land in the county. In order to establish a satisfactory and permanent agriculture such methods must be changed. The impoverished condition of many of the soils does not indicate a lack of mineral plant food so much as an impaired

¹ This decrease may be only apparent, as in the classification of the census each tenancy is tabulated as a "farm." The average size of individual holdings may safely be taken as greater than the figures given.

physical condition and a deficiency of organic matter or humus. In cultivating the soil, especially the heavier types, such as the Cecil clay loam, the small one-horse turning plow and the old-fashioned "bull-tongue" plow are entirely inadequate. To break such land properly a 2-horse or 3-horse team and a heavy turn plow or disk plow are required. The thorough pulverizing of the soil can not be accomplished except with this heavier equipment. The intertillage of crops is best accomplished with the lighter, harrowlike or multiple-tooth cultivators, in order that the cultivation may be shallow and that the surface may be kept as nearly level as possible.

SOILS.

The soils of Union County are separated according to origin into two groups, the residual upland soils and the alluvial soils of the river and minor stream bottoms. The upland soils have been divided into 11 types, grouped in four series, and one miscellaneous type, and the alluvial lands into two types, representing one series and one miscellaneous type.

The residual upland soils are derived from the materials resulting from the breaking down and decay in place of the rocks underlying the region. These are igneous and metamorphic rocks, some of which are highly crystalline. Of these, granite and gneiss are the most common, though schists and diorite and some others are important. Veins of quartz are of frequent occurrence.

Variations in the rocks give rise to distinct peculiarities in the soils of the county. Belts of alternating fine-textured and coarse-textured rocks extend across the county in a northeast-southwest direction. Occupying most of the western and northwestern parts of the county are fine-grained gneiss or schistose rocks which upon decomposition give rise to the fine sandy loam to loam and clay loam soils. East of this development and extending practically across the county a granitic rock, coarse or porphyritic in places, occurs, giving rise to sandy loam and coarse sandy loam soils. Along the Broad River fine-grained granites give rise to fine-textured sandy soils.

Of the four series of upland residual soils, the Cecil is the most important. Other series are the Appling, the Iredell, and the Mecklenburg. Besides these series some rough eroded areas are mapped under the name Rough gullied land.

The better of the alluvial first-bottom lands are classified as Congaree soils, the remaining alluvial lands, because of their variable texture and their poor drainage—due largely to frequent and destructive overflows—have been classified as Meadow.

The individual soils are discussed in greater detail in following pages. The soil map accompanying this report shows the location and extent of the various areas of each type.

The following table gives the names and actual and relative extent of each of the several soils of the county:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Cecil sandy loam.....	116,864	35.7	Congaree silty clay loam.....	2,432	0.7
Cecil clay loam.....	70,912	21.6	Mecklenburg clay loam.....	2,304	.7
Cecil fine sandy loam.....	40,000	12.2	Rough gullied land.....	2,240	.7
Cecil coarse sandy loam.....	24,256	7.4	Congaree fine sandy loam.....	1,984	.6
Meadow.....	20,352	6.2	Iredell stony loam.....	1,856	.6
Appling coarse sandy loam.....	17,024	5.2	Cecil stony clay.....	704	.2
Cecil loam.....	9,664	3.0			
Iredell clay loam.....	8,960	2.7	Total.....	327,680
Iredell fine sandy loam.....	8,128	2.5			

GRAY SOILS.

RESIDUAL MATERIAL—CRYSTALLINE ROCKS.

CECIL SERIES.

The Cecil series includes the most important and widely distributed soils of the Piedmont Plateau. The surface soils are gray, brown, or red. The subsoils consist of red clay. Quartz sand and mica flakes are usually present in the subsoil. Rock outcrops are rare, but fragments and bowlders of the parent rock are found in places on the surface. The topography is rolling to hilly, with level to undulating areas in situations where stream erosion has not been particularly active. These soils are of residual origin and are derived principally from granite and gneiss, which have weathered to great depths. The drainage as a rule is excellent.

In Union County six types of this series occur. They range in texture from coarse sandy loam to clay. The coarser types are derived from porphyritic and coarse-grained granites and the finer from fine-grained gneiss and schists.

CECIL SANDY LOAM.

The surface soil of the Cecil sandy loam, extending to a depth of about 5 to 7 inches is predominantly gray, ranging to grayish brown or light brown. This is underlain by a bright-red, compact, somewhat brittle clay which, although somewhat sandy in the upper part, is fairly uniform throughout. This subsoil material usually extends to a depth of 3 feet or more, although it is in places underlain within the 3-foot section by a grayish, mealy material which soon passes into partially decomposed, soft, granitic rock. In places a flaky micaceous material is present in sufficient quantity to give

the subsoil a slightly greasy feel. In road cuts and gullies veins of white quartz rock are often exposed. Small, angular fragments of such rock are frequently scattered over the surface and disseminated throughout the soil mass. With this exception the soil is usually stone free, though occasionally gray granitic rock fragments are encountered. Rock exposures are not common, but a few are found in the northern part of the county, mainly along the Lockhart Branch of the Southern Railway. The location and approximate extent of these are indicated by symbols on the soil map.

Throughout the type there are small spots of clay loam and sandy loam or sandy clay loam underlain at 1 or 2 inches by red clay. Such variations are known locally, in association with the typical soil, as "mixed land." They are usually too small to be shown separately on the map. These patches are found more frequently on slopes where surface washing has carried away a former deposit of sandy surface soil. In many cases, owing to the shallowness of sandy surface soil, it is difficult to determine whether the soil should be mapped as a sandy loam or clay loam. The shallow development of the sandy loam usually has a reddish color owing to the presence of red clay, and is readily distinguishable from the typical grayish or brownish sandy loam.

The Cecil sandy loam is more extensive than any other single soil type in the county. It predominates throughout the central, eastern, and northeastern parts of the county and is widely developed in the southwestern section between the Tiger and Enoree Rivers. Smaller areas occur in other parts of the county.

The type occupies broad, gently undulating to rolling ridges, where the more typical areas are found. It is also encountered on the slopes bordering streams, where it is generally cut by numerous minor stream courses. It is not considered typically developed in such positions because of the presence of many small, eroded spots and of various miscellaneous materials, such as coarse sand and gravel or small rock fragments. The largest and most typical area occurs in the northern part of the county, comprising Pea Ridge. On practically all of the other ridges mapped as this type the areas are typical, although less extensive. Bordering nearly all the larger stream courses, as well as many of the smaller ones, the areas of this soil are rough and broken, being intersected by many ravines or gullies, and in many cases by small bodies of Rough gullied land. This development represents a rough phase of the type, much of which can not be profitably utilized for tilled crops.

Excellent drainage prevails over practically the whole soil type. In rare instances underground seepage from hillsides leaves poorly drained spots. In some of the slight depressions at the heads of streams or drainage courses, and along the lower slopes bordering

some of the streams, small strips of soil, resembling the Appling, occur where the subsoil is not well drained. In such places the surface soil is light gray and the subsoil lighter gray, with reddish mottlings, indicating incomplete oxidation. However, these places are of limited extent and ordinarily are not too wet for profitable cropping.

This type is subject to erosion wherever the slope is great enough to permit drainage waters to flow off rapidly. The numerous shallow places or "galled spots" and the areas of Cecil clay loam occurring within these sandy loam areas are the result of this washing away of the sandy surface material.

The original forest growth consists largely of white, red, and other oaks, hickory, dogwood, some shortleaf pine, and a number of other miscellaneous trees. Most of this original growth has been removed, leaving pine as the predominant species. In a few localities the original hardwood timber remains.

Most of the type has been or is under cultivation. An occasional field, once cleared, has been abandoned and now supports a growth of pine. Evidences of former cropping on some of this reforested land are observed in the rows left after the last crop was made.

Cotton is the crop most extensively grown and forms the chief source of farm revenue. Corn is grown to a much less extent and mainly for home needs. Oats constitute the leading small-grain crop, but are grown in only a limited way. Wheat was formerly produced more extensively than at present. Other crops, such as sorghum, sweet and Irish potatoes, other vegetables, and a few small fruits are grown in a small way for home use.

Yields are quite variable, depending on the state of soil fertility and care in handling the land. Cotton where properly cultivated and fertilized often yields 1 bale per acre, although under present methods from one-third to one-half bale is the average yield. Corn yields in exceptional cases as high as 60 to 70 bushels per acre, but 40 bushels is about as much as can be reasonably hoped for. With indifference in cultivation corn yields vary from almost nothing up to 10 to 15 bushels. Oat yields are low, usually averaging about 15 bushels, although a few of the better farmers often get yields of 40 to 50 bushels.

Cherries, peaches, pears, grapes, raspberries, and strawberries can be produced successfully for home use. The sandier areas of the type give good yields of sweet and Irish potatoes and other vegetables and melons.

The system of single cropping now generally in practice has caused a decline in the productiveness of a large part of the type, and shallow plowing, coupled with clean cultivation, has permitted wasteful erosion. The type will be benefited by deeper plowing and the addi-

tion of organic matter. The present practice is to depend too largely upon commercial fertilizers.

This type ranges in value from \$20 to \$35 an acre. Land in the best locations is sometimes held at \$75 to \$100 an acre.

CECIL FINE SANDY LOAM.

The surface soil of the Cecil fine sandy loam is gray, ranging to light brown. It is underlain at about 8 inches by a red clay similar to the subsoil of the Cecil sandy loam. The type includes a few stony areas. The subsoil of that part of the type mapped along the Broad River above Neal Shoals has a paler red color and contains more granular material than the typical soil, representing an approach toward the Appling series. In the northwestern section the line of separation between this type and the Cecil clay loam and loam types is not very distinct, and as shown on the soil map is frequently somewhat arbitrary.

This soil type has its largest development in the southwestern part of the county in the vicinity of Crosskeys and farther north in the vicinity of West Springs. Smaller areas occur in the northwestern part of the county and in a disconnected strip along the Broad River.

The surface varies from gently rolling to slightly hilly. Where the streams are more numerous the surface is predominantly more broken. Drainage is practically everywhere well developed. The type is subject to erosion, although on the steeper cultivated slopes more or less effective systems of terraces are usually maintained. In a few scattered patches the surface material is washed away, and the soil has more nearly the characteristics of the Cecil loam.

White and red oak, pine, some cedar, dogwood, and sassafras comprise the principal forest growth.

This soil is one of the best upland soils of the county for general farming. Wherever care is exercised crops give good returns. On the better phases, with proper attention to cultivation and fertilization, cotton yields as high as a bale per acre, though the average yield is below one-half bale. Corn yields are not high, 15 to 20 bushels per acre being about the average. On that part of the type north of Neal Shoals the farmers ordinarily produce from 7 to 10 bushels of corn per acre. Oats yield from 15 to 40 bushels, averaging about 25 bushels. Occasionally a little sorghum is grown, and to a limited extent crimson clover. Other crops, such as sweet and Irish potatoes and small fruits, are grown for home consumption.

The soil may be improved without difficulty. It is easily tilled and responds readily to fertilization. By increasing the content of humus through applications of barnyard manure and the growing of

green-manuring crops this soil can be made to rank with the most valuable in the county. Land values vary from \$15 to \$35 an acre.

CECIL COARSE SANDY LOAM.

The surface soil of the Cecil coarse sandy loam extends to a depth of about 6 to 8 inches. It has a gray color, ranging to light grayish brown. Large quantities of fine sand, silt, and clay enter into its composition, but the coarse sand present is sufficient to give a looser structure than that of the Cecil sandy loam. The subsoil consists of a red, brittle clay, usually containing some coarse quartz sand and small quartz fragments. Where this type approaches areas of the Appling coarse sandy loam the color of the subsoil is lighter, being pale red or pinkish.

In some localities, particularly on the slopes, the soil is somewhat stony, being strewn with fragments of granitic rock. As a rule these fragments are not present in sufficient quantities to interfere seriously with cultivation. In a few places the larger rocks have been removed. In these stony areas grayish partially decayed rock is usually reached within a depth of 3 feet.

The largest body of Cecil coarse sandy loam forms a belt extending from the vicinity of Santuck in a southwest direction practically to the Enoree River. Other large areas are developed just west of this belt, and a few small areas are mapped in other parts of the county.

The surface varies from nearly level or rolling on the ridges to hilly and broken near the larger streams. Drainage is well established. The surface is washed and gullied in places, largely because of careless tillage. Wherever the drainage waters wear down to the soft, granular, partially decomposed rock of the lower subsoil, the resultant gullies soon become difficult or impossible to control.

Considerably more than half of the type is under cultivation. Some fields, once utilized, have been abandoned, and some tracts, mainly the rougher phases, are forested, the timber consisting largely of shortleaf pine, with some oak and other hardwoods. Hardwoods constitute the predominant original growth.

Where cultivated this land is used for about the same purposes as the Cecil sandy loam, with cotton and corn as the principal crops. Cotton gives an average yield of about one-third bale and corn from 5 to 15 bushels per acre. Oats yield from 15 to 25 bushels. Better yields are secured by farmers who give more attention to the preparation of the land and subsequent care of crops. In seasons of drought crops are likely to suffer, but when the rainfall is normal about as good results are obtained on this type as on the Cecil sandy loam. As is the case with most of the soils of the county, this soil is in need of humus. With the application of barnyard manure

and the production of more green manuring crops, such as cowpeas, bur clover, vetch, oats, rye, and similar crops, to be plowed under to supply needed organic matter, and forage crops, this deficiency could be largely met. The rougher cleared areas are best used for permanent pastures, using Bermuda grass, the common broom sedge, and lespedeza.

The fertilizers suitable for the Cecil sandy loam are equally beneficial to this soil in similar applications. Little potash is probably needed, and where summer and winter legumes are grown frequently in rotation with other crops but little nitrogen is required. Barnyard manure is highly beneficial in growing all crops, and the soil may be improved by applying phosphatic fertilizers.

APPLING SERIES.

The Appling soils are prevailingly grayish, ranging to pale yellow. The subsoils are mottled or streaked red and yellow, and occasionally grayish or drab. This series is developed in the Piedmont Plateau. The soils are residual from schist, hornblende schist, gneiss, and granite. The topography is about the same as that of the Cecil series, but possibly somewhat less rolling. These soils are not well drained.

One type of this series is found in Union County. It has a coarse sandy texture and is derived from a coarse-grained siliceous granite.

APPLING COARSE SANDY LOAM.

The surface soil of the Appling coarse sandy loam is about 12 to 16 inches in depth, and contains a large quantity of material finer than coarse sand. The coarse sand, however, is present in sufficient quantities to give an unmistakably gritty feel and to render the soil loose. The soil is quite incoherent, owing to a deficiency in organic matter. The upper part of the subsoil consists of a yellowish sandy clay. At about 24 inches the material becomes more dense and is mottled or streaked with bright red and gray or white. Occasionally more or less decomposed rock is encountered within the 3-foot section.

Most of this soil occurs in one body, with a few outlying areas to the north, west, and southwest of Santuck. Other small bodies are encountered in various parts of the county.

The surface varies from nearly level to gently rolling over most of the type, particularly in the vicinity of Santuck. That part extending westward a mile or two from Neals Creek is dissected by stream valleys. For the most part these valleys have rounded, sloping sides and are not very badly gullied, but the topography is comparatively rough. Some of the land bordering Tinker Creek is somewhat hilly and broken, and dissected by minor stream valleys. In places the soil material is more or less eroded. This is due largely

to its lack of coherency. The drainage is fair, though in some of the flatter areas the dense subsoil retains an excess of water, which is detrimental to crop production. Tile drainage is beneficial in many cases.

Cotton yields as high as one-half to three-fourths bale per acre, but the average is less than one-half bale. Corn does not do well and yields vary from about 5 to 15 bushels. Texturally this soil is much better suited to truck and other special crops than to general farming. It is well suited to early vegetables, such as sweet and Irish potatoes, melons, and tomatoes, peas, and other vegetables for canning. It is a good peach and bright tobacco soil, and is adapted to strawberries, raspberries, grapes, and similar fruits. These products are not grown, except in a small way for home consumption, but the yields justify the statements made. The commercial production of any of these crops of course will depend upon other factors besides those inherent in the soil.

The type is mainly in need of humus, which under local conditions can be most economically applied by growing and plowing under green manuring crops.

Owing to the low yields of the crops commonly grown on this soil type, the land is not considered very desirable and values are low, varying from \$10 to \$25 an acre.

The results of mechanical analyses of samples of the soil and subsoil of the Appling coarse sandy loam are given in the following table:

Mechanical analyses of Appling coarse sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
242221.....	Soil.....	8.0	18.1	11.4	23.5	15.9	17.2	5.8
242222.....	Subsoil.....	11.0	15.6	8.2	14.4	8.4	13.1	29.2

BROWN SOILS.

RESIDUAL MATERIAL—CRYSTALLINE ROCKS.

CECIL SERIES.¹

CECIL LOAM.

The surface soil of the Cecil loam is brown, ranging to grayish brown, and consists of a loam or silty loam to heavy fine sandy loam 6 to 8 or 10 inches in depth. The subsoil consists of a red, moderately friable to brittle clay, often appreciably gritty. Mica flakes are

¹ For series description, see p. 17.

rarely present in noticeable quantities. The soil is compact when dry and has a tendency to bake and form clods where it does not contain sufficient organic matter. In a few localities the surface is slightly stony, although as a rule the stones are not present in sufficiently large quantities to interfere with cultivation.

A phase of this soil, varying in some particulars from the typical, is developed in most of those areas mapped on the slopes along the Pacolet River. Here the soil consists generally of a dark-brown, rather silty loam, 6 to 7 inches deep. Intermingled with this fine earth are large quantities of angular feldspathic rock fragments or gravel, varying from about one-eighth to one-half inch in diameter, which give the soil a loose, loamy structure. The subsoil consists of red clay, similar to that of the typical Cecil loam.

Most of this soil occurs in the northwestern corner of the county, northwest of Jonesville. A few small, scattered areas are found along the Pacolet River and along the Broad River.

The surface varies from undulating to rolling or somewhat hilly. Most of the type has good surface drainage. Some destructive erosion is in progress. This is best checked by systematic terracing, which is commonly practiced, and by improved methods of soil management.

The characteristic forest growth consists of white oak, post oak, sweet gum, hickory, dogwood, and pine.

Almost all of this soil is under cultivation. Cotton and, to a less extent, corn are the important crops. Some oats, sorghum, and occasionally a little wheat are grown. Crop yields are comparable with those given on the Cecil clay loam. Owing to its looser structure, this soil is more easily tilled than the Cecil clay loam. It is considered a strong soil and is easily improved. While commercial fertilizers are used with each crop, little or no attempt is made to maintain the supply of humus.

MECKLENBURG SERIES.

The surface soils of the Mecklenburg series are predominantly brown, ranging from reddish brown to red. The subsoils consist of yellowish-brown stiff clay and usually grade into disintegrated rock within the 3-foot section. These soils occur in the Piedmont Plateau. They are residual in origin, and derived from diorite, metagabbro, and similar rocks. In places the soil appears to be Iredell material in an advanced stage of weathering. The topography is gently rolling, and the surface drainage is good. The clay loam of the series is the only type mapped in Union County.

MECKLENBURG CLAY LOAM.

The surface soil of the Mecklenburg clay loam is reddish brown. It is about 4 to 6 inches in depth, and ranges to a sandy clay loam. The material is fairly friable, but has a tendency to clod more or less if broken when too moist or too dry. The subsoil consists of a dull-red or pale-red to yellowish-brown, dense, sticky clay. Below about 24 inches the subsoil is lighter in color, showing greenish shades, and consists of a yellowish, tough, sticky, waxy clay loam, resembling the subsoil clay of the Iredell clay loam. In places the lower part of the 3-foot section contains the greenish, mealy, partially decomposed rock commonly found underlying the Iredell soils. Where erosion has worn away the original soil mantle this partially decomposed rock may be exposed, and sometimes along the slopes of minor stream courses strips of the dull-yellowish, waxy clay, which is characteristic of the soils of the Iredell series, are encountered. Only in a few places are the stones present in sufficient quantities to interfere with tillage operations.

This soil type is of small extent and is comparatively unimportant in Union County. It usually occurs in small, disconnected areas adjoining bodies of Iredell clay loam. It occupies rolling ridges, small knolls, and slopes, mainly along the Broad River north of Browns Creek and in the southeastern part of the county, south of Carlisle. A few small areas are distributed throughout the southwestern part of the county.

Cotton and corn are grown on most of this type. A few patches support a forest growth consisting mainly of oak, hickory, and sweet gum. Crop yields are about the same as those produced on the Cecil clay loam. Owing to its slightly stiffer structure it is somewhat more difficult to handle, and where a good mellow seed bed is not prepared crops do not succeed. Texturally the type is suitable for small-grain and forage-crop production and it makes a good pasture land where seeded to Bermuda grass.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Mecklenburg clay loam:

Mechanical analyses of Mecklenburg clay loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
242219.....	Soil.....	5.2	11.4	8.0	22.2	12.6	7.7	33.0
242220.....	Subsoil.....	3.4	8.0	4.6	14.7	9.1	20.9	39.0

IREDELL SERIES.

The soils of the Iredell series are prevailingly brown, ranging from light brown to almost black. The subsoil consists of extremely plastic, sticky, or waxy clay of yellowish-brown to greenish-yellow color. Disintegrated rock is frequently encountered within the 3-foot section. Small iron concretions are sometimes found in the soil. This series is encountered in the Piedmont Plateau. In Union County three types, the fine sandy loam, clay loam, and stony loam occur. The soils are residual, the parent rock consisting mainly of diorite, diabase, hornblende schist or hornblende gneiss, and chloritic rocks. In Union County the first two rocks are the chief sources of material. The topography of the series varies from nearly flat to gently rolling, and drainage is generally good.

IREDELL FINE SANDY LOAM.

The surface soil of the Iredell fine sandy loam is dull brown or dark brown. The subsoil is encountered at about 8 to 10 inches, the line of demarcation between the soil and subsoil being quite distinct. Below 24 to 30 inches the material is generally a dull-greenish, more or less decomposed, mealy rock. The area mapped north of Jonesville, lying largely between Mill Creek and the Pacolet River, may be regarded as a phase. The surface soil in this area has about the same color as the typical soil, but it is somewhat finer in texture. The subsoil, while heavy, dense, and plastic, has a lighter color, with some ashy-gray mottlings, and in places streaks of brown or reddish brown. The agricultural value of this phase is about equal to that of the typical areas.

The Iredell fine sandy loam is confined almost entirely to the western part of the county, with a few small areas in the southern part. It occurs mainly in small, isolated bodies less than a square mile in extent. The two largest areas are between West Springs and Fair Forest Creek and between Mill Creek and the Pacolet River.

The surface varies from rolling to undulating. Some areas are somewhat hilly and others are more or less dissected by ravines and gullies. In general the drainage is good, though in some small depressions or sags it is deficient.

The Iredell fine sandy loam is residual from intrusive basic rocks, of a more siliceous nature than those rocks giving rise to the related clay loam type.

The forest growth consists mainly of red, white, and blackjack oaks and shortleaf pine. As in the case of the Iredell clay loam, this soil is frequently referred to as "blackjack" land.

With the exception of a few rough locations, most of the type either has been or is being cultivated. The crops common to the

region are grown and do fairly well. Some trouble is caused by the "rusting" of cotton, and but low to moderate yields are obtained. From one-third to one-half bale per acre is about the average yield. The soil seems well adapted to corn, but 12 to 15 bushels per acre is the average yield. The type does not seem well suited to oats, and yields are generally low. The soil is in need of organic matter.

IREDELL CLAY LOAM.

The surface soil of the Iredell clay loam is dark brown. It has a depth of 3 to 5 inches. It is fairly mellow and friable, and when worked under conditions of moderate moisture content is not likely to form clods or lumps which can not readily be broken. Scattering quartziferous stones are common, often being present in sufficient quantities to interfere with cultivation. Occasionally small iron concretions are encountered in the soil mass. The line of separation between the surface soil and the subsoil is quite distinct. The subsoil consists of a dull-yellow or brownish-yellow, heavy, plastic, tenacious clay. Usually at from 24 to 30 inches the material changes to a greenish, rather mealy, partially decomposed rock. This is underlain by the solid rock, which is sometimes encountered within the 3-foot section. Because of its stiff, waxy nature the subsoil is often spoken of as "pipe clay".

Some of this type as mapped is more nearly a loam or fine sandy clay loam. In these cases the surface material has a noticeably sandy character. Much of the area mapped between Sugar Creek and the Tiger River, in the western part of the county, has these characteristics. A large part of this variation is also rather stony. Patches of this type, too small to map separately, are included in the soils of the Cecil series, usually being located at the forks of streams and sometimes along the slopes of ravines. Some of these spots are quite typical, while others are merely exposures of the greenish, partially decomposed rock ordinarily found in the lower subsoil of typical areas. These patches have a rough surface.

The Iredell clay loam is the closest structured and most intractable soil in the county. While the Cecil clay loam and, to a less extent, the Mecklenburg clay loam are heavy-textured soils, they possess a considerable degree of friability, and less difficulty is experienced in handling them than the Iredell clay loam.

The Iredell clay loam is found in nearly all parts of the county. The area in the western part, that along the Broad River southwest of Lockhart, and that northeast of Carlisle are the most important developments. The area northeast of Carlisle is more nearly a true clay loam, and is the most typical development of the type in the county.

In general, the surface varies from nearly level to rolling. Some areas, particularly that southwest of Lockhart, are quite rough and broken. Much of the area in the western part of the county is low and flat, and is known locally as "meadow woods land." Drainage is usually well established, though in some of the flatter areas the soil is rather soggy.

The characteristic forest growth consists of blackjack oak, some red and water oak, and hickory. Pine and cedar are quite common. Because of the characteristic growth of blackjack oak this land is commonly designated "blackjack land."

A large part of this type is in cultivation. The rougher and more broken areas are either forested or used for pastures. Opinions differ as to the desirability of this soil as farm land, but it is generally considered a strong soil which, where properly handled, is productive of good crops. About all the general farm crops common to the region are grown. Corn does well under favorable moisture conditions, but cotton, because of "rusting," does not produce as good yields as on the various Cecil soils. Corn is inclined to "french" during unfavorable seasons. Cotton generally yields about one-half bale per acre. On some of the better phases of the soil some of the best farmers produce from 20 to 40 bushels of corn per acre, with an average of about 25 bushels. The average for the type, however, is probably less than 25 bushels per acre. Commercial fertilizers are used extensively, being applied at the time of planting. Sometimes additional applications are made during subsequent cultivation. To offset the tendency of cotton to "rust" and of corn to "french," applications of potash in the form of kainit are made, generally at the time of preparing the seed bed. Some of this soil is used for pasture land, to which purpose it is well adapted, as a number of varieties of grass thrive on it. Clovers, cowpeas, and other legumes are grown with little effort.

The best phases of the Iredell clay loam are valued as high as \$35 to \$40 an acre, and owners are reluctant to sell at that price. The rougher and less accessible locations are valued at not more than \$8 or \$10 an acre.

IREDELL STONY LOAM.

The surface soil of the Iredell stony loam is a dark or dull-brown loam to clay loam, which is somewhat sandy in places. The subsoil, which is typical of the series, is encountered at 6 to 8 inches. It is underlain, frequently at about 24 inches, with partially decomposed rock similar to that usually underlying the Iredell clay loam and fine sandy loam. Large quantities of rough rock fragments of igneous origin and resembling diorite are scattered over the surface and throughout the soil section.

The type is most extensively developed southeast of Colerain. Small areas occur in the vicinity of Lockhart.

The area southeast of Colerain has a fairly smooth surface, varying from undulating to rolling. The remaining areas are rougher and in places are steep and broken.

The forest growth consists mainly of blackjack oak and water oak, with some hickory and pine.

Owing to the stony and otherwise rough nature of this soil, very little of it is under cultivation. Occasionally a small tract is cultivated to cotton or corn. Some fields, once cleared of timber and stones, have been abandoned and are again forested. The best agricultural use of this land is for pasture.

WATER-LAID MATERIAL (RECENT ALLUVIUM)—MIXED DERIVATION.

CONGAREE SERIES.

The soils and subsoils of the Congaree series are predominantly brown, ranging to reddish brown. There is little change in texture, structure, and color throughout the 3-foot section. In places grayish and yellowish mottlings are encountered in the subsoil of poorly drained areas. These soils are developed in the overflowed first bottoms of the streams of the Piedmont region and in the Coastal Plain along streams issuing from the Piedmont region. They are alluvial in origin, and derived from material washed mainly from Piedmont soils, with some Appalachian material and, in the Coastal Plain, a slight admixture of Coastal Plain material. The soils are poorly drained and sometimes subject to overflow. The topography is nearly level to slightly undulating.

CONGAREE FINE SANDY LOAM.

The surface soil of the Congaree fine sandy loam ranges to a very fine sandy loam, and extends to a depth of about 10 to 12 inches. The subsoil is somewhat heavier than the surface soil, in places approaching a loam or silty clay loam. It sometimes includes strata of a brown or grayish silt loam or silty clay loam 2 or 3 inches in thickness. Large quantities of mica flakes are disseminated throughout the soil section. Occasionally some rounded and water-worn gravel and stones occur, but as a rule the soil is free of these coarser materials.

This type occurs mainly in disconnected strips not over one-fourth mile wide along the Broad and Pacolet Rivers. A few small areas are mapped along the Enoree and Tiger Rivers. It usually borders the streams, and a strip of the Congaree silty clay loam generally lies between this soil and the slopes of the uplands.

The surface is nearly level or slightly undulating. The type occupies the first bottoms of streams. Immediately bordering the stream the elevation is usually higher than farther back, the strips forming natural levees. The drainage between overflows is good. A sandier phase in places is so loose as to be droughty.

As all of the type is subject to overflow, some material, consisting mainly of sand, is still being deposited periodically. Along the Broad River above Neal Shoals, owing to the impounding of the waters for power development at this place, this overwash sand has been deposited to such an extent that desirable lands have become valueless for agriculture.

The characteristic forest growth consists of sycamore, elm, ash, and willow. Wild onions and sorrel are common.

Owing to overflow, crops are more or less uncertain. For this reason cotton is not grown to any great extent. Cotton has yielded as high as 1 bale per acre on this type. Corn is the principal crop. It does well ordinarily, yielding 40 to 50 bushels per acre on the better areas, and under exceptionally favorable conditions as much as 80 to 90 bushels per acre.

The better areas of this soil, which are of comparatively small extent, are valued at \$75 to \$100 an acre. Areas receiving any considerable deposit of overwash sand are held at a very low figure.

CONGAREE SILTY CLAY LOAM.

The surface soil of the Congaree silty clay loam is about 6 to 7 inches in depth. It grades into the subsoil, which is grayish brown in color, and somewhat heavier and more compact than the soil. Below 24 inches the material is usually mottled with rusty brown. Frequently strata of fine sandy materials are encountered at various depths. Large quantities of mica particles are distributed throughout the soil and subsoil. The soil, because of its low-lying position and poor drainage, works up lumpy and cloddy, and is particularly subject to baking and cracking upon drying.

This soil is confined to first bottoms, mainly along the Broad and Pacolet Rivers, with small areas along the Tiger and Enoree Rivers. It generally occurs as narrow strips intermediate between bodies of Congaree fine sandy loam bordering the streams and the slopes of the upland.

The soil has been formed by the deposition of fine material in rather slack water, the coarser particles of sand having been deposited mainly near the stream banks where the current was swifter. The position of the fine-textured soil back from the stream and next the uplands is accounted for by this assorting power of running water.

But little of this type is regularly cultivated. Many fields once cultivated are now used for pastures. Corn does fairly well on some of the better drained fields. Where protected from destructive overflows the type may be improved by ditching and tiling.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Congaree silty clay loam:

Mechanical analyses of Congaree silty clay loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
242203.....	Soil.....	0.0	0.2	0.2	3.4	11.7	61.1	23.1
242204.....	Subsoil.....	7.6	4.8	2.2	4.8	30.8	43.8	5.7

RED SOILS.

RESIDUAL MATERIAL—CRYSTALLINE ROCKS.

CECIL SERIES.¹

CECIL CLAY LOAM.

The surface soil of the Cecil clay loam is typically red, ranging to reddish brown. It varies in texture to a sandy clay loam, and is about 3 to 6 inches in depth. The subsoil is typical of the series and ordinarily extends to a depth of 3 feet or more, and often to 6 or 8 feet, without any important change. Here and there in the lower part of the 3-foot section the subsoil is lighter in color and texture, indicating the proximity of the partially decomposed underlying rock. The type is fairly friable, though the surface material works up somewhat lumpy if care is not taken to plow under proper moisture conditions. In most cases the organic content is low. Just as in the case of the Cecil sandy loam, veins of white quartz are of common occurrence. Being more resistant to decomposing agencies than the larger masses of the parent granitic rock, these remain in an unweathered state. Angular fragments from these veins are disseminated through the soil and subsoil and are scattered over the surface in places. Large rock fragments are not common.

Some areas of this soil, particularly those closely associated with the sandy types of the series, consist of a sandy clay or sandy clay loam. They once had a mantle of sandy material like the surface soil of the Cecil sandy loam, but this has been partially washed off. Such areas represent a phase of the type, and are known locally as "mixed" or "mulatto" land. They have been in course of formation for many years, and with present methods of farming they are extending.

¹ For series description, see p. 17.

Another variation of very small extent is developed in strips along lower slopes bordering the Pacolet and Broad Rivers, occupying a bench or terracelike position. The material has a deep dark red color and a mellow surface structure. The subsoil is usually somewhat darker than that of the higher upland areas. This soil is highly esteemed for farming. Examples of this kind of land may be seen immediately south of Lockhart and in the bend of the river a little over a mile above this town. Another small tract is located at Neal Shoals.

Locally the Cecil clay loam is known as "red land." It is associated largely with the Cecil sandy loam or other sandy members of this series. Owing to its heavy texture, it is more difficult to handle than the sandy types. It is a strong soil, though not quite so desirable as the sandy members of the Cecil series.

The Cecil clay loam is well developed throughout the southern Piedmont Plateau. In Union County, areas of this soil are distributed throughout the county. The largest single body occurs in the southeastern part south of Carlisle.

This type occupies rather rough, sloping to hilly country. Much of it is found along the lower slopes bordering stream courses, where it is more or less dissected by ravines and gullies.

The presence of small areas of the Iredell clay loam and to a certain extent the Iredell fine sandy loam in connection with an intricate stream system, as shown on the soil map, indicates the rough and broken areas. Such areas generally comprise inferior farm land. The type is also encountered on some of the gently rolling ridges, where the soil is most typically developed. Such areas occur about 4 miles west and 3 miles north of Jonesville, and 3 to 4 miles east of Sedalia. The nearly continuous area of this type, 35 to 40 square miles in extent, in the southeastern part of the county, is generally hilly and broken, and badly dissected by stream valleys and gullies. It is said that this part of the county was once in a fairly prosperous condition, but through neglect and poor management the soil has washed badly, and the outlook has become so discouraging that much of the land has been abandoned.

The Cecil clay loam is formed largely by erosion, which has more or less completely removed the original sandy surface. It is an erosion type, formed from areas which formerly consisted of the more sandy types of Cecil series.

Various species of oak and hickory made up the original forest growth, but where this has been removed shortleaf pine has grown up after the land has been abandoned. Most of the forest growth now consists of pine. Sweet gum and dogwood are common.

Practically all of the Cecil clay loam has been or is being cultivated. Probably over one-half or two-thirds of the total area mapped is now

used regularly for general farming. Cotton, corn, and oats are about the only crops grown. Cotton ordinarily does not yield much over one-half bale, but some of the more careful farmers on the better phases of the type in favorable seasons obtain an average of 1 bale per acre. Corn yields are not high, 10 to 15 bushels being the average. Oats do not produce more bushels per acre as a rule than corn. Wheat and sorghum are not grown to any great extent. With improvement of the tilth of the soil and proper fertilization, together with the growing of leguminous crops, there would be apparently no reason why these yields could not be greatly increased.

The "bull-tongue" and small one-horse turning plow are wholly inadequate to the proper preparation of this soil for planting. By the use of these light implements the surface soil is broken to a depth of only 2 or 3 inches, and the seed bed is not thoroughly prepared. As a result, on many slopes the rains periodically wash away much of this loosened surface soil. On the slopes, terracing, which is now practiced to some extent, is necessary to prevent washing even with deep plowing.

The steeper, hilly, and rougher phases of this type are best used for forestry or as pasture land. This soil is well adapted texturally to certain grasses, among them Bermuda grass.

The value of this land varies widely. In the more desirable locations it sells for as much as \$35 to \$40 an acre, though the larger part of the type has a value of not more than \$10 to \$15 an acre.

CECIL STONY CLAY.

The Cecil stony clay is a red to reddish-brown clay to clay loam or sandy clay loam, underlain at about 6 to 8 inches by a stiff, red clay subsoil, typical of the Cecil series. The surface is thickly strewn with stones from about 2 to 6 inches or more in diameter, and the subsoil also contains a high percentage of similar rock fragments.

The largest area of this type occupies the rounded hill immediately northwest of Lockhart, extending in a strip about a mile southward. This area is regarded as typical. Other areas of similar character but of limited extent are mapped. The soil of many of these areas does not have so heavy a texture as that of the larger area northwest of Lockhart, being more loamy or sandy.

Very little of this type is cultivated. The larger part is forested or is used for pasture. Some small patches have been cleared of the larger stones and crops are grown. Its best use is for forestry and pasturage.

MISCELLANEOUS MATERIAL.

ROUGH GULLIED LAND.

Those areas in Union County which are so rough and gullied that they are of practically no value for agriculture are mapped as Rough gullied land. A part of this land was at one time fairly smooth and arable, but since the country has been settled destructive erosion has brought about the unfavorable condition. Erosion became active with careless methods in the continuous cropping of hillsides, which should have been either devoted to forestry or set aside for pastures. Most of the areas mapped are of small extent, few exceeding 20 acres. Where erosion is permitted to continue the area of this land is becoming more extensive.

The Rough gullied land is generally found bordering the minor stream courses and near the juncture of small drainage ways.

The gullies, when once started, are difficult to control. The method usually employed is to check the flow of water with brush, and this practice is more or less effective. Bermuda grass and old-field pine may be used to bring a part of this land into condition for utilization as pasture or forest land.

MEADOW.

Meadow includes all of the alluvial lands of the county except those mapped as the Congaree fine sandy loam and Congaree silty clay loam. It differs from the Congaree soils principally in being less well drained and in having less uniformity in texture and color.

Meadow occurs mainly along the smaller streams of the county. A few of these bottoms, particularly at the juncture of streams, are from one-fourth to one-half mile wide, but they generally form narrow strips along the minor streams.

Probably at one time the material of these bottom lands was fairly uniform, consisting of a dark-brownish loam to sandy loam, but since the uplands have been cleared erosion has been active, and this eroded material, consisting largely of sand, has been distributed over these bottoms. This deposition has resulted in wide textural variations, the material, ranging from sand to loam and silty clay loam, being so intermingled that as a rule it can not be separated. Such conditions prevail most frequently in the narrowest bottoms.

Owing to the damage caused by overflows and the accumulation of overwash materials, a large part of these bottom lands has been abandoned and allowed to grow up to willow, alder, birch, briers, and coarse grasses. Many small fields, however, are still cultivated, and where protected from the more destructive overflows are considered very productive land. Large yields of corn and of various forage crops are obtained. In some localities good yields of hay of fair quality are obtained. The principal use of this land is for pasturage.

Many Meadow areas may be materially improved. Some probably could be reclaimed for the production of cultivated crops, and others for pasture. By ditching, straightening and enlarging the stream channels, and in places by diking, much of the land may be brought under successful cultivation. Sand wash from adjoining slopes could be materially lessened by careful terracing of the slopes or by keeping them in permanent pasture grasses or timber. Also such overwash could be checked, in places at least, by constructing ditches along the foot of the slopes.

SUMMARY.

Union County is situated entirely within the Piedmont Plateau. It lies in the northwestern part of South Carolina, and has an area of 512 square miles, or 327,680 acres.

The county is drained to the southeast, all of the drainage eventually entering the Broad River, which forms its eastern boundary. Elevations range from about 300 to nearly 700 feet above sea level. In general the surface is moderately sloping, but in detail it has been so dissected by streams that much of it is hilly.

Settlement began before the Revolution. The settlers were largely Scotch-Irish and English, and their descendants constitute the greater part of the present white population. The population reported in the 1910 census is 29,911, over half of which is colored. Union is the county seat and principal trading center.

The Southern Railway, Seaboard Air Line Railway, and Union & Glenn Springs Railroad furnish transportation facilities for most of the county. In general, the roads are in fair condition.

Power is developed at two points in the Broad River. Six large cotton mills and one knitting mill are in operation in the county. These mills use more than twice as much cotton as is produced annually in the county.

The climate is mild and healthful. The summers are long, and the winters short, without severe weather. The annual precipitation averages about 48 inches, and is ordinarily well distributed through the year. The growing season covers a period of seven months.

Cotton is practically the only money crop grown. Corn, oats, wheat, and forage crops are produced in but a small way, not enough of these crops being grown to supply home needs. Average crop yields are low, owing to poor practice rather than poor soils. But little live stock is kept.

Commercial fertilizers are depended upon for crop production, and little attention is given to the increase or maintenance of the organic supply of the soils.

An increasing proportion of land is being worked by tenants, and this system does not improve agricultural conditions.

Including Meadow and Rough gullied land, the soils of the county are separated into 15 different types, 12 of which occupy the residual uplands and 3 the alluvial bottom lands.

The Cecil sandy loam is the most extensive soil type in the county. It is a good general farming soil, easy to cultivate and responsive to good treatment. It gives good yields of cotton, corn, oats, and forage crops. It is also well suited for use in dairying and stock raising.

The Cecil coarse sandy loam is inclined to be a little more droughty than the Cecil sandy loam, but gives good results with the same crops under careful management.

The Cecil fine sandy loam and Cecil loam are important soils, well suited to general farming. They respond readily to good treatment.

The Cecil clay loam is largely an erosion type. It is regarded as a strong soil, and with careful management good yields of cotton and the general farm crops are produced. It is deficient in humus, and slopes erode badly.

The Cecil stony clay and Iredell stony loam are strong soils, but their topography is rough and they are best suited for pasture and forest land.

The Applying coarse sandy loam is a light soil not well suited to general farm crops. It is better adapted to early truck and other special crops.

The Mecklenburg clay loam has a small total area. It is somewhat difficult to handle, but gives fair yields. It is suited to forage crops and grazing.

The Iredell fine sandy loam and clay loam are not extensively developed in Union County. They are somewhat difficult to work, and as a rule yields are low. They are, nevertheless, capable of improvement, and are valuable for the production of forage crops and grazing.

The Congaree fine sandy loam is of limited extent. It borders the larger streams and is subject to overflow. The better phases produce good crops of corn and oats.

The Congaree silty clay loam is also of small extent. It is rather poorly drained, but produces fair crops.

Rough gullied land comprises small areas which are too rough for any purpose except for forestry and to furnish scant pasturage.

Meadow includes all of the alluvial lands not mapped as the Congaree soils. It is generally less well drained than the Congaree types and is subject to destructive overflow. Some of the better areas produce large yields of corn and forage crops, but most of them are used for pasture.

[PUBLIC RESOLUTION—No. 9.]

JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided,* That in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets, bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved, March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils.]

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