

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS.

IN COOPERATION WITH THE NORTH CAROLINA DEPARTMENT OF AGRICULTURE
AND THE STATE AGRICULTURAL EXPERIMENT STATION.

SOIL SURVEY OF BUNCOMBE COUNTY,
NORTH CAROLINA.

BY

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[Advance Sheets—Field Operations of the Bureau of Soils, 1920.]



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[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, 1961, the Division of Soils was reorganized as the Bureau of Soils.]

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MAP.

Soil map, Buncombe County sheet, North Carolina.

SOIL SURVEY OF BUNCOMBE COUNTY, NORTH CAROLINA.

By S. O. PERKINS, in Charge, and R. E. DEVEREUX, of the U. S. Department of Agriculture, and S. F. DAVIDSON and W. A. DAVIS, of the North Carolina Department of Agriculture.

DESCRIPTION OF THE AREA.

Buncombe County is situated in the western part of North Carolina, and equidistant from South Carolina on the south and Tennessee on the north. The boundaries of the county for the most part follow the mountain ranges, giving it a very irregular shape. Its greatest length is about 35 miles east and west, its greatest width 25 miles north and south, and its area is 612 square miles, or 391,680 acres.

The region in which Buncombe County lies could be well divided into two physiographic divisions, intermountain plateau and mountain. The broad valley situated on both sides of the French Broad River comprises the intermountain plateau, which is almost surrounded by mountain ranges, the Blue Ridge and Black Mountains on the east and south and the Newfound Range and the foothills of the Great Smokies on the west and north. The intermountain plateau consists essentially of a rather deeply cut but not very sharply dissected plain somewhat more rugged than some of the Piedmont Plateau province. There is very little really level land on the plateau surface, the rolling topography being more or less continuous. There are narrow strips of nearly level bottom land, from a few feet to 600 feet in width, bordering most of the smaller streams, and in some places along the French Broad and Swannanoa Rivers and Hominy and Cane Creeks these bottoms broaden out to one-half mile in width. The hills range from 50 to 300 feet in height above the streams. These hills are rounded into singularly even and graceful curves. The drainage basins of the French Broad and Swannanoa Rivers and Cane, Hominy, Newfound, and Turkey Creeks form the greater part of the intermountain area, which comprises about 70 per cent of the entire area of the county. The adjacent mountain ranges form a rather abrupt margin to this intermountain area, though outlying knobs and higher hills and ridges in some places render this boundary less apparent. The average elevation of this intermountain plateau is about 2,300 feet above sea level.

The most rugged and mountainous parts of the county are the eastern, southeastern, southwestern, western, and northeastern. The Elk Mountains, commencing just northeast of Asheville, extend into the Great Craggy Mountains. There are numerous peaks in this

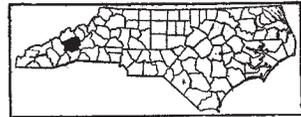


FIG. 23.—Sketch map showing location of the Buncombe County area, North Carolina.

great range, the most important of which are Potato Knob, with an elevation of 6,419 feet; Blackstock Knob, 6,386 feet; Craggy Dome, 6,105 feet; and Yeates Knob, 5,925 feet. Big Pisgah Mountain is the highest peak on the western boundary, with an elevation of 5,713 feet. These mountains are very steep and rough.

The United States Congress has recently created a national park and game preserve, known as the Pisgah National Forest, most of which lies in North Carolina. The largest area of this forest in Buncombe County is in the Pisgah Ridge, in the southwestern part of the county; another area occurs in the Black Mountains and the Great Craggy Mountains. The total area included in Buncombe County is 26,769 acres. The United States Government has option on several thousand acres more.

The French Broad River, the largest stream and the main drainage way, divides the county into two parts, the eastern part being slightly the larger. The river has a general south to north course from the Henderson County line to about 2 miles north of Asheville, and thence flows in a slightly northwesterly direction until it leaves the county. The streams in the eastern part of the county flow in a general westerly direction, emptying into the French Broad River. The largest of these are the Swannanoa River and Reems, Beavercreek, and Flat Creeks. The Ivy River drains the northeastern corner of the county and flows out of the county about 1 mile west of Grantville, emptying into the French Broad River in Madison County. Cane Creek, in the southeastern part of the county, has a southwesterly course, crossing the county boundary into Henderson County, where it empties into the French Broad River. The streams in the western part of the area flow in a northeasterly direction, except Hominy Creek, which runs east, and all empty into the French Broad River. All the streams except the French Broad River and Hominy Creek have their sources within the county.

Buncombe County has excellent natural drainage; creeks, branches, and streamlets ramify all parts of the county, and every farm is connected with one or more of these outlets. Springs of good water are found on almost every farm, and many gravity water systems have been installed. The small streams are swift flowing and have cut deep ravines. Considerable water power is being developed for gristmills, sawmills, and roller mills on nearly all the creeks in the county. The French Broad River has a fall of about 375 feet in its length of 33 miles across the county. Considerable water power is being developed on this stream, but thousands of horsepower are going to waste. The city of Asheville and vicinity is supplied with power from a hydroelectric plant about 5 miles below Asheville.

Buncombe County was formed in 1791 from parts of Burke and Rutherford Counties. In 1808 and 1850 Haywood and Madison Counties, respectively, were formed from parts of Buncombe County. The first settlements in the Buncombe County area were made about 150 years ago. Prior to this the region was occupied by the Cherokee Indians, who were as a rule on fairly friendly terms with the white settlers. The early pioneers were mostly of Scotch and Irish descent, and nearly all the present native inhabitants trace their ancestry to these early settlers.

According to the 1920 census, the total population of the county is 64,148, of which 35,644, or 55.6 per cent, is classed as rural. In recent years there has been a drift of population from the rural districts to the towns and mill centers. The rural population in 1920 averaged 55.8 persons per square mile. In the intermountain plateau section the population is rather evenly distributed; in the mountain region it is confined largely to the valleys of the small streams.

Asheville, the county seat, with a population of 28,504 in 1920, is the principal town. Weaverville, the next largest town, has a population of 606. Other locally important towns are Black Mountain, which had a population of 531 in 1920; Barnardsville, Biltmore, Leicester, Swannanoa, Fairview, Candler, and Montreat.

The transportation facilities of the county are excellent. The main line of the Southern Railway traverses the area, entering the county on the eastern boundary at Ridge Crest, following down the Swannanoa River, passing through Asheville, and thence northward down the French Broad River out of the county. The Spartanburg line and the Murphy branch of the same system, extending south and west from Asheville, afford transportation to the southern and western parts of the county. The Asheville & East Tennessee Electric Railway, running from Asheville to Weaverville, is an outlet to the northeastern part of the county.

The public roads of Buncombe County are as a whole the best in any county in western North Carolina. Asheville is on the eastern branch of the Dixie Highway, and is the terminus of the Asheville-Charlotte-Wilmington Highway via Chimney Rock and the Asheville-Hendersonville-Greenville-Spartanburg Road. The roads in almost every section of the county are well graded and kept in good repair, and roads are being regraded and rebuilt with macadam, asphalt, concrete, or sand-clay. The telephone service is fairly good throughout the county.

The principal markets for agricultural products are Asheville and Black Mountain. Other local markets are Weaverville, Barnardsville, Sandymush, Candler, and Swannanoa. All truck crops find ready sale in Asheville, Weaverville, Black Mountain, and Montreat. A good many cattle are driven to Clyde, in Haywood County, and shipped out of the State. All dairy products, poultry, and poultry products find ready sale in Asheville and other places in the county.

CLIMATE.

The climate of Buncombe County is favorable to general agriculture. It is characterized by a somewhat lighter annual precipitation than the rest of the mountain section of North Carolina, and the rainfall around Asheville is probably much lighter than in other parts of the county. The county has more fair days and a comparative absence of disagreeable or destructive winds, owing to its position with regard to the surrounding mountains.

The mean annual precipitation at Asheville is 41.06 inches. The rainfall is distributed so that crops seldom suffer from drought or excessive rain. Even in 1904, the driest year recorded, the rainfall was 30.07 inches and was about normal during the growing season.

In 1918, the wettest year on record, it was 51.08 inches. The rainfall is distributed throughout the year, but is greatest during the growing season and lightest during September, October, and November. The average annual snowfall for the 20 years of record is 9.3 inches.

The mean annual temperature is 54.1° F.; the warmest month is July, with a mean temperature of 71.7° F., and the coldest is January, with a mean temperature of 35.4° F. There is little variation in the mean temperature of the winter months. The highest temperature recorded at the Asheville station was 95° F. on August 6, 1918. The lowest, -6° F., was in February.

The average date of the last killing frost in the spring is April 14, and that of the first in the fall, October 18. This gives an average growing season of 187 days, which is adequate for most of the staple crops grown in the State. The latest recorded date of killing frost in the spring was May 10, and the earliest in the fall, October 3. The grazing season lasts practically all the year. The prevailing direction of the wind in the summer is southwest and in the winter northeast.

The following table gives the normal monthly, seasonal, and annual temperature and precipitation, as compiled from the records of the Weather Bureau station at Asheville:

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

(Elevation, 2,255 feet.)

Month.	Temperature.			Precipitation.			
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year (1904).	Total amount for the wettest year (1918).	Snow, average depth.
	° F.	° F.	° F.	Inches.	Inches.	Inches.	Inches.
December	37.8	70	-4	3.09	2.02	4.73	0.8
January	35.4	75	-3	2.85	1.42	4.56	3.6
February	38.5	77	-6	3.21	2.06	1.98	3.2
Winter	37.2	77	-6	9.14	5.50	11.27	7.6
March	44.9	86	5	3.95	4.34	2.25	.6
April	53.9	86	13	3.20	1.64	2.74	.1
May	62.6	91	31	3.60	3.17	4.38	.0
Spring	53.8	91	5	10.75	9.15	9.37	.7
June	68.7	92	38	4.20	4.01	6.53	.0
July	71.7	94	48	4.75	2.61	2.74	.0
August	70.5	95	47	4.57	3.55	5.07	.0
Summer	70.3	95	38	13.52	10.17	14.34	.0
September	65.0	88	32	2.90	2.13	3.00	.0
October	53.3	85	20	2.48	.02	11.32	.2
November	45.1	75	9	2.27	3.10	1.78	.8
Fall	55.1	88	9	7.65	5.25	16.10	1.0
Year	54.1	95	-6	41.06	30.07	51.08	9.3

AGRICULTURE.

The early pioneers settled along the creeks and rivers and began to cultivate the richer and more easily tilled bottom land. For

generations they bought little and sold little because of the distance to market; there were no railroads and the county roads were poor. They depended a good deal on hunting and fishing, but the chief source of income was cattle and hogs. The animals were marked or branded and turned loose in the mountains. No fences were required, except around the gardens and corn patches. Cattle and hogs were driven to markets in South Carolina. As a class, the people of this section never were wealthy; they were content to make a good living without accumulating much or keeping pace with the agriculture in other sections of the State. This region was affected very little by the Civil War. The county did not really begin to develop until the railroad reached Asheville.

According to the census of 1880, there were 2,560 farms in Buncombe County in 1879, with an average of 38.9 acres of improved land per farm. Corn, with a total area of 29,108 acres, was the most important crop, followed by wheat, oats, rye, and hay in the order named. Tobacco was grown on 947 acres, with a production of 475,428 pounds. The production of sorghum sirup amounted to 43,678 gallons. Buckwheat was grown on 575 acres, with a production of 3,981 bushels. The output of potatoes was 19,211 bushels, and 87 acres of sweet potatoes produced 5,872 bushels. Orchard products were valued at \$22,270, and forest products at \$47,646.

The acreage of corn, oats, hay, and sweet potatoes increased during the next decade, while wheat, buckwheat, and rye decreased. The production of potatoes more than doubled, while the acreage in tobacco was trebled in this period, 3,409 acres producing 1,482,688 pounds. There were 102,238 apple trees and 33,500 peach trees in 1889.

From the returns of the 1900 census it is seen that the production of corn, wheat, hay and forage, fruits, and livestock and livestock products had made the heaviest increases. The value of livestock, dairy, and poultry products sold in 1899 amounted to \$287,244; forest products were valued at \$63,481; and orchard products at \$50,061.

During the decade from 1900 to 1910 the acreage in corn decreased about 30 per cent, oats about 50 per cent, wheat about 20 per cent, hay and forage crops about 40 per cent, while tobacco decreased from 1,178 to 44 acres. There was an increase in the acreage of Irish potatoes and in fruit and truck crops and a large increase in the value of livestock and livestock products.

At present corn is the principal crop grown. According to the 1920 census, 671,522 bushels were produced from 28,830 acres in 1919, with an average yield of 23.3 bushels per acre. Corn is used chiefly for feeding stock and fattening hogs, and some is ground into meal for home use. Many farmers have a surplus that is sold in the local markets. The principal varieties are Cross 182, Biggs Prolific, Tip-pard, and Boone County White. Most of the corn is produced on the bottom lands and colluvial slopes, as the higher yields are obtained on these soils, but in the vicinity of Leicester and Jupiter and throughout the central and northern parts of the county the best farmers produce good yields of corn upon the uplands.

Wheat is the next crop of importance, the 1920 census reporting a production of 123,534 bushels on 14,333 acres, with an average yield

of 8.6 bushels per acre. Wheat is used mainly to supply flour for the home, but some of the better farmers produce a surplus, which is sold in the local markets or to millers. Smooth wheats are usually grown on the uplands and bearded wheats on the bottom lands.

Oats were grown on 2,604 acres, yielding 36,236 bushels, in 1919, an average of 14 bushels per acre. The principal varieties are Red Rust Proof, Winter Appler, Ninety Day, and Black Spring. Oats are sometimes sown with crimson clover and cut for hay, and some oats are fed to stock in the sheaf.

Hay and forage crops occupied 16,149 acres, yielding 20,009 tons, in 1919. Cultivated grasses, consisting mostly of clover and timothy mixed, and of clover alone, produced most of the hay crop. Clover and timothy mixed occupied 4,214 acres and produced 4,301 tons of hay, while clover alone occupied an area of 2,130 acres, producing 1,993 tons of hay. Clover is a good improver for the land, and many of the farmers grow the crop for the beneficial effects that it has on succeeding crops of corn and wheat.

Soy beans are beginning to be important. The crop is cut for hay, harvested for seed, or turned under for soil improvement. When cut for hay the yield ranges from $1\frac{1}{2}$ to 4 tons per acre, and when harvested for seed, from 12 to 18 bushels per acre. At the Buncombe County State Test Farm at Swannanoa as much as 48 bushels per acre has been produced on experimental plots.

Sorghum is grown on many farms for the manufacture of sirup. According to the 1920 census, the acreage in 1919 was 3,085 acres, from which 46,483 gallons of sirup were produced.

Potatoes are grown throughout the county and good yields are obtained, the 1920 census reporting 73,551 bushels from 963 acres, an average of 76.4 bushels per acre. Yields range from 50 to 200 bushels per acre. The potatoes are of excellent quality, the tubers being smooth and having a mealy structure. Sweet potatoes were grown on 131 acres, yielding 9,066 bushels. Vegetables are grown not only for home consumption but to supply the market in Asheville and other towns. Approximately \$500,000 worth of vegetables are annually sold in the county. The production of tobacco in 1919 was 80,000 pounds. Buckwheat is grown in patches distributed over the county.

Fruit growing is an important industry, particularly in the mountainous section of the county. Nearly every farmer throughout the area has a few apple trees, and many of them have extensive orchards. New orchards are being set out. The principal varieties grown commercially are the Winesap, Stayman Winesap, Limbertwig, Delicious, Grimes, York Imperial, Hoover, Wolf River, and Gano. Apples do especially well on the mountain slopes, where the air drainage is good. There is every reason to believe that this industry will be greatly extended in the future, as the soils and climatic conditions are favorable for the production of a good quality of fruit. The 1920 census reports the number of bearing trees and the yields as follows: Apples, 164,172 trees, 58,886 bushels; peaches, 37,022 trees, 3,395 bushels; pears, 1,480 trees, 144 bushels; plums, 1,682 trees, 104 bushels; cherries, 5,758 trees, 3,044 bushels. All these fruits apparently do well when properly cared for.

The combined value of all domestic animals January 1, 1920, reached a total of \$1,778,063. On that date there were 10,074 hogs in the county, 1,333 sheep, 8,829 beef cattle, and 12,381 dairy cattle. For 1919 the value of dairy products, excluding home use of milk and cream, amounted to \$744,901, and the value of poultry and poultry products, \$300,471.

The cattle are well distributed over the county, though more extensively raised in the mountain sections. The hogs are confined mainly to the valley section. Sheep are raised chiefly in the mountains. Part of the live stock is butchered on the farms or sold in the local markets; the rest is shipped out of the county. There are a few cattlemen who own large areas of mountain land and handle a considerable number of cattle each year, annually shipping out the mature and fat cattle and carrying younger animals over the winter.

In addition to the staple farm crops, fruits, poultry, and dairy products, and cattle, a considerable revenue in the aggregate is derived from the sale of lumber, crossties, and tanbark. The marketing of these products gives employment to people during that season of the year when farm work is not heavy.

The agriculture of Buncombe County at the present time is typical of that of a large section of this mountainous country in that no large and important money crop is raised. Most of the farmers produce a sufficient quantity of the staple farm products, such as corn, wheat, clover, oats, potatoes, buckwheat, fruits, dairy products, and all kinds of vegetables and truck crops to supply home requirements. The cash income received by the farmers is chiefly from the sale of the corn, wheat, fruits, cattle, dairy, and poultry products, and truck crops, supplemented in many cases by returns from the sale of forest products, such as lumber, tanbark, acid wood,¹ and crossties. Potatoes and cabbage are the principal source of income in some of the mountain sections. Some farmers in the county do not produce sufficient grain and hay to feed their work stock, and considerable quantities are shipped into the county every year. Since this area is well adapted to these crops, every farmer should grow enough for home use and have a surplus for sale. In the vicinity of Asheville, Weaverville, Black Mountain, Montreat, and Swannanoa the chief source of income is from the summer tourists who visit this section and from the sale of vegetable and truck crops. Truck farms are found all over the county. With good roads it is possible by use of motor trucks to place vegetables in the local markets in first-class condition, and the farmers find ready sale in these markets for all their produce at good prices.

The soils of the stream bottoms are recognized by the farmers as being more productive for corn and hay and those of the uplands as better adapted to wheat and clover. The Porters loam, Porters stony loam, and the Burton stony loam are known as excellent grass and orchard land. Corn and potatoes also do well on these soils. The Davidson clay loam and Cecil clay loam are considered best for small grains and clover, but corn also is a successful crop on these soils. The Cecil fine sandy loam and Cecil loam are good general-

¹ Wood used in the production of certain products by distillation.

purpose soils. Truck crops are grown with excellent results on these soils.

The farm improvements as a rule are good. The farm houses are generally roomy and well built and the barns usually large enough to shelter all the stock. In some of the more remote mountain sections are found a few one-room houses and inadequate shelter for the stock.

Among the most extensively used implements on the farms are binders, threshing machines, mowing machines, one-horse and two-horse turning plows, three-horse riding plows, both disk and turning, disk harrows, drag harrows, hillside plows, grain drills, and corn harvesters. There are a few tractors, silage cutters, corn shredders, and farm motor trucks.

In 1919, according to the census, \$56,109 were spent for fertilizer on 2,059 farms reporting its use, an average of \$27.25 per farm reporting. Acid phosphate, the principal fertilizer used, is applied at the rate of 100 to 300 pounds per acre. A mixture of cottonseed meal and acid phosphate, 100 pounds of meal to 200 pounds acid, is sometimes used. Corn does not receive much fertilizer, and on the bottom lands and mountain slopes it is seldom given any. The same fertilizers are used for all crops except potatoes, on which a complete mixture analyzing 8-2-2² or 8-3-3 is used. Bottom soils are not as a rule fertilized. Stable manure is used on the poorest upland fields, gardens, and truck patches.

Farm labor is scarce and high. Most of the farmers have to depend mainly on their own family for cultivating and handling the crops. Laborers are usually paid from \$1 to \$2 per day. When hired by the month the wage ranges from \$20 to \$50. Some laborers, hired for long periods, are provided with house, garden, and cow in addition to these wages. From 6 to 10 cents a bushel is paid for picking apples. The 1920 census reports an expenditure of \$161,565 for labor on 914 farms, an average of \$176.75 per farm reporting.

The farms in Buncombe County vary in size from 10 to 250 acres, with a few large holdings of 1,200 to 2,000 acres, these large tracts being mostly forest and mountain pasture land. According to the 1920 census report, the average size of farms is 71.9 acres, of which 48.6 per cent, or 35 acres, is improved land. In 1920, 74.7 per cent of farms were operated by owners, 24.3 per cent by tenants, and 1 per cent by managers. Under the share system, which is in general use on the better upland soils of the county, the landlord furnishes house, implements, and one-half the fertilizer, and receives one-half of the corn and two-thirds of the wheat. On the bottom lands the tenant usually receives one-third of the crops.

Farm land varies in price from \$10 to \$200 an acre, depending on the state of improvement. Usually the best bottom land brings the highest price. The average price of good farm land is about \$85 an acre. The average assessed value of farm land as reported by the 1920 census is \$48.82 per acre.

The mountainous portions of the county offer splendid opportunities for apple growing, stock raising, and forestry. These mountains contain large areas of virgin hardwood forest.

² Proportions, respectively, of phosphoric acid, nitrogen, and potash.

SOILS.³

The soils of Buncombe County are prevailingly brown to reddish brown, although there are some noticeable areas of gray to grayish-brown soils, and also a few areas of black soils. The brown to reddish-brown soils occupy by far the greater part of the county and represent most of the agricultural land in the area. They are forest soils, and therefore contain very little organic matter. The dominant textures of these soils are loams and clay loams with small areas of fine sandy loam. Most of these soils have a friable or a brittle structure, and there are only a few small areas of soils that have plastic subsoils.

A common characteristic of these soils is the absence of free carbonates; that is, no carbonates have been accumulated in these soils, although the original material contains lime. Leaching has been thorough, owing to the extremely heavy rainfall and the excellent natural drainage. In the wooded areas erosion is much less active than in the cultivated fields.

There are four main groups or classes of upland soil in Buncombe County. The first group comprises the reddish-brown to red surface soils that have red, stiff, but fairly brittle subsoils. These occur extensively in the northwestern part and the west-central part of the county in the French Broad Valley. They are particularly noticeable in the vicinity of Asheville and around Leicester and Jupiter, and also in the southern part of the county around Arden Park. These soils have been classed as the Cecil types and range in texture from fine sandy loam to clay. The fine sandy loam and loam are grayish brown to brown in the surface portions, while the clay loam and clay are reddish brown to red in the surface soil. These soil types occupy the smoother upland areas of the county. They occur principally on the intermountain areas or along the foothills of the mountains, and range in elevation from about 2,000 to 2,500 feet.

The second group comprises brown soils with yellowish-brown to reddish-brown friable subsoils. These are developed in large areas in the extreme western part of the county, in the southeast corner, and in the eastern and northeastern parts. They represent typical mountain soils and have been classed as Porters loam and Porters stony loam. These soils are typically developed at elevations ranging from 2,500 to 6,000 feet.

The third group of soils comprise gray or brownish-gray surface soils, with yellow to brownish-yellow friable subsoils. These are the Ashe soils, which are closely associated with the Porters soils. They are developed along the high mountains in the northeastern part of the county and occupy a comparatively small area. The Ashe stony loam is the most important type.

The fourth group of soils comprises types with black surface soils and reddish-brown friable subsoils. These soils are represented here

³ The soils of Buncombe County do not join those of Henderson County. The Cecil loam, Rough stony land, and Burton stony loam of Buncombe County adjoin large areas of Porters loam of Henderson County. Small areas of Ashe stony loam also join small bodies of Porters loam and Porters sandy loam. These discrepancies along the county boundary are due to a better understanding and reclassification of the soils since Henderson County was surveyed in 1907. The Porters series has been revised to include brown soils with a reddish-brown or yellowish-brown friable subsoil, and the Burton series has been established to take care of the black soils in the mountains which were formerly mapped as Porters black loam.

by the Burton stony loam, which is developed on the high mountains and along the northern slopes in the northeastern part of the county on Great Craggy Mountain and in a few small areas scattered elsewhere throughout the high mountains.

Throughout the northeastern part of the county are extensive areas of Rough stony land, which is unsuited for agriculture. There are also large areas of like nature in the southeastern and northwestern corners of the county.

In addition to these general groups of upland soils, there are a few small areas of soils which have distinct characteristics. These are included in the Davidson, Iredell, Wilkes, and Appling series. There are also a few strips of first-bottom and second-bottom soils along the French Broad River and some of the creeks.

Practically all of the soils of Buncombe County are residual in origin; that is, they have been derived from the weathering of the underlying rock formations. By far the greater part of the county is underlain by the Carolina gneiss, which forms the country rock in the northeastern, eastern, western, and southern parts of the county and also in the vicinity of Asheville. This is a light-gray to dark-gray rock, composed of quartz, feldspar, muscovite, and a little biotite mica. It has a banded structure. Associated with this rock is a mica gneiss which differs from the Carolina gneiss in that it contains more feldspar. This formation gives rise to the Cecil, Porters, and Ashe soils. In the northern part of the county, from Grantville to Jupiter and on past Alexander and across the French Broad River, are areas of Roan gneiss. This formation is darker colored than the Carolina gneiss and probably contains more hornblende and biotite mica. It gives rise principally to the Cecil soils. In the southeastern corner of the county small areas of fine black schist or slate rock occur. Strips of conglomerate are also developed in the vicinity of Black Mountain and extending a short distance to the southwest. To the west of Alexander are small areas of meta-gabbro. This represents the light and dark colored gabbro rock which gives rise to the Iredell stony loam. There are spots of soapstone rock between Swannanoa and Asheville. In the extreme western end of the county are a few spots of Hiwassee slate.

The soils of the county have been classed into soil series on a basis of similarity in color, structure, origin, organic content, topography, and drainage conditions. The series have been subdivided into individual types on the basis of texture; that is, whether the soil is a sand, sandy loam, loam, silt loam, clay loam, or clay, which is determined by the proportions of mineral particles of different sizes of which the soils are composed.

The upland soils of the county, comprising practically the entire area, have been classed in the Cecil, Porters, Ashe, Burton, Davidson, Iredell, Wilkes, and Appling series.

The types in the Cecil series have gray, reddish-brown, or red surface soils and a red, stiff but brittle clay subsoil. The fine sandy loam and the loam have gray to brown surface soils, whereas the clay loam and clay have reddish-brown to red surface soils. Five types, the Cecil loam, clay loam, fine sandy loam, stony loam, and clay, were mapped.

The types in the Porters series are characterized by brown surface soils and a yellowish-brown to reddish-brown friable subsoil. These

represent the typical mountain soils and are readily distinguishable from the Cecil. The Porters loam and stony loam were mapped.

The soils of the Ashe series differ from those of the Porters in that the surface soil is gray or brownish gray, and the subsoil is yellow to brownish yellow. They are closely associated with the Porters soils, and in many places it was difficult to draw any distinct line between them. Only two types, the stony loam and fine sandy loam, are developed in the county.

The types included in the Burton series are characterized by black surface soils high in organic matter and a reddish-brown or yellowish-brown friable soil. Only one type, the Burton stony loam, is mapped.

The Davidson series includes types with reddish-brown to dark-red surface soils and a darker red to maroon red, stiff but friable, smooth subsoil. The soils are derived from diorite and metagabbro rocks. One type, the clay loam, occurs in the county.

The types in the Iredell series have dark-red to rusty-brown surface soils and a brownish yellow, heavy, plastic impervious clay subsoil. This series is derived from diorite and metagabbro, and the type mapped, the Iredell stony loam, is readily distinguished from any of the other soils in the county.

In the types of the Wilkes series the surface soils are gray to brownish, and the subsoil is very variable in color and structure, frequently grading into either a yellowish-brown heavy clay or the disintegrated rock within the 3-foot section. One type, the sandy loam, is mapped.

The Appling series includes types with gray to brownish-gray surface soils and a mottled yellow and red or reddish-yellow, compact but friable subsoil. Only the Appling fine sandy loam is developed here.

Along the rivers and larger creeks are developed areas of first-bottom soils and small bodies of second-bottom or terrace soils. These soils represent materials which have been washed from the uplands and redeposited by the streams. The Altavista series includes the second-bottom or terrace material, and the Congaree and Toxaway series comprise the first-bottom soils.

The types of the Altavista series have gray to light-brown surface soils and a yellow to brownish-yellow friable subsoil. These soils are developed on the second bottoms or terraces. The Altavista fine sandy loam is mapped.

The Congaree series includes types with brown to reddish-brown surface soils and a light-brown friable subsoil. Both the soil and subsoil contain a noticeable amount of small mica scales. Two types, the fine sandy loam and silt loam, occur in this county.

The types in the Toxaway series are characterized by black surface soils and a black, steel-gray, or brown, friable subsoil. Only the Toxaway loam is developed.

In addition to the above-described series there are three miscellaneous classifications of material, namely, Meadow (Congaree material), Rough stony land, and Rock outcrop.

In the following pages of this report the different soils are described in detail and their relation to agriculture discussed. The

following table gives the actual and relative extent of the different soil types:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Porters stony loam.....	87,104	22.2	Davidson clay loam.....	3,520	0.9
Cecil clay loam.....	85,504	21.8	Cecil clay.....	2,496	.6
Cecil loam.....	66,688	17.0	Appling fine sandy loam.....	2,368	.6
Rough stony land.....	36,160	9.3	Ashe fine sandy loam.....	2,048	.5
Cecil fine sandy loam.....	30,464	7.8	Iredell stony loam.....	960	.3
Porters loam.....	22,592	5.8	Altavista fine sandy loam.....	832	.2
Congaree fine sandy loam.....	11,008	2.8	Rock outcrop.....	832	.2
Burton stony loam.....	7,808	2.0	Meadow (Congaree material).....	832	.2
Cecil stony loam.....	7,744	2.0	Texaway loam.....	448	.1
Ashe stony loam.....	7,680	2.0			
Congaree silt loam.....	7,552	1.9			
Wilkes sandy loam.....	7,040	1.8			
			Total.....	391,680

CECIL STONY LOAM.

The Cecil stony loam is a grayish-brown to brown friable loam 6 to 10 inches deep, underlain by a red to a brownish-red rather heavy friable clay, which may extend to 3 feet or more, though locally the bedrock is encountered at 20 to 30 inches below the surface. In places the brown surface soil passes into a pale-red friable clay loam that extends to a depth of 9 to 14 inches and gradually passes into a red, stiff, crumbly clay. Quartz gravel and larger fragmentary rocks are scattered plentifully over the surface and mixed with both soil and subsoil. This soil type differs from the Cecil loam chiefly in that it contains from 30 to 60 per cent of angular rock fragments consisting principally of gneiss. The surface soil on Spivey Mountain and Deaver View is a reddish-brown stony loam.

The Cecil stony loam lies along the foot of some of the higher mountains, on knolls, and on the tops of some of the low mountains. The largest bodies occur $2\frac{1}{2}$ miles north of Liberty Church, around Spivey Mountain and Deaver View, $2\frac{1}{2}$ miles south of Candler, near Avery Creek, bordering Stony Fork south of Dunsmore, and in other areas scattered throughout the southern and eastern parts of the county.

The surface of this type varies from rolling to strongly rolling and steep. Both surface and internal drainage are good.

The total area of the Cecil stony loam is comparatively small. It covers less than 8,000 acres and is not of great importance, although the small areas in cultivation give good results. It is a good soil for fruit growing, apples and peaches both doing well. The tree growth on the forested areas consists mainly of oaks, pine, white pine, poplar, dogwood, maple, sourwood, and a little chestnut. On some of the smoother areas, where the stones are not too numerous, corn yields 10 to 40 bushels per acre, wheat 8 to 12 bushels, and other crops give good yields.

The stone content of this type makes it hard to handle. One-horse plows are in general use. Fertilizer is seldom used. This land is always sold in connection with adjoining soils. The same methods of improvement are followed as on the Cecil loam.

CECIL FINE SANDY LOAM.

The Cecil fine sandy loam consists of an upper layer of gray to yellowish-gray fine sandy loam, 6 to 9 inches thick, underlain by a yellowish-red or pale-red fine sandy loam, passing at 10 to 15 inches into a red, stiff, though friable fine sandy clay to clay, which usually extends to a depth of several feet. The surface material in places varies in color from light-gray or whitish to brown or grayish brown. The grayish-brown and brown surface soil generally rests directly upon the red-clay subsoils; the light-gray soil has a reddish-yellow to pale-red substratum passing gradually into the red subsoil. In other places the surface soil has a reddish-brown or yellowish-red color, which is due to a higher content of clay, the soil being heavier than the average. These variations occur in small bodies scattered throughout the areas mapped as Cecil fine sandy loam. Quartz gravel and small angular rock fragments appear on the surface in many places and in a few isolated spots in sufficient quantities to make a gravelly type. The spots, however, were not large enough to be mapped separately. The subsoil usually contains some fine quartz sand or gravel, although in some areas it is practically free from any grittiness. The subsoil as a rule contains finely divided mica flakes in the lower depths.

The Cecil fine sandy loam, as mapped in Buncombe County, includes small areas of Cecil loam, Cecil sandy loam, Ashe fine sandy loam, and Appling fine sandy loam. Separation of the areas on a map of the scale used in the survey is practically impossible.

The largest areas of this type occur just north of Buenvista, south of Asheville, along the Swannanoa River between Asheville and the east county boundary, just north and about 1 mile south of Hominy Creek station, and in the vicinity of Weaverville. Several bodies are distributed in the southern part of the county just north of Cane Creek. Smaller spots are scattered throughout the smoother parts of the county.

The topography ranges from undulating and gently rolling to rolling on the low ridges and other smoother areas to strongly rolling on some of the slopes. Both surface and under drainage are well established, owing to the relief and to the friable nature of the soil and subsoil.

The Cecil fine sandy loam is an important soil, and about 70 per cent of it is in cultivation. The type is easy to handle and responds readily to good treatment. It is not considered as productive for wheat, clover, and corn as the Cecil clay loam but better suited to rye, soy beans, sweet potatoes, and all kinds of truck crops. In practice, the crops common to this section of the State are grown indiscriminately. Crops mature a little earlier on this soil than on the heavier soils. Corn yields from 10 to 40 bushels per acre, wheat 8 to 12 bushels, rye 15 to 20 bushels, soy beans 15 to 25 bushels, and sorghum 60 to 150 gallons of sirup per acre.

Fertilizers are generally used on this type. Wheat receives 200 to 400 pounds of acid phosphate per acre. The application to corn is less than for wheat and other crops.

The Cecil fine sandy loam sells for \$60 to \$150 an acre, depending on improvements and the nearness to towns.

The type is deficient in organic matter, but this can be supplied readily at little cost by growing cowpeas, soy beans, crimson clover, or rye, and turning these under as green manure or by feeding the forage to cattle and incorporating the manure in the soil.

CECIL LOAM.

The surface soil of the Cecil loam consists of an upper layer 3 to 6 inches thick of grayish-brown to yellowish-brown friable loam to sandy loam and a lower layer of pale-red loam to clay loam with a depth of about 10 inches. The subsoil is a red, heavy but brittle clay, which extends to a depth of 3 feet or more. On some of the lower mountain slopes, on top of Spivey Mountain and Deaver View, and in other places in the county the surface soil is brown to reddish brown and rests directly on the red somewhat friable subsoil. The type usually contains some gravel and small angular rock fragments. The subsoil carries a considerable amount of mica flakes.

The Cecil loam is the second in extent of the soil types found in the intermountain plateau. Large areas are situated south of West Asheville and Buenavista on both sides of the French Broad River to the Henderson County line and along Beaverdam and Reems Creeks. Other smaller bodies are scattered throughout the intermountain section and border some of the streams extending up into the mountains.

The topography of this type in the intermountain areas varies from undulating and gently rolling to rolling, as on top of the hills and low mountains, and on the slopes of smaller valleys from strongly rolling to steep. Both surface and under drainage are well established. Owing to the friable nature of both surface and subsoil, the rainfall is freely absorbed, thus preventing surface wash, so that the steepest slopes can be cultivated without great danger of damage from erosion.

The Cecil loam is an important soil in the agriculture of the county, and about 60 per cent of it is cultivated or in use as pasture land. The uncultivated areas are forested chiefly with oaks of different species, walnut, poplar, maple, ash, hickory, and several varieties of pine. A few white walnut, or butternut, and chestnut trees are found on the hills and low mountains.

Corn and wheat are the most important crops. Corn yields from 20 to 40 bushels, and wheat about 10 bushels per acre. Oats, rye, potatoes, sweet potatoes, soy beans, peas, cabbage, and all kinds of vegetables are grown on this soil. Every farmer raises enough hogs to supply the home with meat and to have some for sale in the local market. Beef cattle are grazed and fattened, and a few dairies are established on the type.

This soil is generally plowed with 2-horse turning plows and cultivated with walking and riding cultivators. The surface features are such that grain drills and other improved machinery can be employed satisfactorily, and equipment of this kind is found on many of the farms. Commercial fertilizers are not used generally, but about 200 pounds per acre of 16 per cent acid phosphate is applied at the time of sowing wheat. Fertilizer seldom is applied to corn land.

The Cecil loam sells for \$30 to \$200 an acre, the price depending on nearness of the farm to towns, the situation with respect to transportation facilities, and the state of improvement.

CECIL CLAY LOAM.

The Cecil clay loam, locally known as "red land," is practically the same as the red soil mapped as Cecil clay loam of the Piedmont Plateau. The surface soil in most areas consists of 3 to 10 inches of red to reddish-brown clay loam or heavy fine sandy clay loam, but in places the upper 2 or 3 inches may consist of grayish or brownish fine sandy loam, with the red heavy clay loam immediately below. In other places where the type is associated with the Davidson clay loam, and in some places in the northern part of the county, the surface soil is a rich-brown loam to clay loam. The subsoil is a red, compact, heavy but brittle to crumbly clay, which generally extends to a depth of several feet. It commonly carries some quartz sand, but occasionally it is a smooth clay free of gritty particles. The subsoil in local spots scattered over the area is yellowish red or reddish yellow.

In general the subsoil contains some mica scales, and in some places the lower part of the 3-foot section contains a sufficient admixture of mica to give it a decidedly greasy feel. There are a few isolated spots of this type that have also a large quantity of mica in the surface soil, and had these been large enough they would have been mapped as the Talladega clay loam. Included with this type also are small bodies of Cecil fine sandy loam, Cecil clay, Davidson clay loam, and Cecil loam.

The Cecil clay loam is the second most extensive type in the county. It is distributed throughout the intermountain section and occurs in narrow strips bordering the larger streams leading into the mountains. This type is typically developed in broad areas in the vicinity of Jupiter, Leicester, Asheville, and on both sides of the French Broad River in its course through the county.

The topography varies from gently rolling and strongly rolling to steep. The greater part of it is suitably located for agricultural use. Natural surface drainage is good. The run-off on the steeper slopes in some places is excessive, and the surface soil in many places is washed off, leaving the red clay exposed. Internal drainage is fairly well established.

The Cecil clay loam is the most extensive soil in the so-called intermountain plateau of Buncombe County, and it is one of the best and most extensively farmed upland soils in this section. About 70 per cent of it is in cultivation; the rest supports a forest growth consisting chiefly of white oak, red oak, black oak, white pine, yellow pine, hickory, maple, dogwood, and old field pine.

The most important crops on this soil are wheat, clover, corn, and oats. The yields of wheat range from 12 to 20 bushels per acre, corn 15 to 50 bushels, clover 1 to 2 tons, and oats 20 to 35 bushels. Sweet and Irish potatoes, sorghum, buckwheat, soy beans, and all kinds of vegetables are among the minor crops. Near the towns and villages truck growing is carried on to a considerable extent. A large number of apple trees are growing on this soil.

The farm methods on this soil include fall and winter plowing with 2-horse turning and 3-horse disk plows. A few tractors are in use. Many farmers sow wheat after corn, the seed bed in such cases rarely being well prepared.

Land of this type ranges in price from \$35 to \$200 an acre, depending upon location, state of improvement, and proximity to towns and transportation facilities.

A good deal of the Cecil clay loam has been depleted of its organic matter and is not in a high state of productiveness. It is, nevertheless, naturally a strong soil and capable of being built up to its original condition by deeper plowing, the turning under of clover, cowpea vines, soy beans, and rye for manure. The application of barnyard manure, if in sufficient supply, will accomplish the same result. When organic material has been supplied, the soil limed, and the land thoroughly prepared by plowing and repeated harrowing, the application of acid phosphate will give large increases in crop yields.

CECIL CLAY.

The surface soil of the Cecil clay is a red heavy clay loam to clay, with a depth of 4 to 8 inches. The subsoil is a bright-red, heavy, stiff, but fairly brittle clay, extending to a depth of several feet. There is some variation in the type; the immediate surface in places consists of 2 or 3 inches of yellowish-brown to reddish-brown loam to clay loam, and in other small areas of material of the subsoil, the surface soil having been washed away.

This is an inextensive and unimportant type occupying the slopes and tops of some of the hills in the intermountain section, where for the most part the clay loam has been washed off. It is closely associated with the Cecil clay loam. The largest body lies about 3 miles west of Biltmore on the Vanderbilt estate. A few other small spots are scattered over the central and north central parts of the county.

The topography ranges from gently rolling to strongly rolling. The natural surface drainage is good and the run-off is excessive, in some places causing erosion. The underdrainage is impeded by the close, heavy structure of the subsoil. On the smoother rolling areas occurring within the Cecil clay loam the Cecil clay is farmed. The same crops are grown, and the same methods of handling and the same kind of fertilizer used. The yields on the clay are not as high as on the clay loam. As a rule, where the type occurs in larger bodies it is not in a very high state of productiveness. This type is always sold in connection with the adjoining soils.

The Cecil clay needs deeper plowing, liming, and the incorporation of organic matter. With proper management it can be brought to a high state of cultivation. It is slightly more difficult to till than the clay loam.

PORTERS STONY LOAM.

The surface soil of the Porters stony loam consists of a light-brown to dark-brown friable loam ranging in depth from 6 to 14 inches and containing a considerable quantity of well-decomposed organic matter. The subsoil is a yellowish-brown to reddish-brown friable loam to clay loam. Both the surface soil and subsoil contain from 30 to 60 per cent of mica-schist fragments, Roan gneiss,

and Carolina gneiss from a few inches to several feet in diameter. In coves on the north slopes, where the type grades into the Burton stony loam, the surface soil is nearly black.

The Porters stony loam as mapped includes areas of Porters loam, Burton stony loam, Ashe stony loam, and Rough stony land, and a few small areas of Rock outcrop too small to map. In a few places patches of a soil having a red to brownish-red subsoil also are included.

The Porters stony loam is the most extensive soil type mapped in Buncombe County. It is confined entirely to mountainous parts and is typically developed on mountain slopes, in most places extending to the top of the mountains. The largest bodies lie in the southwestern, western, eastern, and northeastern parts of the county.

The topography varies from rolling on the lower slopes through very steep on the mountain sides to gently rolling on the tops of some of the mountains. The drainage is excellent. The porous nature of the subsoil allows the rain water to be absorbed freely, so that rather steep slopes can be cultivated with little danger of erosion.

The Porters stony loam is a large and important type, although only a small proportion of it is in cultivation. The steepest slopes are almost entirely occupied by forest consisting of chestnut, chestnut oak, poplar, spruce, hemlock, sugar maple, buckeye, red, white, and black oak, ash, and a few white walnuts. Some rather large areas are cleared and used for pasture and general farming. Its principal use is for stock raising and fruit growing. Orchards are generally located in coves and on slopes with northern and western exposures, although there are a few orchards on the tops of some of the lower mountains.

Corn, wheat, oats, and potatoes are the main crops. Cabbage, buckwheat, turnips, and all kinds of vegetables do well. Cattle raising is the chief industry. A few small dairies are located on this type; nearly every farmer keeps one or more milk cows, and some sell butter in the local markets.

Corn, the most important farm crop, yields from 20 to 50 bushels per acre without the use of fertilizer; wheat on the lower slopes and on areas of smoother topography produces from 9 to 18 bushels; oats, from 20 to 40 bushels; and Irish potatoes, from 75 to 200 bushels.

Shallow breaking with hillside plows is the general practice, and small plows are used for cultivation. The soil is mellow and does not require deep plowing. Large plows and machinery can not be used on account of the generally steep topography and the abundance of loose rocks scattered over the surface and mixed with the soil mass. These stones hinder cultivation to a certain extent. Fertilizer is not used on this type, except for orchards and potatoes.

The Porters stony loam ranges in price from \$10 to \$50 an acre, depending mostly on its location; topography, and accessibility to roads.

PORTERS LOAM.

The surface soil of the Porters loam consists of a brown to dark-brown, mellow, friable loam 7 to 15 inches deep. The subsoil is a yellowish-brown to reddish-brown friable clay loam to sandy clay

extending to a depth of 20 to 36 inches, where it commonly rests upon bedrock. In some places there is no subsoil, the surface soil resting directly on rock. The subsoil is usually porous and friable, especially where the type grades into the Burton stony loam and in coves on northern slopes. In such areas the surface soil is very dark brown and the subsoil is a brownish-yellow to yellowish-brown friable loam to clay loam. Along the slopes of the mountains the soil is a lighter brown and the subsoil becomes a reddish-brown to pale-red or orange color. In other places on the tops of mountains the subsoil resembles that of the Ashe soils. The slopes on the north side of Sandymush Creek include some sandy material, and other spots have considerable sand in both soil and subsoil. It is not infrequent for the disintegrated bedrock to appear at any depth between 18 and 30 inches. The Porters loam as mapped includes small bodies of Burton stony loam, Burton loam, Ashe loam, Ashe stony loam, and Porters stony loam too small to map.

The Porters loam is the most extensive cultivable soil type in the mountain region of Buncombe County. It is developed along the slopes, in the gaps, and on the tops of the low mountains, and occasionally on the tops of the higher mountains. The largest areas lie in the Barnardsville section, east of Stocksville, on Sunset, Britten, and Hamburg Mountains, and scattered in small patches throughout the mountainous sections in the western and northwestern parts of the county.

The topography ranges from gently rolling on the mountain tops and in the gaps to strongly hilly and steep on the mountain slopes. The natural drainage is excellent, owing to the sloping surface, the friable nature of the surface soil, and the porous condition of the subsoil, which allows the rain water to enter freely.

This type is an important soil, although but a small proportion is in cultivation. The mountain tops and gaps include in places small cleared fields used chiefly for grazing; the slopes are used for pasture and general farming.

The greater part of the Porters loam is forested, principally with chestnut, white oak, red oak, black oak, pine, maple, buckeye, poplar, hickory, and spruce. In this forest there is an undergrowth consisting largely of rhododendron and azalea.

Corn and potatoes are the chief crops. Oats, wheat, rye, and cabbage also do well. Fruit growing and cattle raising are, however, the principal sources of income. Vegetables are grown mostly for home use. Corn yields from 20 to 40 bushels, and Irish potatoes from 60 to 200 bushels per acre. Oats, wheat, and all kinds of vegetables give good yields.

The methods of handling this soil are essentially the same as on the Porters stony loam. Fertilizer is seldom used for any field crop except potatoes. The orchards are fertilized.

Land values of the Porters loam range from \$20 to \$150 an acre, depending mostly on the location and the topography.

The Porters loam and Porters stony loam yield to the same treatment. They are the best cattle-raising and fruit-growing soils in Buncombe County. Apples produced on this type are especially fine flavored, and there are great possibilities for the fruit grower in this section.

ASHE STONY LOAM.

The surface soil of the Ashe stony loam consists of grayish-brown, yellowish-brown, or light-brown friable loam to sandy loam 7 to 9 inches deep, upon the surface of which are scattered an abundance of loose rocks, mainly angular gneiss fragments, ranging in size from pieces 3 or 4 inches in diameter to large bowlders. The subsoil is a friable sandy clay loam to fine sandy clay, varying in color from light grayish yellow through yellow to brownish yellow. In some places the first inch or two is brown to nearly black, owing to the accumulation of organic matter. Bedrock is reached at a depth of 20 to 30 inches. Both the soil and subsoil contain a considerable quantity of mica flakes. As mapped the type includes a few small spots of Ashe loam.

The Ashe stony loam occurs mainly on the tops and on the slopes near the tops of the mountains and ridges, the areas being scattered throughout the mountainous sections of the county. The largest areas lie near Barnardsville, around the head of Reems Creek, and in the southern part along the Henderson County line.

Owing to the general roughness of the surface and the friable nature of the subsoil, this type has thorough drainage.

The Ashe stony loam is not an extensive soil and is unimportant agriculturally. The cleared areas are used chiefly for pasture. A few patches are used for corn or oats, with yields about the same as on the Porters stony loam. This type is never sold by itself. It is best suited to forestry, and nearly all of it is now in a mixed forest of oak, chestnut, poplar, hemlock, and spruce.

ASHE FINE SANDY LOAM.

The surface soil of the Ashe fine sandy loam is a gray fine sandy loam, with a depth of 3 to 8 inches, passing into a light-yellow friable fine sandy loam, which extends to a depth of 12 to 18 inches. This is underlain by a yellow friable fine sandy clay subsoil, which in many places is marked with gray or reddish mottling at depths of 24 to 36 inches. In some places in forested areas the upper inch or two of material has a dark-gray color, due to the admixture of relatively large quantities of organic matter. Small spots of Ashe loam, sandy loam, coarse sandy loam, Appling fine sandy loam, and Porters fine sandy loam, too small to be shown on the map, are included with this type. The spots of loam are somewhat more numerous than the other soils.

All the Ashe fine sandy loam in the area is included in a few small bodies. The largest of these occur in the vicinity of Liberty Church, on top of Burney Mountain. Two small areas lie near Inanda and isolated spots in other places in the county.

The surface over most of this type varies from almost level to undulating or rolling; in a few places it is strongly rolling to steep. Surface and internal drainage are well established.

The Ashe fine sandy loam is a type of small extent in Buncombe County, but is of considerable importance in the mountain sections. The greater part of it is under cultivation; the rest supports a forest consisting chiefly of different species of oaks, dogwood, poplar, maple, pine, hickory, and persimmon.

Corn, wheat, and oats are the most extensively grown crops. Soy beans, rye, potatoes, watermelons, and all kinds of vegetables are successfully grown. Corn yields from 15 to 30 bushels per acre, wheat 8 to 15 bushels, and oats 12 to 30 bushels.

The Buncombe County State Test Farm at Swannanoa carries on some experiments on a small patch of this soil, and the crop yields compare favorably with those on the adjoining Cecil fine sandy loam. The farm practice is practically the same as on the Porters fine sandy loam. The two types bring about the same price.

The Ashe fine sandy loam is deficient in organic matter, which can be supplied most economically by turning under soy beans, rye, crimson clover, or cowpea vines.

The table below gives the results of mechanical analyses of samples of the soil, subsurface, and subsoil of the Ashe fine sandy loam:

Mechanical analyses of Ashe fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
235930.....	Soil, 0 to 3 inches.	2.9	6.9	6.4	32.0	14.9	29.2	7.8
235931.....	Subsurface, 3 to 14 inches.	1.6	6.4	5.9	27.8	12.5	29.2	16.6
235932.....	Subsoil, 14 to 30 inches.	.8	4.6	4.8	24.2	11.2	22.9	31.5

BURTON STONY LOAM.

The surface of the Burton stony loam varies from a dark grayish brown to black friable loam, containing a relatively large proportion of well-decomposed organic matter and ranging in depth from 8 to 15 inches. In some of the northward-facing coves in poorly drained spots it approximates muck. As it grades into the Porters soils the proportion of organic matter becomes less and the color changes to a rich brown. The subsoil is prevailingly a brown to yellowish-brown friable loam to clay loam, which seldom extends to a depth of 3 feet, being underlain in most places by bedrock at 15 to 30 inches. Occasionally the black surface soils rest directly on the bedrock. Scattered over the surface and mixed with both soil and subsoil are angular fragments of gneiss and schist, and there are many outcrops of ledges of these rocks, the Burton stony loam in some places grading into Rough stony land.

The Burton stony loam is developed almost entirely in the north-eastern part of the county. One body is mapped on the Pisgah Ridge in the southwestern part and another on Sandymush Bald in the northwestern part. It occurs on the tops or near the tops of the highest mountains, chiefly on the northern and northwestern slopes. The topography ranges from gently rolling on the tops of the mountains to strongly rolling to steep and rough on the slopes. The areas are well drained.

This is a productive soil, though it is not used for general farming purposes, as its location makes it almost inaccessible except at great cost for building roads. Its principal use aside from forestry is for grazing, and it is considered the best soil in the county for stock

raising, as grasses thrive upon this soil when cleared. Corn and potatoes do well in the few smooth areas that have been placed under cultivation.

A very small percentage of this type is cleared. The forest is characterized by such species as sugar maple, buckeye, chestnut, chestnut oak, red oak, black oak, poplar, spruce, and balsam.

Land of this type sells at \$10 to \$50 an acre, depending on the forest growth, topography, and accessibility.

DAVIDSON CLAY LOAM.

The surface soil of the Davidson clay loam is a brownish-red to dark-red clay loam 6 to 10 inches deep. The subsoil is a dark-red or maroon-red heavy smooth clay, carrying a few small soft iron concretions. Along the line of contact with the Iredell soils fine rock fragments or partially disintegrated diorite and gabbro-diorite rocks and sometimes iron concretions occur on the surface. In the northern part of the county, around Grantville, the surface carries considerable quantities of sand and small gravel, probably the result of the incomplete disintegration of hornblende gneiss of the Roan gneiss formation, from which the adjoining Cecil clay loam soil is derived.

There are only two important bodies of the Davidson clay loam in Buncombe County. The largest and most typically developed area occurs west of Alexander; the other is in the northern part of the county around Grantville. A few other small spots are found in the area.

The topography varies from gently rolling to strongly rolling. The natural surface drainage is good, but owing to the heavy structure of the subsoil water percolates slowly and subdrainage is somewhat deficient. The type does not erode easily and suffers very little damage from heavy rains.

The Davidson clay loam is not extensive in the county but is an important soil for general farming. It is considered the strongest upland soil of this section, and the greater part of it is in cultivation. The forest growth on the uncultivated areas consists chiefly of hickory, oaks, dogwood, pine, poplar, and cedar.

Wheat, clover, and corn are the main crops, and soy beans, cowpeas, potatoes, sweet potatoes, and all kinds of vegetables are minor crops. Wheat yields 15 to 30 bushels per acre, clover 1 to 3 tons, and corn 20 to 50 bushels.

All this type is used or can be used advantageously for farming or for pastures. The soil is handled in the same way as the Cecil clay loam. Acid phosphate is the fertilizer used almost exclusively for all crops. Wheat receives an application of 200 to 300 pounds per acre; smaller quantities are used for corn. A little lime is sometimes applied to fields intended for clover.

This type of soil sells at \$75 to \$150 an acre, depending on the state of improvements and the transportation facilities.

The Davidson clay loam is a very strong soil and can be built up to a high state of productiveness by the incorporation of organic matter, deeper plowing, and the addition of lime.

IREDELL STONY LOAM.

The Iredell stony loam to a depth of 8 to 12 inches consists of a dark-gray to grayish-brown mellow loam, drying out to a gray or a brownish gray, underlain by a subsoil of dingy-yellow to dull-brown or drab, tough, waxy, plastic clay. The subsoil varies locally from a yellowish to a reddish brown, the reddish color occurring where the type grades into the Davidson clay loam. The subsoil usually grades into the decayed or disintegrated diorite rock at anywhere from 20 to 30 inches. Diorite fragments are abundant on the surface and throughout the soil mass.

This type is of a very small extent. A few spots of Iredell fine sandy loam and Davidson clay loam, too small to be shown separately, are included with it. Also some small areas of stone-free soil, which really represent the loam of the series, have been included with the Iredell stony loam on account of their small extent.

The type occurs on well-rounded knolls. Surface drainage is usually good, but, owing to the impervious structure of the subsoil, underdrainage is imperfect.

Very little of this land is farmed. The cultivated areas are used chiefly for wheat, oats, clover, and corn, of which fairly good yields are obtained. The forest growth consists of small oaks, hickory, dogwood, and old field pine.

WILKES SANDY LOAM.

The surface soil of the Wilkes sandy loam consists of two layers, an upper one of gray to grayish-brown coarse sandy loam to fine sandy loam, and a lower one of pale yellow or yellow and gray, mottled with brown, compact sandy loam. The combined thickness of these layers is 6 to 18 inches. The subsoil, which is encountered at depths between 7 and 18 inches, is a mottled reddish-brown and dingy-yellow, friable or plastic clay, or a yellow and gray sandy clay or sticky clay. As may be seen from the above description, this type of soil varies greatly in color, texture, and structure. It includes areas of Appling, Cecil, Davidson, and small intrusions of Iredell material. In places the range in texture varies from a gravelly sandy loam to a fine sandy loam; in other places it is nothing more than a partially disintegrated hornblendic gneiss of the Roan gneiss formation, with dikes of gabbro diorite and aplitic granite. The Wilkes sandy loam thus represents more a soil condition than a soil type.

Practically all of this soil lies along the breaks bordering the streams in the north-central part of the county. The largest areas occur on both sides of the French Broad River in a broken belt from the vicinity of Olivette to the Madison County line.

The greater part of this type occupies the steeper and rougher slopes in the intermountain plateau region. The topography ranges from rolling to steep and broken. Natural surface drainage is good, and on the steeper slopes the run-off is excessive, causing erosion, but in spots in the rolling areas where the subsoil is a plastic clay the underdrainage is poor.

The smoother areas are considered good land for general agriculture. Probably 20 per cent of the type is under cultivation; the rest

supports a forest consisting chiefly of hickory, oak, maple, persimmon, and old field pine. Corn, wheat, and sorghum are the principal crops. Oats, tobacco, sweet potatoes, watermelons, and all kinds of vegetables do well. Corn yields from 10 to 30 bushels per acre, wheat 8 to 10 bushels, and sorghum 40 to 100 gallons of sirup.

The farm practice on this type is practically the same as on the adjoining soils. Where areas are sold separately the price ranges from \$20 to \$40 an acre.

More care should be taken with this soil, as it erodes very easily. Deeper plowing and the planting of winter cover crops and grasses would prevent erosion to a certain extent. The smoother areas can be built up and made to produce good yields of various crops now grown in this part of North Carolina.

APPLING FINE SANDY LOAM.

The surface soil of the Appling fine sandy loam consists of gray to brownish-gray fine to medium sandy loam, passing at 6 to 10 inches into pale-yellow compact fine sandy loam, carrying some quartz gravel, which extends to a depth of 15 inches. The subsoil is for the most part a mottled yellow, brown, and red, heavy, fine sandy clay, but in many places a heavy, almost plastic clay, yellowish red or brown in color, appears within the 3-foot section. The type in this county differs somewhat from the type as mapped in other areas.

The Appling fine sandy loam occurs in small bodies throughout the intermountain basin, usually along the heads of the small streams and branches, in the gaps in the low ridges between the heads of watercourses, and along the slopes near the small branches and creeks. The largest body lies in a low gap around Arden. The topography varies from almost level to undulating and rolling. The drainage is for the most part good, though imperfect in some of the more level spots.

The type has a small total area in the county and therefore is not very important for farming, although most of it is in cultivation. The native forest consists chiefly of oak, old field pine, maple, poplar, persimmon, and dogwood. Corn and wheat are the main crops. Rye, soy beans, and vegetables do well on this soil. The crop yields, methods of handling, fertilization, and land values are the same as on the associated soils.

ALTAVISTA FINE SANDY LOAM.

The Altavista fine sandy loam consists of 6 to 9 inches of a brownish-gray to yellowish-gray fine to very fine sandy loam, underlain by a subsoil of yellow friable fine sandy clay. In places the subsoil has a yellowish-red color, and in some places becomes heavy in the lower part. The surface soil varies in color from light gray to brown and in texture from fine sandy loam to sandy loam. The small area $2\frac{1}{2}$ miles southeast of Barnardsville has a grayish-brown surface soil and a brownish-yellow subsoil. Along Cane Creek the soil is a light-gray very fine sandy loam to sandy loam. In places water-rounded quartz bowlders and gravel are encountered within the 3-foot section.

The Altavista fine sandy loam occurs on second bottoms or terraces, where it was deposited before the streams had cut down to their present level. It is above the normal overflow of the streams. This type occupies a small acreage in the county. The largest bodies lie along Cane Creek and Swannanoa River. Another area occurs along Dillingham Creek $2\frac{1}{2}$ miles southeast of Barnardsville, and a few small areas lie in other parts of the county. The surface is nearly level to gently rolling, and, owing to the friable nature of both surface soil and subsoil, drainage is well established.

This type, although inextensive, is an important soil, practically all of it being in cultivation. Corn, wheat, and soy beans are the chief crops. Sorghum, rye, peas, crimson clover, potatoes, and all kinds of vegetables do well. Corn yields from 20 to 40 bushels per acre, wheat 9 to 12 bushels, and soy beans about 15 bushels.

The Altavista fine sandy loam is handled in the same way as the Congaree soils, but generally receives a light application of 16 per cent acid phosphate as a fertilizer. This type is always sold in connection with the adjoining soil.

TOXAWAY LOAM.

The surface soil of the Toxaway loam consists of 6 to 10 inches of dark-gray to black mellow loam or silt loam, the color depending on the content of organic matter. The surface soil is underlain by a layer 8 to 16 inches thick, of the same color as the overlying material but usually of a silty clay loam texture. In places the soil is a dark-brown silt loam, especially where it is associated with the Congaree silt loam. The lower subsoil varies from dark grayish brown to gray and brown mottled loam to clay. In some places the upper subsoil is a dark-brown loam, which grades down into a brownish-yellow silty clay.

This type covers only a small area in Buncombe County. An area lying along the French Broad River near Buck Shoals and others near Swannanoa on the Swannanoa River are among the largest mapped.

The Toxaway loam occupies level or gently sloping bottoms along the streams, generally in association with the Congaree soils. It is subject to overflow from the streams in time of heavy rains, and crops are occasionally damaged to some extent. Artificial drainage is necessary to fit the land for cultivation.

The greater part of the Toxaway loam is in cultivation or in pasture. It is naturally productive, but requires lime for best results. The crops grown and the yields are about the same as on the Congaree silt loam, and the same methods of farming are practiced. It is always sold in conjunction with the Congaree types.

CONGAREE FINE SANDY LOAM.

The Congaree fine sandy loam is a light-brown to brown fine sandy loam, from 10 to 18 inches deep, underlain by a yellowish-brown to brown fine sandy loam, silt loam, or silty clay loam, mottled with brown and gray in the lower part of the 3-foot section. Scattered throughout this soil are small areas and narrow bands of loamy fine sand and brown gravelly sand or sandy loam. Spots of dark-brown

loam to silt loam occur in a few places where the finer sediments have accumulated. In such areas, which are generally found nearer the uplands, there is more organic matter. Both soil and subsoil contain considerable quantities of finely divided mica.

The Congaree fine sandy loam normally lies nearest to the streams, and as a rule there are narrow strips and spots of Congaree silt loam lying between the fine sandy loam and the uplands. In most places the type is too small to be shown on the map, and as mapped it includes small areas of Congaree silt loam, Toxaway loam, Congaree stony fine sandy loam, and fine sand.

This type is a first-bottom soil occurring in narrow strips along the streams throughout the county. Its surface is generally level, but in some places, especially along the Swannanoa River, the floods have eroded the land and formed temporary channels and small ridges. The type is subject to frequent overflow following heavy rains, but otherwise the drainage is generally good.

The Congaree fine sandy loam in this county has a small total area, but it is nevertheless an important soil. The greater part of it is under cultivation or used for pasture. It is an excellent soil for the production of corn, the yields ranging from 20 to 50 bushels per acre. Oats, wheat, soy beans, and crimson clover do well. Watermelons, potatoes, sorghum, rye, and truck crops also are grown with good results. Commercial fertilizer is seldom used for corn, but wheat commonly receives applications of 16 per cent acid phosphate at the rate of 100 to 200 pounds per acre. A complete fertilizer mixture, analyzing 8-2-2 or 8-3-3, is used for potatoes. This type, where it occurs in sufficiently large areas to be sold by itself, brings from \$50 to \$200 an acre.

CONGAREE SILT LOAM.

The surface soil of the Congaree silt loam consists of 8 to 18 inches of brown silt loam. The subsoil is a chocolate-brown to yellowish-brown silty clay loam to silty clay, extending to a depth of 3 feet or more. Both soil and subsoil contain finely divided mica flakes in sufficient quantities to give a greasy feel. In places where the colluvial wash from the clay loam soils is mixed with the alluvial soil the surface is a reddish-brown silty clay loam. As mapped the type includes spots of Toxaway loam, Congaree silty clay loam, and narrow strips of Congaree fine sandy loam usually lying immediately along the streams. These areas were not of sufficient size to warrant separate mapping.

The Congaree silt loam is developed along the French Broad River, Swannanoa River, the North Fork of Swannanoa River, and Cane, Newfound, and Flat Creeks. It lies also along a number of the smaller streams in various parts of the county.

The topography is generally flat or almost level with a gradual slope toward the stream courses and in the direction of the flow. Occasional swales or depressions occur. The Congaree silt loam usually lying next to hills or uplands is slightly lower than the strips of fine sandy loam bordering the streams, but is generally well drained except in places along Cane Creek and some small spots in other places in the county.

The Congaree silt loam is the most productive soil in the county, especially for corn and hay. It is nearly all in cultivation. Corn

yields from 30 to 60 bushels per acre without the use of fertilizers. Oats and wheat are important crops, oats yielding from 15 to 30 bushels per acre, and wheat from 9 to 15 bushels.

Land of this type brings the highest prices of any type in the county. Prices range from \$100 to \$200 an acre, varying with the drainage conditions, nearness to shipping points, and state of productiveness. Small areas are, however, generally sold in connection with the adjoining uplands, and the price then depends a great deal on the quality of the upland soils.

Owing to the high natural productiveness of the type, which is maintained by the continual deposition of fresh sediments, fertilizers are seldom used on the Congaree silt loam. The use of lime on this soil will, however, be found beneficial.

MEADOW (CONGAREE MATERIAL).

The few small strips of soil mapped as Meadow (Congaree material) vary greatly in color and texture. Over the greater part of areas the soil consists of a brown fine sand, fine sandy loam, or gravelly and stony fine sand, the fine earth containing a high percentage of micaceous material. In some places where semiswampy conditions prevail the material is a dark mucky loam. The subsoil varies from a mere gravel bed to material of loamy sand to sticky clay texture.

Only small bodies of this soil are mapped, chiefly along the Swananoa River, and Dillinghams and Carters Creeks. The greater part of it is poorly drained. It is not a productive soil for farming, but supports a growth of wild grasses which afford excellent summer pasturage.

Included with Meadow (Congaree material) are a few strips of Riverwash, consisting of sand, gravel, and small stones brought down from the mountains. Such areas are practically nonagricultural, but supply a little grazing. Perhaps a few spots could be used in growing sorghum or corn. The largest strip is found along Stony Fork Creek in the southwestern corner of the county.

ROUGH STONY LAND.

The land mapped as Rough stony land is composed of steep mountain slopes or of rough areas strewn with large boulders and cut with numerous outcropping ledges of rock.

Such areas occur in all of the mountainous sections of the county, but the largest bodies lie on the eastern slope of the Great Craggy Mountains and on Pisgah Ridge.

The land is unsuited for agriculture. It is associated with the stony loams of the Burton, Porters, and Ashe series, and the boulders on the surface are of the same rocks as form the beds underlying these several series.

Most of the Rough stony land is forested, and timber constitutes its greatest value. The principal kinds of trees are chestnut, chestnut oak, white, black, and red oak, buckeye, maple, poplar, spruce, and hemlock. In a few places the type supplies a little grazing.

ROCK OUTCROP.

The areas mapped as Rock outcrop represent solid ledges of rock on the sides and tops of the mountains. The areas are covered with large boulders with a very little soil material and are unsuited to agriculture. The most extensive areas are the tops of Big Pisgah Mountain and Bullhead Mountain. Several small areas are scattered through the Great Craggy Mountains and other mountains in the county.

SUMMARY.

Buncombe County is situated in the western part of North Carolina. The country included consists of a broad intermountain plateau almost surrounded by mountains. This intermountain plateau has a rolling to hilly topography and in its relation to the mountains resembles the Piedmont Plateau. It has an average elevation of about 2,300 feet above sea level. The range of elevation for the entire county is from 1,750 feet above sea level at a point where the French Broad River enters Madison County to 6,419 feet on the summit of Clingmans Peak on the northeastern boundary of the county.

The French Broad River and its tributaries carry the drainage of the county. Streams and streamlets reach all parts of the county and only a few small areas of flat bottom land are poorly drained.

In 1920 the total population of the county was 64,148, 55.6 per cent of which was classed as rural. The principal towns are Asheville (the county seat), Weaverville, Black Mountain, Barnardsville, Biltmore, Leicester, Swannanoa, Fairview, Candler, and Montreat.

Transportation facilities are excellent. The main line of the Southern Railway and two branches of the same system enter the county. The Asheville & East Tennessee Railroad (electric) runs from Asheville to Weaverville. All the public roads are excellent throughout the year; they are well graded, and there are many miles of asphalt, concrete, macadam, and sand-clay hard-surfaced roads.

The climate of Buncombe County is suitable for general agricultural pursuits. The rainfall is sufficient and well distributed throughout the year and the winters are mild. The average growing season is 186 days.

The earliest settlements were made along the streams, especially the Swannanoa and French Broad Rivers. The uplands were not farmed until later on. At present the population is well distributed over the county, except in the roughest mountain sections.

General farming and truck growing are the prevailing types of agriculture. Corn is the main crop. Livestock raising is carried on to some extent. Nearly every farmer raises enough cattle and hogs to supply the home with meat, and a few have cattle for sale. Fruit growing and cattle and sheep raising are receiving a good deal of attention in the mountainous parts of the county.

The heavier upland soils are recognized by the farmers as being better adapted to wheat and clover, and the lighter soils to corn, oats, potatoes, and truck crops. Corn does best on bottom land, but is grown on all the soils of the county.

Practically the same methods and equipment prevail throughout the smoother part of the county, but the equipment varies some in the mountain section.

Acid phosphate is the most generally used fertilizer, although some complete fertilizer and a mixture of cottonseed meal and acid phosphate are used.

About 74.7 per cent of the farms of the county are operated by the owners.

The average value of farm lands is around \$60 an acre, but many of the smoother upland areas and the bottom lands bring as high as \$200 an acre.

Buncombe County occurs in two soil provinces, the Appalachian Mountain Plateau and the River Flood Plains. The Appalachian Mountain Plateau is divided into an intermountain plateau and a mountain region. The soils of the intermountain plateau are represented by the Cecil, Ashe, Davidson, Appling, Iredell, and Wilkes series. These are good general farming soils, and can be built up to a high state of productiveness. The most extensive mountain soils are classed in the Porters, Burton, and Ashe series. These are usually productive soils but are not farmed very extensively, owing to their general rough and mountainous topography. The soils of the Flood Plains are important on account of their productiveness and favorable position for farming, although they occupy only a small part of the county. Most of these alluvial soils are in cultivation, and the crop yields are good.



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