



Issued June 30, 1916.

U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF SOILS—MILTON WHITNEY, Chief.

IN COOPERATION WITH THE NORTH CAROLINA DEPARTMENT OF AGRICULTURE,  
W. A. GRAHAM, COMMISSIONER; B. W. KILGORE, STATE CHEMIST AND  
DIRECTOR AGRICULTURAL EXPERIMENT STATION;  
C. B. WILLIAMS, AGRONOMIST.

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SOIL SURVEY OF WAKE COUNTY,  
NORTH CAROLINA.

BY

L. L. BRINKLEY, OF THE NORTH CAROLINA DEPARTMENT OF  
AGRICULTURE, AND N. M. KIRK, RISDEN T. ALLEN,  
AND B. B. DERRICK, OF THE U. S. DEPART-  
MENT OF AGRICULTURE.

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W. EDWARD HEARN, INSPECTOR, SOUTHERN DIVISION.

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[Advance Sheets—Field Operations of the Bureau of Soils, 1914.]



WASHINGTON:  
GOVERNMENT PRINTING OFFICE.  
1916.

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## LETTER OF TRANSMITTAL.

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

*Washington, D. C., November 10, 1915.*

SIR: In the extension of the soil survey in the State of North Carolina during the field season of 1914 a survey was made of Wake County. This work was done in cooperation with the North Carolina Department of Agriculture, and the selection of the area was made after conference with State officials.

I have the honor to transmit herewith the manuscript report and map covering this work and to request their publication as advance sheets of Field Operations of the Bureau of Soils for 1914, as authorized by law.

Respectfully,

MILTON WHITNEY,  
*Chief of Bureau.*

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

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### FIGURE.

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### MAP.

Soil map, Wake County sheet, North Carolina.

# SOIL SURVEY OF WAKE COUNTY, NORTH CAROLINA.

By L. L. BRINKLEY, of the North Carolina Department of Agriculture, and N. M. KIRK, RISDEN T. ALLEN, and B. B. DERRICK, of the U. S. Department of Agriculture.

## DESCRIPTION OF THE AREA.

Wake County lies in the central part of North Carolina. It is bounded on the north and northeast by Granville and Franklin Counties, being separated from the latter for a short distance by Moccasin Creek, on the south by Johnston, Harnett, and Chatham Counties, and on the west and northwest by Chatham and Durham Counties. It contains approximately 840 square miles, or 537,600 acres.

Wake County lies mainly in the Piedmont Plateau region, with about one-tenth of its area in the Coastal Plain. The topography of the Piedmont Plateau section ranges from level to hilly and broken, being formed of a succession of narrow ridges and broader stream divides. The crests of the interstream areas are level to gently rolling, but become more hilly and broken as the streams are approached. Some of the more level areas occur in the vicinities of Rolesville, Knights Crossroads, Zebulon, Auburn, Carpenter, Apex, and Holly Springs. There are many watershed areas which have a surface ideally suited to farming. Noticeable among these



FIG. 1.—Sketch map showing location of the Wake County area, North Carolina.

is the ridge extending from Raleigh to the Chatham County line, via Cary, Apex, and Newhill, followed by the Seaboard Air Line Railway. From Cary to the Durham County line lies a ridge interrupted only by the Crabtree Valley at Morrisville. Others occur between Adams Crossroads and the Durham County line, between Wake Forest and the Neuse River on the Raleigh Road, and between Falls and the Franklin County line. The most conspicuous rolling or hilly areas are encountered in the southwest-central part of the county along Walnut, Swift, and Middle Creeks, to the north and northeast of Cary, in the northern part of the county north of Falls and to the west of Wake Forest, and along the Neuse River. Throughout the county the Neuse River and the larger creeks have

cut rather deep valleys, and along the channels lie strips of level bottom land.

The surface features of the Coastal Plain section of the county vary from level to rolling, or even somewhat broken nearer the larger streams. Conspicuous among the more level areas are those in the vicinity of Varina, Wilbon, McCullers, Willow Spring, Cairo, and Kennebec, and east of Williams Crossroads. Some of the more rolling areas are encountered in the vicinity of Plymouth Church, near Fuquay Springs, and on the road between Varina and Holly Springs.

The elevation of the county above sea level ranges from 315 to 497 feet. The elevations at some of the towns are as follows: Zebulon and Knightdale, 315 feet; Raleigh, 363 feet; Fuquay Springs, 370 feet; McCullers, 371 feet; Wake Forest, 390 feet; Apex, 480 feet; and Cary, 497 feet.

Wake County is well drained, mainly through the Neuse River. An inextensive area in the eastern part is drained by Moccasin Creek and its tributaries, and the southwestern part is drained through a system of creeks and branches flowing in a southwesterly direction.

On the Neuse River water power is used for operating cotton mills at Falls and for generating electric power at Milburnie. Little River and numerous creeks furnish power for operating grist mills.

Wake County was formed in 1771 from parts of Orange, Cumberland, and Johnston Counties. The early settlers were largely of English descent, with some Scotch. Some of the English settlers came up the Neuse River from Johnston and other eastern counties, while others came from the Albermarle section. The English settled along the Neuse and in the central part of the county, and the Scotch in the southern part. Later immigrants came from Virginia and Pennsylvania.

The population in 1910 as reported by the census was 63,229. Although Wake County ranks second in population among the counties of North Carolina, and though many of the rural districts are well settled, there are still many large tracts of land which await development and there are many abandoned fields that could easily be reclaimed.

Raleigh, located near the center of the county, is the county seat and the capital of North Carolina. It had a population of 19,218 in 1910, and is the third largest city in the State. As an educational and industrial center it is one of the first cities in North Carolina. The city has cotton mills, knitting mills, oil works, foundries, fertilizer factories, and lumber plants. Apex, in the southwestern part of the county, has a population of 681; Wake Forest, in the north-

eastern part, 1,443; Zebulon, in the eastern part, 483; and Fuquay Springs, in the southern part, 127. Wendell, Cary, Holly Springs, and Morrisville are other towns of local importance.

The county has excellent transportation facilities, being traversed by main lines of the Seaboard Air Line Railway and the Norfolk Southern Railroad, the Greensboro-Goldsboro Branch of the Southern Railway, the Durham & Southern Railway, and the Durham & South Carolina Railroad.

Considerable interest is manifested in road improvement. The Central Highway, reaching from the coast to the western part of the State, has recently been extended through the county. Good roads have been built in many other sections. Road work is carried on mainly by convict labor.

The county is well supplied with rural mail delivery routes and telephone lines. Good schoolhouses and churches are located throughout its extent.

Raleigh is a good market for the central part of the county for such products as cotton, truck crops, fruits, berries, pork, beef, and poultry and dairy products. Apex, Fuquay Springs, Wendell, and Zebulon are markets for tobacco and to some extent for other products.

#### CLIMATE.

Wake County, lying in the warm temperate zone, possesses a mild and healthful climate. The summers are not oppressive nor are the winters severe. The absolute range in temperature is from 103° F. to -2° F. The mean annual temperature is approximately 60° F. The rainfall, averaging 48 inches a year, is favorably distributed, the heaviest precipitation occurring in May, June, July, and August.

The average date of the last killing frost in spring is April 4, and of the first in the fall, November 3. This gives a growing season of 213 days, which is sufficient for the production of a wide range of crops. The latest killing frost recorded in the spring occurred on May 6, and the earliest in the fall, on October 8.

The following table, compiled from the records of the Weather Bureau station at Raleigh, gives the normal monthly, seasonal, and annual temperature and precipitation for the county.

*Normal monthly, seasonal, and annual temperature and precipitation at Raleigh.*

| 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.....  | 42.7         | 75                | 9                 | 3.18           | 0.32                              | 1.24                               |
| January.....   | 40.4         | 79                | 2                 | 3.12           | 0.60                              | 3.96                               |
| February.....  | 43.3         | 80                | -2                | 4.24           | 3.23                              | 5.10                               |
| Winter.....    | 42.1         | 80                | -2                | 10.54          | 4.15                              | 10.30                              |
| March.....     | 50.4         | 94                | 16                | 4.19           | 2.77                              | 7.25                               |
| April.....     | 59.0         | 95                | 28                | 3.41           | 2.50                              | 2.98                               |
| May.....       | 68.1         | 98                | 38                | 4.57           | 3.55                              | 9.24                               |
| Spring.....    | 59.2         | 98                | 16                | 12.17          | 8.82                              | 19.47                              |
| June.....      | 75.1         | 102               | 46                | 4.57           | 4.01                              | 4.12                               |
| July.....      | 78.5         | 103               | 54                | 5.43           | 2.51                              | 10.99                              |
| August.....    | 76.8         | 99                | 52                | 6.14           | 8.60                              | 10.42                              |
| Summer.....    | 76.8         | 103               | 46                | 16.14          | 15.12                             | 25.53                              |
| September..... | 70.6         | 100               | 39                | 3.71           | 4.33                              | 1.76                               |
| October.....   | 60.5         | 89                | 31                | 3.12           | 0.47                              | 2.64                               |
| November.....  | 50.2         | 82                | 17                | 2.42           | 2.60                              | 3.71                               |
| Fall.....      | 60.4         | 100               | 17                | 9.25           | 7.40                              | 8.11                               |
| Year.....      | 59.6         | 103               | -2                | 48.10          | 35.49                             | 63.41                              |

#### AGRICULTURE.

Land grants for territory now included in Wake County were issued as early as 1744. The first farmers grew corn, wheat, oats, tobacco, and a little cotton on the uplands, while on the grass lands along the streams they raised cattle and hogs. The implements used in cultivation were crude and most of the work was done by hand, resulting in light yields. Most of the farmers had mills for making meal and flour, and distilleries for using the surplus grain and fruit. They also made turpentine and tar to a small extent. At first there was little exportation, but later the settlers began to trade with Newbern, selling flour, pork, and tobacco, and taking in exchange commodities they could not produce. Still later navigation on the Cape Fear River began and Fayetteville became the market for the eastern, southern, and western parts of the county. For the farmers of the northern part Petersburg, Va., was the better market. Cattle and hogs were driven to this place in large numbers.

The area devoted to cotton in 1879 amounted to 59,916 acres, from which 30,115 bales were produced. The total area devoted to corn

was 53,172 acres; to wheat, 14,783 acres, and to oats, 13,948 acres. Sweet potatoes, hay, tobacco, and rye were grown to a small extent.

In 1889 there was a decrease in the production of cotton, corn, and wheat, while oats, rye, sweet potatoes, and hay showed substantial gains. The acreage in tobacco increased from 230 acres in 1879 to 1,378 acres in 1889. Cowpeas, beans, Canada peas, Irish potatoes, buckwheat, peanuts, fruits, and garden vegetables were grown to some extent.

By 1900 the attention of the farmers had been turned somewhat from the production of cotton, wheat, and oats, and tobacco had become an important money crop. Corn made a considerable gain during the preceding decade, and live stock, dairy products, poultry, and fruits occupied important places in the farm schedule.

In 1909 cotton was the most important crop in Wake County. It occupied 48,664 acres, and the production reached 27,458 bales. Tobacco was grown on 8,101 acres, from which 4,478,073 pounds were obtained, and there were 51,886 acres in corn, producing 686,991 bushels. In the same year 39,809 bushels of oats, 25,377 bushels of wheat, 20,661 bushels of peas, 233,585 bushels of sweet potatoes, 17,809 bushels of Irish potatoes, 6,201 bushels of peanuts, 172 bushels of rye, 6,060 tons of hay and forage, and 491 tons of sorghum were grown. Vegetables amounting in value to \$305,212, and fruits and nuts valued at \$107,741, were produced. The receipts from the sale of domestic animals amounted to \$84,864, and the value of animals slaughtered on farms was \$240,923. The value of dairy products, excluding home-used milk and cream, amounted to \$210,458, while the receipts from the sale of dairy products reached \$83,634. The value of poultry and eggs produced amounted to \$187,616, and the receipts from the sale of poultry and eggs totaled \$53,030.

Cotton, the most important money crop, with proper fertilization and cultivation, gives good yields on all the well-drained types, with the possible exception of the finer textured members of the Granville series. It is most extensively grown on the sandy soils of the Cecil series in the Piedmont Plateau section of the county and on the Norfolk and Ruston sandy loams in the Coastal Plain section. The Simpkins and Kings Improved are the favorite varieties.

As a cash crop tobacco is second. A large acreage is devoted to this crop in the western, northeastern, and southern parts of the county. The Granville coarse sandy loam, Granville sandy loam, and Durham coarse sandy loam are recognized as the best tobacco soils of the county. These types produce the best wrapper tobacco and some of the best bright tobacco grown in the county. In many localities the Applying coarse sandy loam, Cecil coarse sandy loam, and

Cecil sandy loam have been devoted to this crop with good results. A good grade of tobacco is grown on the Ruston sandy loam and the soils of the Norfolk series, but the leaf produced on these types is generally lighter than that produced on the Piedmont soils. The yields range from about 500 to 1,000 pounds per acre, depending upon the soil and the methods of fertilization and cultivation. The most popular varieties grown include the Gold Leaf, Adcock, and Warren.

Corn is the first crop in point of acreage, and is produced in all parts of the county. All the upland soils respond readily to fertilization and proper cultivation and give good yields, and large yields are obtained on the bottom lands without the use of fertilizers.

Oats and wheat are grown inextensively throughout the county. The Granville and Cecil soils give good yields of wheat, but require thorough preparation of the land and careful fertilization. Fall-sowed oats do best, as the spring-sowed crop is liable to injury by excessive summer rains. Rye is seeded to provide winter pasturage. Many farmers make use of rye as a cover crop, to which use it is well adapted.

The cultivated legumes include cowpeas, peanuts, and various clovers. They are grown in all parts of the county. Cowpeas are planted in rows, sowed in corn at the last cultivation, or on oat or wheat stubble. The clovers are grown as hay and pasturage crops, and to some extent for winter cover.

Sweet and Irish potatoes, cabbage, turnips, tomatoes, watermelons, and cantaloupes are the principal vegetable crops of Wake County. They are grown in all sections, but usually only in sufficient quantity to supply the needs of the family. It is only in the vicinity of Raleigh and others of the larger towns that trucking is carried on. Sweet potatoes are among the most important of the vegetable crops. They yield 75 to 300 bushels per acre, the wide range in yields being due to differences in type of soil as well as in methods of cultivation and fertilization.

Fruits are not grown commercially in Wake County, except for the surplus production of the small orchards disposed of in the markets of near-by towns. Peaches and apples are much the most important fruits. Grapes (Scuppernong and Misch) and figs are less extensively cultivated. Pears, cherries, and strawberries are minor fruit crops.

The animal industries of Wake County are not well developed, although the county is surpassed by only two others in North Carolina in value of domestic animals. The 1910 census reports 12,405 cattle, of which over half are dairy cows. Horses and mules numbered about 8,000 and hogs 17,000. Cattle and hogs are raised on nearly every farm, usually only in sufficient numbers to supply domestic requirements. In some sections, particularly near some of

the towns, live stock is raised on a large enough scale to permit the marketing of a few head annually. Flocks of sheep and goats are rare. Poultry, consisting of chickens, ducks, geese, and turkeys, is raised on practically every farm, and census figures show the annual value of fowls and eggs produced as about one-quarter million dollars.

Dairying is engaged in to some extent in all sections, but the county does not rank high in the production of butter and cheese. The sale of dairy products is largely confined to the vicinity of Raleigh.

There is no systematic crop rotation in general practice, although the best farmers follow some definite plan of crop arrangement. For the Granville, Durham, Appling, and Cecil soils a favorite rotation consists of oats and clover the first year, corn the second year, and tobacco the third year. The North Carolina experiment station recommends this 3-year rotation for the sandy soils of the Piedmont Plateau region: First year, cotton, about 8 pounds of crimson clover and 3 pecks of rye per acre being sowed after the first picking and turned under; second year, corn; and third year, oats and vetch, followed by cowpeas. For the clay loams of the Piedmont Plateau region the station recommends the following rotation: First year, corn, with wheat sowed the following fall and red clover sowed in the wheat the following spring; after the wheat is harvested the red clover is to be left on the land, and one cutting made that year and one or two cuttings the following year.

Most of the farmers recognize the value of certain types of soil for the production of specific crops. Cotton makes its most rapid growth on the sandy soils of the Cecil series and on the Norfolk and Ruston sandy loams. Only early maturing varieties can be successfully grown on the heavy clay loams, owing to the loss likely to occur through damage to immature bolls by frost. Tobacco does well on the medium-textured and coarse-textured members of the Granville series, on the Durham and Appling coarse sandy loams, and on the Norfolk and Ruston sandy loams. Corn does well on all the upland soils, but the soils of bottom lands, owing chiefly to the larger and more constant water supply on these low-lying lands, are particularly suited to this crop. Oats, wheat, grasses, and clovers do well on the heavy red clay loams of the Cecil and Louisa series, on the finer textured soils of the Granville series, and on the Iredell loam. Truck crops, sweet potatoes, watermelons, and cantaloupes do best on the types having deep sandy surface soils. The sandy lands found in the bottoms along the Neuse River are admirably adapted to watermelons.

Fertilizers are widely used in Wake County. In the census year 1909 the expenditure for fertilizer amounted to \$387,777, practically

three times the outlay in 1899. A large part of the fertilizer used is purchased as complete mixtures, but many farmers either do their own mixing or have their fertilizer put up at the factories according to special formulas. For cotton, an application of 300 to 600 pounds per acre of an 8-3-3<sup>1</sup> mixture is commonly made. Tobacco is the most heavily fertilized crop, 750 to 1,200 pounds per acre of an 8-3-3 mixture being generally applied, although some make lighter applications of an 8-4-4 or 8-4-6 mixture. Corn on the uplands is generally fertilized with 200 to 400 pounds of an 8-3-3 fertilizer, and some farmers find it profitable to apply a top dressing of 100 pounds of nitrate of soda and cottonseed meal mixed. Wheat is sometimes given 200 to 400 pounds of 8-3-3 fertilizer, though it often receives only acid phosphate. From 50 to 100 pounds of nitrate of soda sowed broadcast over wheat and oats in the spring increases the yields, and cowpeas are benefited by an acreage application of 300 to 500 pounds of acid phosphate.

Most of the soils of the county can be brought up to and maintained in a high state of productiveness. A few of the farmers have adopted intensive methods, including deep plowing, subsoiling, turning under green manuring crops, liming, and the rotation and diversification of crops. The yields on all soils are increased by deep plowing in the fall, breaking the land a little deeper each year, until a depth of about 10 inches has been reached. This is particularly beneficial in the case of the heavy clay loam soils of the Cecil and Louisa series and the Iredell loam. Most of the soils are benefited by liming, especially where large quantities of green manures have been turned under. Much of the abandoned hillside land that is washed and gullied could be reclaimed and safeguarded from future erosion by deep plowing, sowing to winter cover crops, and seeding to grasses. In many of the rolling and hilly sections of the county where the soils are particularly adapted to grains, clovers, and grasses there are possibilities in the extension of the animal industries, and the soils would on the whole be much improved under a farming system where more live stock is kept.

Farm labor is scarce throughout the county, especially in the vicinity of the towns, owing to the demand for labor in the many lumber mills and manufacturing plants, where the wages are higher and certain other conditions more attractive. For farm work, men receive from \$1 to \$1.50, and women and children from 50 cents to \$1 a day. Cotton pickers are paid by the hundredweight, the pay ranging from 50 cents per hundred pounds in the early part of the season to \$1 late in the fall.

The farms vary considerably in size. Many farms comprise 20 to 40 acres, while on the other hand there are plantations ranging

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<sup>1</sup> Numerals represent respective percentages of phosphoric acid, nitrogen, potash.

in size from 300 to 600 acres, and a few holdings of 800 to 900 acres. The average size of farms for the county is 78.4 acres.<sup>1</sup> Within recent years many large tracts have been subdivided and sold.

Approximately 45 per cent of the farms of Wake County are operated by owners. On these most of the work is done by the farmers and their families. Nearly all the remaining 3,390 farms are operated by tenants. Many systems of leasing are employed. In some cases the owner receives a money rent, while in others for a one-horse farm he receives about 1,000 pounds of lint cotton. Where the owner furnishes the land, work stock, implements, and one-half the fertilizer he receives one-half of all crops.

Land values have increased appreciably in the last few years, owing to the construction of railroads through remote parts of the county, the establishment of new towns, and the building of good highways. In the vicinity of Raleigh values range from \$60 to \$225 an acre, and near the smaller towns from \$40 to \$100 an acre. In the more remote sections land can be bought for about \$15 an acre.

#### SOILS.

Wake County is traversed by the line separating the Piedmont Plateau and Coastal Plain provinces. Approximately one-tenth of its area, or about 80 square miles, in the southeastern and extreme southern parts of the county, is within the Coastal Plain. The line of demarcation between these two provinces begins where the Southern Railway crosses the Wake-Johnston County line and extends southwesterly, passing about 3 miles to the north of Fuquay Springs and through Holly Springs, where it makes a slight deviation toward the south. Coastal Plain material extends here and there into the Piedmont region, while erosion in places has carried Piedmont material along slopes and stream courses for short distances into the Coastal Plain province.

All the upland soils of the Piedmont Plateau section of the county are residual in origin, having been formed through the weathering of the various underlying rock formations. Practically all the eastern part of the county, east of a line beginning south of Auburn, on Swift Creek, and extending along the course of the Neuse River to Wake Forest, is underlain by coarse-grained and porphyritic granites. Diorite rock occurs in small areas in the northern extremity of the county, being conspicuous around Free Union Church. The principal developments of mica schist are also in the northern extremity of the county, mainly northwest of Wake Forest. The Triassic formation, consisting predominantly of red and gray sandstones and shales, underlies the southwest corner and the western

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<sup>1</sup>The census tabulates each tenancy as a distinct farm.

part of the county. The line separating this formation from the Coastal Plain and the Piedmont material begins near the Harnett and Chatham County line, passes near Holly Springs, west of Cary, and continues in a northeasterly direction to the Durham County line at Sycamore Creek. Another prominent development of this formation begins at Lawrences Bridge on the Neuse River and extends northeasterly to the point where Beaverdam Creek intersects the Granville-Wake County line. The prevailing rocks throughout the central, north-central, and the remaining parts of the county are medium-textured to fine-grained granites and gneisses, with small areas of schist. Just east of Raleigh granite outcrops. Evidences of graphite were observed north of Raleigh, north of Method, and southwest of Cary. Quartz intrudes in characteristic veins through the formations of the Piedmont Plateau, and the quartz gravel and fragments which are abundant on the surface over considerable areas are due to the superior resistance of this mineral to weathering. Mica is abundant in the mica schist and there is a considerable content of mica in all the residual soils.

These rocks of diversified chemical and physical composition have upon disintegration and subsequent weathering given rise to soils of considerably different character.

In the Piedmont Plateau section of the county the Cecil, Durham, Louisa, Appling, Granville, and Iredell series are developed.

The soils of the Cecil series are characterized by gray to red surface soils and red, stiff clay subsoils. They have been formed largely through the weathering of granites and gneiss, these being modified locally by schist. These rocks carry iron-bearing minerals which, upon oxidation, have imparted the red color to the soil and subsoil.

The Cecil coarse sandy loam is derived mainly from coarse-grained and porphyritic granites, while the gravelly loam is derived entirely from porphyritic granite. Other members of the series have been formed through the weathering of medium-textured granites and gneisses, and to a small extent from schist. The difference in the texture of these soils is due largely to surface erosion, which has produced the heavy types by a more or less complete removal of the sandy mantle in places, and has given rise to the sandier members by the slow but constant carrying away in suspension, of the fine material by rain water.

The Durham series is represented by three types, the coarse sandy loam, fine sandy loam, and gravelly sandy loam, the last being shown by gravel symbol in coarse sandy loam color. The surface soils are prevailingly light gray in color, and the subsoils consist of yellow, moderately friable clay. The coarse sandy loam owes its origin to the weathering of coarse-grained granites, and the fine sandy loam

to the breaking down of granites of correspondingly finer texture. These granites appear to be more siliceous and to contain a smaller content of iron-bearing minerals than the granites underlying the Cecil types, and the less pronounced oxidation is largely responsible for the lighter color of both the soil and subsoil.

The Louisa series comprises three types, the sandy loam, clay loam, and gravelly loam, the last being shown by gravel symbol in sandy loam color. These have been derived from the decay of mica schist, modified locally by gneiss. The feature distinguishing these types from the Cecil series is their relatively high mica content. Mica scales occur to a greater or less extent in the surface soil, and in such large quantities in the subsoil as to give the red clay a moderately friable structure, a greasy feel, and a speckled, glistening appearance. Generally the mica schists have not weathered so deeply as the similar rocks giving the Cecil series, or else surface erosion has kept close pace with disintegration, and consequently the partially disintegrated rock is frequently encountered within the 3-foot section.

The Appling series is represented by the Appling coarse sandy loam, sandy loam, and gravelly sandy loam, the last being shown by gravel symbol in sandy loam color. These types comprise material intermediate, in point of subsoil color, between the red clay of the Cecil series and the yellow clay of the Durham. The coarse sandy loam owes its origin to the disintegration and decay of coarse-grained and porphyritic granites, while the sandy loam is derived largely from granite and gneiss rocks.

The Granville series is characterized by light-gray surface soils and yellow, friable clay subsoils, which, in the lower part of the 3-foot section, grade into a mottled Indian-red, reddish-yellow, and gray clay. In this county it embraces five types, the coarse sandy loam, sandy loam, gravelly sandy loam, shown by gravel symbol in sandy loam color, fine sandy loam, and silt loam. These are residual products of the Triassic formation, consisting of purplish, Indian-red, and gray sandstones and shales, outcrops of which occur in road cuts and on eroded knolls. The coarse sandy loam, sandy loam, and gravelly sandy loam have been derived from coarse-grained sandstones. The yellow color of the subsoil, as contrasted with the Indian-red color of the substratum, would indicate that the processes of leaching and the changes brought about in the weathering of this sandstone have removed the compounds having a greater content of iron. The silt loam is the result of the weathering of purplish and gray shale.

The Iredell series is represented by only one type, the Iredell loam. This type is characterized by a brownish-gray surface soil and a

brownish-yellow, waxy, impervious clay subsoil. It has been derived from the weathering of diorite rock, modified locally by acid granite.

The formations over the Coastal Plain section of the county include unconsolidated sands, clays, and gravel of sedimentary origin, brought down from the Piedmont and Appalachian Mountain regions and deposited while this part of the county was sea floor. These sediments have been more or less changed since their deposition by the agencies of weathering, including erosion, oxidation, drainage, and the decaying of vegetation. These changes have resulted in the formation of different soil types, which are classed with the Norfolk, Ruston, and Orangeburg series.

The Norfolk series in this county includes the coarse sand, sand, and sandy loam. These types are characterized by light-gray surface soils and yellow sand or sandy clay subsoils. The light color of the soil and subsoil of these types as compared with that of the Ruston sandy loam is due to less complete oxidation of the iron compounds or to a smaller content of iron-bearing minerals in the original material. The surface soil of the Ruston type is not materially different from that of the Norfolk soils, but the subsoil is intermediate in color between the red of the Orangeburg and the yellow of the Norfolk. The Orangeburg type is of small extent and is mapped with the Ruston sandy loam, being distinguished by inclusion symbols.

In places along the line of contact between the Piedmont Plateau and Coastal Plain regions a shallow covering of unconsolidated Coastal Plain material overlaps the residual clays of the Piedmont soil province. The surface soil here is brownish and the subsoil a red, stiff clay. This material is really the Bradley gravelly sandy loam, but on account of its small extent it is shown on the map by inclusion symbols with the Cecil sandy loam.

Along the rivers and practically all the smaller streams are continuous strips of recent alluvium, occupying the present flood plains, and in a few places old alluvium, occupying second bottoms or low terraces. These alluvial sediments represent wash from the surrounding uplands, brought down and deposited by the streams at times of overflow. The second-bottom or terrace soil was deposited when the streams flowed at much higher levels than at present. This terrace material is really the Altavista silt loam. On account of its small areas this type has been mapped with the Congaree silt loam, being distinguished by inclusion symbols. Similarly, the miscellaneous type, Meadow, is mapped with the Congaree fine sandy loam. The two Congaree soils comprise alluvial first-bottom material.

The following table gives the name and the actual and relative extent of each of the soil types mapped in Wake County:

*Areas of different soils.*

| Soil.                         | Acres.  | Per cent. | Soil.                       | Acres.  | Per cent. |
|-------------------------------|---------|-----------|-----------------------------|---------|-----------|
| Cecil sandy loam.....         | 113,024 | 21.0      | Cecil fine sandy loam.....  | 13,440  | 2.5       |
| Durham coarse sandy loam..    | 77,056  | 14.3      | Cecil gravelly loam.....    | 8,384   | 1.6       |
| Cecil coarse sandy loam.....  | 55,616  | 10.4      | Norfolk sand.....           | 7,872   | 1.5       |
| Cecil clay loam.....          | 41,792  | 7.8       | Louisa sandy loam.....      | 7,744   | 1.4       |
| Granville fine sandy loam.... | 38,400  | 7.1       | Norfolk sandy loam.....     | 7,616   | 1.4       |
| Appling coarse sandy loam.... | 34,240  | 6.4       | Durham fine sandy loam..... | 6,784   | 1.3       |
| Ruston sandy loam.....        | 24,320  | 4.5       | Norfolk coarse sand.....    | 6,720   | 1.3       |
| Granville sandy loam.....     | 19,584  | 3.6       | Granville silt loam.....    | 4,928   | .9        |
| Granville coarse sandy loam.. | 18,944  | 3.5       | Louisa clay loam.....       | 4,224   | .8        |
| Appling sandy loam.....       | 16,192  | 3.0       | Iredell loam.....           | 1,600   | .3        |
| Congaree silt loam.....       | 15,040  | 2.8       |                             |         |           |
| Congaree fine sandy loam....  | 14,080  | 2.6       | Total.....                  | 537,600 | .....     |

CECIL GRAVELLY LOAM.

The fine-earth material of the Cecil gravelly loam, to a depth of about 6 inches, is a brownish-gray fine sandy loam or sandy loam. Approximately 30 to 50 per cent of the surface soil consists of fine particles and fragments of the parent rock and a small quantity of quartz gravel. The surface soil is underlain by a yellowish-gray gravelly sand, which continues to a depth of 3 feet or passes into a red or reddish-yellow, coarse, friable sandy clay. Frequently on knolls and crests of ridges the gravelly sandy material grades almost imperceptibly into the disintegrated granite at about 10 to 20 inches. Outcrops of this coarse-grained or porphyritic granite are common, and surrounding these outcrops fragments of rock are present on the surface. Spots of gravelly sand of a decidedly brown color and having a red, yellow or brown, friable sandy loam subsoil with a large content of fine particles of granite are occasionally encountered.

The Cecil gravelly loam is an inextensive and unimportant type. The most conspicuous developments of this soil are along Powell and Hodges Mill Creeks, near Milburnie, east and southeast of Rolesville, in the vicinity of New Hope Church, and along the Neuse River.

The type usually occupies knolls and ridges, and occasionally slopes. Its porous structure and friable texture induce excessive drainage, favored by the rolling surface. Where the soil is underlain at a shallow depth by the rotten rock it is naturally droughty.

With the exception of the rougher areas in the vicinity of Rolesville, practically all of this soil is under cultivation. Cotton yields

from one-half to one bale, corn from 12 to 20 bushels, and tobacco from 600 to 800 pounds per acre. All of these crops receive about the same fertilization as on the associated types. The high yields on this type are probably due to the fact that the rock from which it is derived has an exceptionally high content of potash.

This soil is generally sold with the adjoining types at from \$15 to \$35 an acre.

#### CECIL COARSE SANDY LOAM.

The surface soil of the Cecil coarse sandy loam is typically a gray, coarse sandy loam or loamy coarse sand having a depth of about 5 to 12 inches. The subsoil is a red, stiff to moderately crumbly clay, which usually extends to a depth of more than 3 feet, but which in small areas passes into the disintegrated rock at about 30 to 36 inches. Generally, the subsoil of this type is not quite so red as the subsoil of the other members of the Cecil series, and frequently on the slopes, where erosion has kept comparatively close pace with weathering, the color is more nearly a salmon red or a reddish brown. In places there is a small quantity of angular quartz gravel, quartz fragments, and particles of the parent rock on the surface. On some of the slopes the sandy material has been largely washed off, leaving a red loam containing coarse sand and fine gravel. Areas of gravelly loam and Appling coarse sandy loam too small and scattered to separate are mapped with this type.

The Cecil coarse sandy loam comprises a large aggregate area in the eastern half of the county. The type occupies level to gently rolling interstream areas, which become strongly rolling, broken, and somewhat rough near the streams and drainage ways. By reason of the open structure of the surface soil and the rolling topography, natural surface drainage is well established. Ravines occur in places on the steeper slopes, but aside from this erosion is not pronounced, although terracing and contour cultivation are necessary to prevent surface wash and gullying.

Much of this type is under cultivation. The more rolling and broken bodies are forested with red, white, and post oak, together with some shortleaf and old-field pine. Cotton, corn, clover, and cowpeas yield well on the heavier and shallower areas, and rye, watermelons, peanuts, sweet potatoes, and other vegetables do well on the deeper and more sandy areas. Cotton yields from one-half to 1 bale per acre with a liberal application of commercial fertilizer, and corn from 12 to 20 bushels. The soil is benefited by deep plowing and the application of organic matter.

Land of this type sells for \$15 to \$50 an acre, depending on the location with respect to towns.

## CECIL FINE SANDY LOAM.

The surface soil of the Cecil fine sandy loam consists typically of a gray fine sandy loam, which usually passes at about 3 to 5 inches into a yellowish-gray or reddish-yellow fine sandy loam. The subsoil, beginning at about 7 to 10 inches, is a red, stiff but moderately brittle clay extending to a depth of 3 feet or more. In a few localities, especially west of Raleigh, the subsoil is a reddish-yellow clay, which in the lower part of the 3-foot section grades into the characteristic red clay. In a few spots northwest of Cary the surface soil is reddish brown in color. On eroded slopes the sandy surface material has been washed away, leaving the red clay exposed. Quartz gravel and fragments appear on the surface in places, and occasionally in sufficient quantities to make the soil gravelly or stony.

The Cecil fine sandy loam has an inextensive development in the county. The largest areas are mapped west of Raleigh in the vicinity of Method, near Cary, in the vicinity of Tippers Crossroads, and west of Ebenezer Church.

The surface of the greater part of this type is gently rolling to hilly, becoming rough and dissected along the small streams. Surface drainage is excellent, and in places the run-off is so rapid as to cause gulying.

Typically the Cecil fine sandy loam is a mellow and easily tilled soil, and only in the areas of finer textured soil is there any noticeable baking or clodding when plowing is done under proper moisture conditions. Much of this land is under cultivation, the remainder being forested with red, white, and post oak, hickory, and old-field pine.

Corn, cotton, oats, wheat, clover, and cowpeas do well, and areas having a deep surface soil are well suited to tobacco, sweet potatoes, and late truck crops. At present the type is used mainly for corn, cotton, and oats. Sweet potatoes are grown for home consumption. Corn yields 15 to 25 bushels, cotton from one-third to 1 bale, and sweet potatoes 100 to 200 bushels per acre. Fall-sowed oats give good yields. This soil responds to the same methods of cultivation and improvement as the Cecil sandy loam.

Land of this type sells at \$15 to \$25 an acre in the more remote sections of the county, and for \$75 to \$125 an acre in the vicinity of Raleigh.

## CECIL CLAY LOAM.

The surface soil of the Cecil clay loam, locally called "red land," is prevailingly a reddish-brown to red clay loam or heavy loam ranging in depth from about 4 to 8 inches. The subsoil, extending to a depth of several feet, is a red, stiff clay, hard and brittle when dry, and

sticky and plastic when wet. This soil represents a grade of material intermediate in texture between the Cecil sandy loam and the Cecil clay. Included in the type as mapped are intricately associated spots of Cecil sandy loam, fine sandy loam, and heavy red clay. Practically every field on this type presents a rather spotted appearance, owing to these variations in surface color. Spots of dark-brown or snuff-colored clay loam, commonly called "dead land" or "push land," are occasionally seen. Frequently the surface material to a depth of about 1 to 3 inches is a gray to reddish-brown heavy sandy loam. Like the other Cecil types, the Cecil clay loam has on the surface in some localities a noticeable quantity of angular quartz gravel and fragments. The red "galled" spots, developed mainly by the exposure of the underlying red stiff clay by surface erosion, would have been represented as Cecil clay had their extent warranted a separation on the soil map.

The Cecil clay loam is one of the extensive and important types of the county. It has a rather general distribution in the central and northwestern parts.

The topography is characteristically gently rolling to rolling. On the crests of the broader divides the surface is gently rolling, but it becomes more sharply rolling and broken as the streams are approached. The natural surface drainage is good to excessive, and in the rougher areas the run-off is so rapid that many gullies and ravines have been formed by erosion.

Most of the Cecil clay loam is under cultivation. The native forest growth consisted mainly of hardwoods, such as red, white, and post oak, and hickory, together with some poplar, sourwood, dogwood, and cedar. Old-field pine springs up on the abandoned fields.

Wheat, oats, corn, red clover, soy beans, cowpeas, early maturing varieties of cotton, cabbage, Irish potatoes, and late garden vegetables are successfully produced on the type. Cotton yields about one-half to 1 bale when fertilized with as much as 400 pounds of an 8-3-3 fertilizer per acre, and corn from 15 to 30 bushels. Sorghum cane is grown for sirup for domestic use. In the vicinity of Raleigh late truck crops are extensively grown for market, and there are small apple, peach, and pear orchards.

This type, owing to its relatively high content of sand in the surface soil, usually works up into good tilth, though it requires heavy machinery and strong draft. It is naturally a strong soil and can be built up to a high state of productiveness with proper methods of cultivation and fertilization, including deep plowing, thorough preparation of the seed bed, the turning under of leguminous crops or barnyard manure, and liming, the latter at the rate of 1,000 to 2,000 pounds per acre. Fertilizers are essential for the profitable

production of corn, wheat, and oats. Under ordinary conditions increased yields of these crops are obtained with light applications of 16 per cent phosphate.

The price of the Cecil clay loam ranges from \$20 to \$100 an acre, depending on the improvements and location.

#### CECIL STONY CLAY LOAM.

The areas in Cecil clay loam color, but indicated on the map with stone symbols, comprise the Cecil stony clay loam, which, owing to its small development and its close association with the clay loam, is not mapped separately. The stony clay loam differs from the clay loam principally in the abundance of quartz fragments, measuring 2 to 6 inches in diameter, scattered over the surface and distributed through the soil. Most of the type occurs in the northern part of the county. Some of the more prominent areas are near Leesville, in the vicinity of Pleasant Grove Church, and between Lower and Upper Bartons Creeks. It occupies chiefly rolling ridges and markedly rolling to broken slopes. Surface drainage is good. Some of the smoother areas are under cultivation. The rolling and broken bodies are forested with red, white, and post oak, and some cedar and pine. This soil responds to the same methods of treatment as the Cecil clay loam, although, on account of its stone content, it is more difficult to cultivate.

Owing to its distance from towns and transportation facilities, the value of this land is low, ranging from about \$12 to \$25 an acre.

#### CECIL SANDY LOAM.

The surface soil of the Cecil sandy loam is prevailingly a gray, light sandy loam or a loamy sand of medium texture, ranging in depth from 6 to 12 inches. In those areas where the sandy surface soil is more than 6 inches deep a yellowish to reddish-yellow sub-surface stratum of light sandy loam immediately overlies the typical red clay subsoil. In places, especially where the type borders the Cecil clay loam, the surface soil is a light-brown to almost red sandy loam. The subsoil of the Cecil sandy loam is a red stiff clay similar to that of the Cecil clay loam, and extending usually to a depth of several feet. Disintegrated granitic and gneiss rocks appear within the 3-foot section on some of the slopes and knolls. Quartz fragments appear on the surface throughout the greater part of the type, but seldom in sufficient quantities to render the soil a stony or gravelly type.

While most of the type consists of material of medium texture, there are slight variations embracing spots of coarse sandy loam, fine sandy loam or clay loam. The clay loam variation on the

steeper slopes is due mainly to removal of the sandy surface material by erosion. Spots having a gray sandy surface soil and a reddish-yellow subsoil are included with this type as mapped.

The Cecil sandy loam is the most extensive soil type in Wake County. It is developed throughout the central, south-central, southeastern, and northern parts of the county in rather continuous bodies of irregular outline and in numerous isolated areas.

The type occupies level, gently rolling, and smoothly sloping areas. The bolder topography is naturally developed on the lower slopes, where there has been dissection by small streams and ravines. The surface of the type is characteristically smoother than that of the associated Cecil soils, but the position as well as the structure of the soil favors good drainage. Generally the lay of the land permits both intensive and extensive farming operations with improved machinery.

A large percentage of this type has been cleared and is now under cultivation. The remainder supports a forest growth consisting principally of white, red, and post oak, with some hickory, dogwood, sourwood, cedar, and in places a second growth of pine.

A wide range of crops can be grown on this soil. The heavier areas and those with shallower surface soil are generally used for the production of corn, wheat, oats, cotton, clover, and cowpeas, while the areas having the sandier and deeper surface soil give best results with sweet and Irish potatoes, peanuts, watermelons, cantaloupes, heavy tobacco, and truck crops, such as English peas, Lima beans, tomatoes, early cabbage, squash, cucumbers, turnips, okra, parsnips, radishes, onions, and beets. Sorghum cane is grown on a small acreage, to furnish sirup for home use. Fruits, including the peach, apple, cherry, plum, and grape, are grown in quantities large enough to supply the local markets to a greater or lesser extent. In the vicinity of Raleigh considerable trucking is carried on. Dairying is an important industry on this type.

Corn, when fertilized liberally with an 8-3-3 mixture, yields 15 to 40 bushels per acre. Cotton yields from one-half to 1 bale per acre, and in exceptional cases, when heavily manured or fertilized, as much as 1½ bales has been obtained. Oats yield fairly well, but most of the oat crop is fed in the sheaf. Sweet potatoes yield 75 to 200 bushels per acre.

The Cecil sandy loam is a mellow, friable soil, and is more easily tilled than the associated type, the clay loam. The areas of shallower surface soil, where the stiff clay comes near the surface, require deeper plowing and more thorough preparation of the seed bed than those in which the sandy surface soil is deep. Ordinary droughts do not injure growing crops where the soil has been well prepared and

subsequently given frequent shallow cultivation. Like all the other upland soils of the county, this type is generally deficient in organic matter, and its productiveness and water-holding capacity are greatly increased by turning under green manuring crops, such as cowpeas, clover, and rye, or by the addition of barnyard manure.

The Cecil sandy loam sells for \$25 to \$125 an acre, depending upon the accessibility of markets and its proximity to the city of Raleigh.

#### CECIL STONY SANDY LOAM.

The areas in Cecil sandy loam color, but marked on the soil map with stone symbols, represent the Cecil stony sandy loam. The interstitial material of this soil is not essentially different from that of the sandy loam. Scattered over the surface and disseminated throughout the surface soil in the proportion of about 15 to 50 per cent of the soil mass are angular quartz fragments ranging from small particles to pieces several inches in diameter.

The stony sandy loam is comparatively inextensive, being confined mostly to the northwestern and northern parts of the county, the more prominent bodies occurring northeast of Cary, between Crabtree and Sycamore Creeks, around Ebenezer Church, and near and northwest of Leesville. The topography is prevailingly rolling to hilly, and this type embraces some of the roughest land in the county. The surface drainage is thorough and in places excessive. The stones, abundant throughout the surface material, have a tendency to check erosion and aid in the conservation of soil moisture.

Most of this stony land is forested with white, post, and red oak, hickory, sourwood, dogwood, cedar, and shortleaf pine. Cultivated areas are used for practically the same staple crops as the Cecil sandy loam. Cotton yields from one-half to one bale per acre with an application of 400 to 500 pounds per acre of an 8-2-2 or 8-3-3 fertilizer, and corn from 15 to 30 bushels. The stony sandy loam is not valued so highly as the sandy loam, as the stones to some extent interfere with cultivation and restrict the use of modern machinery. Valuations range from \$12 to \$30 an acre.

#### CECIL GRAVELLY SANDY LOAM.

The areas in Cecil sandy loam color, and indicated by gravel symbols, represent the Cecil gravelly sandy loam. The surface soil is characteristically a reddish-brown fine sandy loam or sandy loam having a depth of about 5 to 8 inches and containing an abundance of quartz gravel and iron concretions. The subsoil is a red, stiff, but fairly brittle clay extending to a depth of 3 feet or more. Included in this type are spots having a mottled red and yellow clay subsoil, resembling the Applying gravelly sandy loam.

Areas of the Cecil gravelly sandy loam are scattered throughout the northwestern part of the county and to some extent over the south-central part. Some of the more typically developed areas are encountered around Macedonia, near Orfords Pond, along Swift Creek, near Banks, northwest of Raleigh, in the vicinity of Mount Vernon and Bay Leaf Churches, near Falls, and to the north and northeast thereof.

The topography of the greater part of the type is rolling to hilly. Level or, gently rolling areas occur on the broader divides such as those around Macedonia. The rolling topography favors thorough surface drainage, but the gravel content in some measure prevents severe erosion. It is detrimental, however, interfering to some extent with tillage.

The original forest growth on this soil consisted mainly of hardwoods. Most of the merchantable timber has been cut and there now remains a scattered growth of red, white, and post oak, hickory, and shortleaf pine.

The Cecil gravelly sandy loam is used chiefly for corn, cotton, cowpeas, and clover. These and the other common crops succeed on this type. Cotton, with a liberal application of an 8-3-3 fertilizer, yields one-half to one bale per acre. Corn yields 15 to 30 bushels an acre with an application of 200 to 400 pounds of a similar mixture.

While some areas of this type sell for as much as \$100 an acre, it is not so valuable a soil for agriculture as the Cecil sandy loam, and the usual price ranges from about \$20 to \$30 an acre.

#### BRADLEY GRAVELLY SANDY LOAM.

Inclusion symbols are used on areas mapped with the Cecil sandy loam to represent small bodies of Bradley gravelly sandy loam. The surface soil of this type is a brownish-gray to yellowish-brown sandy loam to fine sandy loam ranging in depth from about 5 to 8 inches and containing about 20 to 50 per cent of rounded quartz gravel and a few quartz stones. The subsoil is a red stiff clay extending to a depth of 3 feet or more. The subsoil is identical with that of the Cecil soils. Occasionally mica is present to a small extent in flakes.

The Bradley gravelly sandy loam in Wake County is an extension of developments of that type in Johnston County. It occurs in small areas along the line of contact between the Piedmont Plateau and the Coastal Plain regions.

The Bradley gravelly sandy loam occupies knolls, ridges, and hill-sides. Owing to its rolling surface and the open structure of the soil, the natural drainage is excellent. Nearly all of this type is under cultivation. It gives fair yields of cotton and corn.

## DURHAM COARSE SANDY LOAM.

The Durham coarse sandy loam consists of a light-gray to whitish coarse loamy sand, passing at about 6 inches into a yellowish-gray or pale-yellow light sandy loam, which extends to a depth of about 10 to 15 inches. The subsoil in the typically developed areas is a yellow, friable coarse sandy clay, which quickly grades into a deep-yellow clay carrying a sufficient quantity of coarse sand to cause it to be moderately crumbly. Faint mottlings of red are conspicuous in the lower part of the 3-foot section. In places fine quartz gravel and occasionally quartz stones are strewn over the surface, but never in sufficient quantity to interfere with cultivation. Included in this type are spots of Appling coarse sandy loam. Other patches included consist of a coarse sandy loam underlain by a brownish-yellow stiff clay, and frequently at the base of slopes the type consists of patches or narrow strips of gray coarse sandy loam with a white or mottled white, yellow, and gray clay subsoil. Such soil would be mapped Worsham coarse sandy loam if of sufficient extent to separate.

The Durham coarse sandy loam is one of the most extensive and important types in the eastern and southeastern parts of the county. Its development begins on the Franklin County line and continues southward interruptedly to the Johnston County line. It occupies level and undulating areas on the broader divides and rolling to broken areas bordering the drainage ways, where the small streams have eroded the surface rather severely. All of the type possesses good natural drainage. The broad interstream areas have a topography favorable for the operation of farm machinery.

The natural forest growth consists of hardwoods and other trees found on the associated types. A large proportion of this soil has been cleared and put under cultivation.

The type is used for the production of corn, rye, bright tobacco, sweet potatoes, cantaloupes, peanuts, and garden vegetables. Tobacco usually yields from 600 to 800 pounds per acre with a liberal application of an 8-4-4 or 8-4-6 fertilizer. The tobacco grown upon this type cures to a bright and attractive color and sells at fancy prices. Sweet potatoes, when well fertilized or manured, yield from 200 to 300 bushels per acre. Corn, when fertilized with 300 to 500 pounds per acre of an 8-3-3 fertilizer, yields 15 to 30 bushels per acre. On the area south of Auburn and Garner and on many other areas as much as a bale of cotton per acre has been obtained.

The Durham coarse sandy loam is greatly deficient in organic matter. Turning under rye, cowpeas, and crimson clover, or adding large quantities of barnyard manure results in increase in yields noticeable for several years. It is reported that tobacco planted

after clover or cowpeas is inferior in color and texture, but when corn intervenes between a leguminous crop and tobacco both the quality and yield of the leaf are satisfactory. When tobacco, following a leguminous crop, is fertilized with a mixture containing a large proportion of potash and a small proportion of acid phosphate and nitrogen the undesirable results referred to above are practically avoided.

Land of the Durham coarse sandy loam sells at \$15 to \$60 an acre, depending upon the improvements and location.

#### DURHAM GRAVELLY SANDY LOAM.

The areas within the Durham coarse sandy loam marked on the soil map with gravel symbols represent Durham gravelly sandy loam. The surface soil is a light-gray coarse to medium loamy sand having a depth of about 5 to 8 inches and carrying approximately 20 to 50 per cent of quartz gravel and fine fragments. Most of the gravel particles are angular, but some have been rounded by the action of water.

Frequently below 6 inches and extending to the clay subsoil a subsurface stratum of pale-yellow coarse to medium loamy sand is encountered. The typical subsoil is a bright-yellow clay containing a sufficient quantity of coarse sand to render it moderately friable. In areas too small to map the subsoil is a reddish-yellow or red, rather stiff clay, such areas representing the Appling or Cecil gravelly sandy loam. Included in this type are also patches of dark-gray gravelly sandy loam underlain by a brown or brownish-yellow subsoil.

The Durham gravelly sandy loam occurs in small areas in the vicinity of Apex and Cary, northeast of Mount Moriah Church, northwest of Catawba Springs Church, around Pleasant Grove Church, and east and southeast of Tippers Crossroads. It occupies small knolls and narrow ridges, and generally is smoothly sloping. Surface drainage is naturally good or excessive, but the gravel on the surface in a large measure checks erosion.

Owing to the isolated location of this type, the high content of gravel, which interferes to some extent with tillage, and the sloping surface, only a small proportion of it has been brought into cultivation. Most of it supports a growth of hickory, dogwood, red, white, and post oak, and pine. It is not considered a very desirable soil for general farming, although cotton and corn are grown on it to some extent.

#### DURHAM FINE SANDY LOAM.

The Durham fine sandy loam consists of a light-gray fine sandy loam, passing at about 3 to 6 inches into a pale-yellow fine sandy loam, which extends to a depth of about 7 to 12 inches. The subsoil

is a deep-yellow friable clay or fine sandy clay. Occasionally mottlings of red or yellow and red appear in the lower part of the 3-foot section. In numerous patches the soil consists of a dark-gray fine sandy loam underlain by brownish-yellow heavy clay. Quartz fragments are conspicuous on the surface in places throughout the type.

The Durham fine sandy loam is inextensive. It is developed in small bodies around Method and Cary, along Swift Creek, south of Macedonia, in the vicinity of Catawba Springs Church, and near Leesville. It occupies gently rolling or undulating to rolling areas and has good natural drainage.

Only a small proportion of this soil is under cultivation, the remainder being forested with white, red, and post oak, hickory, and dogwood, together with a scattered growth of pine. It is a good tobacco soil, although none of it is used for tobacco at present. Corn, rye, oats, cotton, sweet potatoes, cowpeas, peanuts, chufas, and garden vegetables are suited to it. Yields ordinarily are low, but the type is capable of marked improvement. Corn yields ordinarily from 10 to 20 bushels per acre. Cotton yields one-third to three-fourths bale an acre with an acreage application of 200 to 500 pounds of an 8-3-3 fertilizer. The soil has a friable structure, is easily tilled, and responds readily to applications of organic matter and commercial fertilizers.

The price of this soil ranges from \$15 to \$30 an acre in the more remote locations, and from \$30 to \$60 near towns.

#### APPLING COARSE SANDY LOAM.

The surface soil of the Appling coarse sandy loam to a depth of 2 to 4 inches is a light-gray coarse sand or loamy coarse sand. This passes into a yellowish coarse sandy loam, which extends to a depth of about 6 to 15 inches. The subsoil is prevailingly a reddish-yellow to mottled red and yellow clay of a moderately friable structure. Broadly speaking, the subsoil of this type represents material intermediate in color between the red of the Cecil and the yellow of the Durham. However, mottlings of various shades, together with streaks of red and yellow, appear in the subsoil, especially at depths ranging from about 3 to 5 feet. The areas of deeper surface soil are usually encountered near the base of slopes, where material washed by gravity has been deposited. The Appling coarse sandy loam occurs in close association with the Durham and Cecil coarse sandy loams and includes small spots of each. Small angular quartz gravel appears on the surface and through the soil section, but not in abundance. Granite rock outcrops in places.

This type is confined mainly to the northeastern part of the county, where it is developed in continuous strips and medium-sized areas. It has a prevailingly gently rolling topography. On some of the

broader divides it occupies fairly level areas, while on the slopes near watercourses the surface is markedly rolling. The open structure of the surface soil and the rolling topography induce excellent surface drainage.

The Appling coarse sandy loam where forested supports a growth of white, post, and red oak, with some hickory, cedar, dogwood, shortleaf pine, and old-field pine. It lies in a fairly well developed section of the county, and most of it is under cultivation. It is considered not quite so good a soil for bright tobacco as the Durham coarse sandy loam, and is inferior to the Cecil soils for wheat, corn, and oats. It nevertheless produces tobacco of good grade, and with an acreage application of about 1,000 pounds of an 8-4-4 or 8-4-6 fertilizer, yields about 600 to 800 pounds per acre. Cotton, when given as much as 400 pounds of an 8-3-3 mixture, yields one-half to three-fourths bale per acre. Sweet potatoes, with heavy applications of barnyard manure, yield from 150 to 300 bushels per acre. Garden vegetables, peaches, and apples give good returns. Cowpeas, rye, chufas, and peanuts are profitable crops.

This soil warms early in the spring and permits early planting. Where the surface soil is deeper and the soil is loose and mellow, ordinary plowing seems to meet the requirements, but on the shallow areas, especially where the clay lies within 6 or 8 inches of the surface, deeper plowing and thorough cultivation of the seed bed are required. The type as a whole is deficient in organic matter.

Land of this type near towns and villages sells for as much as \$60 an acre, but in poorly developed localities the price ranges from \$20 to \$30 an acre.

#### APPLING SANDY LOAM.

The surface soil of the Appling sandy loam is a gray, yellowish-gray or brownish-gray light sandy loam, having a depth of about 5 to 10 inches. The subsoil is a reddish-yellow, yellowish-brown, or mottled red and yellow, rather stiff clay. The subsoil has a wide range in color, presenting all shades from red to yellow. Mottlings of red and yellow are characteristic of the lower portion of the subsoil, and become more apparent in the underlying substratum. In places, particularly on the steeper slopes where surface wash has taken place, "galled spots" of reddish loam appear. Spots of fine sandy loam differing from the typical soil only in texture are of necessity included in this type. As in the case of all the residual soils of the county, a few gravel particles and rock fragments are scattered over the surface.

This type does not occur in large areas. Some of the main bodies are encountered around Apex, on the public road between Raleigh and Cary, around Reedy Creek Church, and near Tippers Crossroads.

The Appling sandy loam occupies knolls, ridges, and sloping to rolling land adjacent to the stream courses or bottom lands. The topography favors thorough surface drainage. Gullies have been eroded near the heads of small streams, and terracing is necessary upon the steeper slopes.

Much of the Appling sandy loam is farmed. The remainder is occupied by a growth of the hardwoods common to this region. The type is similar in agricultural value to the Appling coarse sandy loam and responds to the same method of improvement.

The price of this land depends largely upon the location and improvements and ranges from \$15 to \$40 an acre.

In the following table are given the results of mechanical analyses of samples of the Appling sandy loam:

*Mechanical analyses of Appling sandy loam.*

| Number.     | Description. | Fine gravel.     | Coarse sand.     | Medium sand.     | Fine sand.       | Very fine sand.  | Silt.            | Clay.            |
|-------------|--------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
|             |              | <i>Per cent.</i> |
| 232943..... | Soil.....    | 0.8              | 8.2              | 9.6              | 42.3             | 20.7             | 12.9             | 5.3              |
| 232944..... | Subsoil..... | .7               | 4.6              | 4.9              | 16.6             | 8.7              | 14.3             | 50.1             |

APPLING GRAVELLY SANDY LOAM.

The areas in Appling sandy loam color, but mapped with gravel symbols, represent Appling gravelly sandy loam. This soil differs from the sandy loam in carrying about 10 to 40 per cent of quartz gravel, together with a few iron concretions. It is inextensive and occurs only in patches. Some of the largest areas are encountered west of Pleasant Grove and Catawba Springs Churches, in the vicinity of Macedonia, west of Tippers Crossroads, and near Mount Vernon Church. The high content of gravel detracts from the value of this soil. It is mainly devoted to corn, cotton, sweet potatoes, and cowpeas, and apples and peaches. Yields are slightly lower than on the sandy loam. The price of the land ranges from about \$15 to \$40 an acre, the higher values prevailing near towns and railroad stations.

LOUISA SANDY LOAM.

The surface soil of the Louisa sandy loam consists of a brown to brownish-gray sandy loam having a depth of about 5 to 10 inches and containing a small quantity of mica scales. The subsoil is a red clay carrying typically a large quantity of finely divided mica. The mica renders the clay moderately friable and gives it a characteristic greasy feel. In places the decomposed mica schist from which the soil is derived lies within 2 or 3 feet of the surface. Quartz frag-

ments and gravel are encountered sparingly in places on the surface, and here and there quartz veins run through the subsoil. Scattered throughout the type are small bodies of Louisa fine sandy loam, and on the eroded slopes patches of clay loam are common.

Like the other Louisa types, this soil is not extensive. It occurs in the northern part of the county.

The topography is in the main heavily rolling, but less hilly than that of the Louisa gravelly loam. On some of the broader divides the type has a gently rolling surface. It is everywhere thoroughly drained.

A small percentage of the Louisa sandy loam is still forested with red, white, and post oak, hickory, and pine. It is used mainly for the production of corn and cotton. Sweet potatoes, watermelons, and garden vegetables are grown for home consumption. Corn yields ordinarily from 10 to 20 bushels per acre. Cotton, when fertilized with 400 pounds per acre of an 8-3-3 mixture, yields from one-half to two-thirds bale. Sweet potatoes yield 100 to 200 bushels per acre. The Louisa sandy loam is naturally less productive than the Cecil sandy loam, and in order to obtain profitable yields it is necessary to apply commercial fertilizer or barnyard manure liberally. Land of this type is valued at \$15 to \$25 an acre.

Following are the results of the mechanical analyses of samples of the Louisa sandy loam:

*Mechanical analyses of Louisa sandy loam.*

| Number.     | Description. | Fine gravel.     | Coarse sand.     | Medium sand.     | Fine sand.       | Very fine sand.  | Silt.            | Clay.            |
|-------------|--------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
|             |              | <i>Per cent.</i> |
| 232939..... | Soil.....    | 3.8              | 18.0             | 14.0             | 40.2             | 10.0             | 10.1             | 4.3              |
| 232940..... | Subsoil..... | 1.2              | 11.0             | 7.9              | 21.6             | 4.6              | 20.5             | 33.0             |

LOUISA GRAVELLY LOAM.

The areas within the Louisa sandy loam indicated with gravel symbols represent Louisa gravelly loam. The surface soil is predominantly a brown fine sandy loam or loam having a depth of 5 to 8 inches. Scattered over the surface and distributed throughout the soil section is an abundance of quartz gravel and small, rounded, brown or black concretions, together with a few quartz fragments. The subsoil is not essentially different from that of the Louisa sandy loam.

The gravelly loam is developed in small areas in the northern part of the county. The largest bodies are located near Thompsons Mill, west of Penny and Hester Bridge, and in the vicinity of Falls and Wake Forest. The surface is prevailingly rolling to hilly, but erosion

is active and in places the land is rough and broken, owing to dissection by numerous gullies and ravines. In order to prevent damaging erosion terracing is necessary. The best use of the rougher and more hilly areas is for forestry or pasturage.

Much of the Louisa gravelly loam has been cleared. Owing to the high content of gravel in the surface soil, it is more difficult to cultivate than the sandy loam. It requires about the same treatment as the latter. The yields of cotton range from one-fourth to one-half bale per acre. Land of this type is held at \$12 to \$20 an acre.

#### LOUISA CLAY LOAM.

The Louisa clay loam, in its typical development, consists of a red clay loam or heavy loam ranging in depth from about 4 to 8 inches and underlain by a bright-red or deep-red clay. Mica scales exist in both the soil and subsoil, being sufficiently abundant in the latter to give it a friable structure and greasy feel. This type includes eroded or "galled" spots of other Louisa soils of insufficient importance to warrant separation on the soil map. Patches of stony loam, sandy loam, and fine sandy loam are mapped with this type.

The Louisa clay loam is inextensive, and occurs only in the northern end of the county, near Wake Forest, east of Rogers Store, and north of Penny and Hester Bridge.

The prevailing topography of this type consists of knolls, ridges, and steep slopes. The surface drainage is thorough and in places excessive, as rain water does not percolate through the soil readily. On the steeper slopes terracing is necessary in order to prevent erosion. Deep plowing and the seeding of the hillsides to grasses tend to check erosion and lessen the necessity for terraces.

Most of the Louisa clay loam is now in use for the production of cotton and corn. With an application of about 500 pounds of an 8-3-3 fertilizer, cotton generally yields from one-third to two-thirds bale per acre. Corn yields from 10 to 20 bushels per acre, depending on the quantity of "side dressing" applied. This soil is best used for the production of grasses and small grains. It is generally recognized that this soil is not so strong as the Cecil clay loam. It responds to the same cultural methods.

Land of the Louisa clay loam ranges in price from \$12 to \$25 an acre, depending on location and improvements.

#### IREDELL LOAM.

The surface soil of the Iredell loam is a brownish-gray or dull-brown loam to fine sandy loam ranging in depth from about 5 to 10 inches. The subsoil is predominantly a dull-yellow or brownish-yellow, sticky, waxy, impervious clay, which generally passes into

rotten diorite rock at a depth of about 24 to 30 inches. Distributed over the surface and throughout the soil section are numerous iron concretions or accretions and in a few places quartz fragments and boulders consisting of diorite rock. In places the subsoil is a reddish-yellow, stiff, plastic clay. The Iredell loam includes patches of Iredell clay loam and sandy loam too inextensive to be represented on the soil map. This type is locally known as "pipe clay" or "blackjack land."

The Iredell loam is one of the least extensive types encountered. It occurs in small areas, the largest lying south of Lawrences Bridge along the Durham County line.

The topography is level to rolling. The steeper slopes are subject to erosion, while the flat areas in many places require artificial drainage.

About one-half of the Iredell loam is under cultivation, the remainder supporting a cover of blackjack and post oak and old-field pine. The type is used for the production of oats, corn, and cotton. Cotton yields from about one-half to three-fourths bale per acre and corn about 15 to 20 bushels. Oats do well. While corn has a tendency to "french" and cotton to rust, this can be counteracted in a large measure by moderately heavy applications of kainit. Deep plowing in the fall or winter improves the physical condition of the soil. Land of this type ranges in price from \$15 to \$20 an acre.

#### GRANVILLE COARSE SANDY LOAM.

The surface soil of the Granville coarse sandy loam consists of a light-gray to whitish loamy coarse sand or light sandy loam, about 3 to 6 inches deep, grading into a pale-yellow subsurface stratum of coarse sandy loam, which extends to a depth of about 8 to 20 inches. The subsoil typically is a yellow, stiff sandy clay, or a clay carrying some coarse sand. It usually grades into a rather heavy and slightly plastic clay mottled with reddish yellow and gray at about 24 to 30 inches. Below this depth the subsoil shows mottlings of Indian-red or purplish, and frequently at about 30 to 36 inches an Indian-red clay mottled with gray is encountered. This Indian-red clay, which underlies the subsoil at varying depths and outcrops as "galled" spots on hillsides and knolls, is really Penn material. Where this type adjoins the Cecil types the subsoil has a brownish-yellow cast. In places on the slopes the surface soil over small areas is shallow or altogether lacking and the subsoil is a mottled Indian-red, gray, and yellow silty clay. Frequently small quartz gravel is rather abundant and occasionally over an acre or two this soil is decidedly gravelly. In places on eroded slopes the disintegrated purplish sandstone rock lies within the 3-foot section.

The Granville coarse sandy loam occurs in the northwestern and western parts of the county. The topography is prevailingly gently rolling to rolling. The broad interstream areas usually have a gently rolling surface, which becomes strongly rolling and in places noticeably broken as the stream courses are neared. The rolling surface, supplemented by the open and porous structure of the soil, insures excellent drainage for this type. In fact the drainage is rather excessive on some of the steeper slopes, and the run-off is sufficiently rapid to cause the erosion of a few gullies and "galled" spots.

The native forest growth on this type consisted mainly of white, post, and red oak, and hickory, with some dogwood, sweet gum, and shortleaf pine. A large proportion of the type is under cultivation and in a fair state of improvement.

The Granville coarse sandy loam is preeminently suited to bright tobacco. Tobacco yields about 600 to 800 pounds per acre when given an acreage application of 800 to 1,000 pounds of an 8-3-3 fertilizer. Some of the best farmers use a higher grade fertilizer, analyzing about 8-4-4 or 8-4-6. Tobacco grown on this soil in the southwestern part of the county is not affected by tobacco wilt, which is prevalent around Creedmoor, in Granville County, but in the section north of the Neuse River bordering the Granville County line it is more or less affected by this disease.

Corn does well on this soil, yielding ordinarily 15 to 20 bushels per acre, and as much as 40 to 50 bushels when an application of about 400 pounds of an 8-3-3 fertilizer is made. Sweet potatoes when manured or fertilized give good returns. A small acreage is devoted to wheat, which yields 10 to 15 bushels an acre. Rye and crimson clover succeed on this soil. Peanuts, while not grown on a commercial scale, are well adapted to it and if the soil is sweetened with lime, make a filled pod. Certain varieties of peaches, apples, and plums are grown for home use. Garden vegetables do well.

As its light color indicates, this soil is markedly deficient in organic matter.

Land of the Granville coarse sandy loam sells at \$20 to \$60 an acre, depending upon the location and improvements. It is highly prized as a bright-tobacco soil.

#### GRANVILLE SANDY LOAM.

The Granville sandy loam differs essentially from the coarse sandy loam only in texture. The surface soil is a light-gray to whitish loamy sand of medium texture, passing at about 2 to 6 inches into a yellowish-gray or pale-yellow light sandy loam which extends to a depth of about 8 to 15 inches. The subsoil is a yellow, heavy sandy

clay, passing abruptly into a yellow sandy clay mottled with light gray, which in turn grades into a mottled silty clay or clay of variegated colors, the predominant shades being purple, reddish yellow, and gray. Occasionally an Indian-red clay mottled with gray is encountered within the 3-foot section, and frequently on hillsides where erosion has been active this material or the disintegrated purple and gray sandstone rock outcrops. White quartz gravel particles are distributed over the surface in places, but nowhere in sufficient quantity to interfere with cultivation. The subsoil is exceptionally friable.

This type occurs only in the western and southwestern parts of the county. The topography is typically gently rolling to rolling. On some of the broader watersheds the surface is level to undulating, while narrow strips bordering the stream courses have a rough to heavily rolling topography. The position of this soil allows thorough surface drainage.

The forest growth consists of red, white, post, and blackjack oak, sweet gum, dogwood, and pine. Much of the smoother land has been cleared and is now in cultivation. The principal crops grown are bright tobacco and corn. Tobacco yields from 500 to 800 pounds per acre, when given an acreage application of 800 to 1,000 pounds of an 8-3-3 or 8-4-4 fertilizer. Corn, with liberal fertilization, yields 15 to 25 bushels per acre. Sweet potatoes, peanuts, and other vegetables are also extensively grown and give good returns. Land of this type usually brings from \$15 to \$50 an acre.

The following table shows the results of the mechanical analyses of samples of the Granville sandy loam:

*Mechanical analyses of Granville sandy loam.*

| Number.     | Description. | Fine gravel.     | Coarse sand.     | Medium sand.     | Fine sand.       | Very fine sand.  | Silt.            | Clay.            |
|-------------|--------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
|             |              | <i>Per cent.</i> |
| 232921..... | Soil.....    | 8.4              | 11.0             | 5.3              | 23.3             | 25.4             | 27.1             | 4.5              |
| 232922..... | Subsoil..... | .4               | .9               | .8               | 4.2              | 13.8             | 61.3             | 18.7             |

GRANVILLE GRAVELLY SANDY LOAM.

The gravel symbols appearing within areas in Granville sandy loam color on the soil map indicate Granville gravelly sandy loam. This type is not materially different from the sandy loam, except that from 20 to 50 per cent of the mass of the surface soil is made up of intermixed small white quartz gravel.

The Granville gravelly sandy loam is of small extent in the county. The more prominent bodies are encountered to the north of Law-

rences Bridge, near Olive Grove Church, west of Holly Springs, and in the vicinity of Collins Crossroads. This soil occupies a sloping surface and the drainage is excellent. The type is used for practically the same crops, and responds to the same treatment as the coarse sandy loam. It is more difficult to cultivate, and the yields are lower than on the Granville sandy loam. Values range from \$15 to \$25 an acre.

#### GRANVILLE FINE SANDY LOAM.

The surface soil of the Granville fine sandy loam is a light-gray to yellowish-gray fine sandy loam, about 5 inches deep. This is usually underlain by a pale-yellow fine sandy subsurface stratum a few inches in thickness. The typical subsoil is a yellow fine sandy to silty clay, which grades into a reddish-yellow clay and finally into a slightly sticky clay mottled with Indian-red, gray, and yellow. Frequently the lower part of the 3-foot section is an Indian-red clay mottled with gray. In places, especially between Apex and Holly Springs, the surface soil is a very fine sandy loam. On some of the higher knolls and eroded slopes the Indian-red clay comes near the surface, modifying the surface soil in places to such an extent as to develop small purplish spots. Practically the only variation discovered in the subsoil is the presence of a yellowish-brown clay in a few places. Small white quartz gravel is strewn over the surface in conspicuous quantities.

The Granville fine sandy loam is an extensive and important type in the western and southwestern parts of the county.

While the topography is generally undulating to rolling, some of the areas are level. Most of this type is favorably situated for agriculture. As a whole, surface drainage is good.

Forested areas support a growth of white, red, post, and black-jack oak, dogwood, sweet gum, and shortleaf pine.

The principal crops grown on this type are corn, wheat, oats, rye, tobacco, and sweet potatoes. The two last-named crops do best on the areas of more rolling topography and with deeper surface soil. Corn yields from 12 to 20 bushels when fertilized with about 200 to 300 pounds per acre of a mixture analyzing 8-3-3. Wheat yields 8 to 15 bushels an acre, and oats 20 to 30 bushels. Tobacco, with an application of 600 to 800 pounds of 8-4-4 fertilizer, yields from 500 to 800 pounds per acre. Rye makes good yields.

Like the other types of the Granville series this soil is deficient in organic matter. It is, however, friable and easily cultivated.

Land on the Granville fine sandy loam sells for \$12 to \$25 an acre, depending on the location and improvements.

## GRANVILLE SILT LOAM.

The surface soil of the Granville silt loam consists of a yellowish-gray or light-gray silt loam, passing at about 3 to 6 inches into a yellow silt loam. This is underlain at a depth of about 12 to 15 inches by a yellow silty clay loam mottled with light gray or white, which grades into a mottled reddish-yellow and gray or whitish silty clay. Frequently an Indian-red clay mottled with gray is encountered within the 3-foot section, but more often at depths ranging from 3 to 5 feet. Quartz gravel and fragments occur on the surface, but nowhere in sufficient quantity to make the soil a gravelly type or to interfere with cultivation. A conspicuous variation in this type consists of areas of very fine sandy loam, of too irregular occurrence and intricate association to be separated on the soil map.

The Granville silt loam is one of the inextensive types of the Granville series. The largest areas occur around Morrisville, south of Bonsal, and between Apex and Holly Springs.

The topography is characteristically level to very gently rolling, being much smoother than that of any of the other Granville soils. The gently rolling areas possess good natural surface drainage, but the level and flatter bodies require artificial drainage, which can be effected cheaply by open ditches.

Little of this type is under cultivation, most of it being forested with old-field pine and white, red, and post oak. When plowed under normal moisture conditions the soil is mellow and crumbly, and a good tilth can be obtained. Small grains, corn, and grasses are the most profitable crops on this soil, although cotton and tobacco succeed. The soil is naturally deficient in organic matter, and it is necessary to supply this as well as commercial fertilizer before profitable crops are obtained.

Land on the Granville silt loam ranges in price from \$10 to \$25 an acre, depending on the location and improvements.

The results of mechanical analyses of samples of the Granville silt loam are shown in the following table:

*Mechanical analyses of Granville silt loam.*

| Number.     | Description. | Fine gravel.     | Coarse sand.     | Medium sand.     | Fine sand.       | Very fine sand.  | Silt.            | Clay.            |
|-------------|--------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
|             |              | <i>Per cent.</i> |
| 232923..... | Soil.....    | 1.2              | 2.8              | 1.4              | 6.2              | 16.6             | 62.1             | 9.7              |
| 232924..... | Subsoil..... | 3.0              | 6.8              | 3.3              | 13.0             | 18.4             | 30.4             | 24.9             |

## NORFOLK COARSE SAND.

The Norfolk coarse sand, to a depth of about 6 inches, is a light-gray to whitish coarse sand, underlain by a pale-yellow to yellowish-

gray coarse sand which extends to a depth of 3 feet or more. In the forested areas the surface 2 or 3 inches is dark gray, owing to the presence of organic matter. Both the soil and subsoil are prevailingly loose, open, and porous, and frequently they contain a small percentage of fine, rounded, quartz gravel.

This type is confined to the extreme southern part of the county. The most typically developed areas are in the vicinity of Partins Mill, Fuquay Springs, and Wilbon.

The topography ranges from level to rolling. Level areas occur in the vicinity of Cairo and Cardenas. Some of the more rolling areas are well developed around Fuquay Springs and Partins Mill. Owing to its loose and incoherent structure and high position, the type is thoroughly drained; in fact, excessive drainage has resulted in the soil being somewhat deficient in productiveness.

The original forest growth on this type consisted of longleaf pine, but practically all of this has been cut and there now remains principally scrub oak and shortleaf pine, with some rosemary pine. Wire grass is a characteristic growth on this soil.

A large proportion of the Norfolk coarse sand has been cleared and put under cultivation. It is used mainly for the production of bright tobacco, and to some extent for cotton and corn. Tobacco yields 500 to 800 pounds per acre with an acreage application of 800 to 1,000 pounds of an 8-3-3 or 8-4-4 fertilizer. In places the tobacco has a tendency to become yellow prematurely. Such coloration is locally known as "sand yellow." It is reported by some of the best tobacco growers that a light application of lime counteracts this tendency. The yields of corn are prevailingly low, except where the land is heavily manured or fertilized. Sweet potatoes give good yields and the quality is excellent. The type is well suited to early truck crops. Of the fruits, Scuppernong grapes and certain varieties of peaches do well.

The Norfolk coarse sand is decidedly deficient in organic matter, and in order to obtain the best results it is necessary to supply this constituent in the form of leguminous crops, such as cowpeas or soy beans, or of rye, or in the form of barnyard manure.

Formerly this soil was valued at \$5 to \$10 an acre, but since the introduction of bright tobacco its value has greatly increased, and it is now held at \$20 to \$75 an acre.

#### NORFOLK SAND.

The surface soil of the Norfolk sand for about 6 inches is a light-gray medium sand carrying coarse sand particles in small quantity and some fine gravel. It is underlain by a pale yellow or yellowish-gray medium sand reaching a depth of 3 feet or more. Where this sand has been worked through by rain water and bleached it is

almost white, while in fields which have been heavily manured and in forested areas the surface soil has a pronounced dark gray color. Bordering the sandy loam areas the lower portion of the subsoil of this type is frequently a friable sandy loam to sandy clay.

The Norfolk sand occurs in close association with the Norfolk coarse sand in the southern part of the county. The larger areas are developed around Partins Mill, in the vicinity of Cannon Grove Church, near Willow Spring, and north and southeast of Fuquay Springs.

The topography ranges from level and undulating to rolling. The type frequently occupies knolls and ridges and sometimes extends down steep slopes toward stream courses. Like the Norfolk coarse sand, this soil drains quickly and can be cultivated soon after rains. It also withstands drought well, and some of the best crops are obtained in ordinarily dry seasons.

Practically all of the longleaf pine which originally covered this type has been cut and the present forest growth consists mainly of old-field pine, scrub oak, and sweet gum. Upon some of the areas resembling this type in the Sand Hill section of the State the small forked-leaf oak is the characteristic growth.

Bright tobacco is the principal crop grown on this soil. Tobacco yields about 500 to 800 pounds per acre with an application of 800 to 1,000 pounds of an 8-3-3 or 8-4-4 fertilizer, and corn from 10 to 20 bushels with an acreage application of 200 to 500 pounds of an 8-3-3 mixture.

Cotton yields from one-third to two-thirds bale when well manured or fertilized. Heavy manuring or fertilization is necessary for good yields of the staple crops, such as corn and cotton. Early truck crops, especially sweet potatoes, watermelons, and cantaloupes, are well suited to this type, and rye and chufas succeed. Among the fruits, certain varieties of peaches and Scuppernon and Misch grapes are most successful and most commonly grown.

Land of the Norfolk sand is valued at \$20 to \$75 an acre; formerly it could be bought for \$5 to \$10.

#### NORFOLK SANDY LOAM.

The surface soil of the Norfolk sandy loam consists of a light-gray loamy sand, passing at about 6 inches into a yellowish-gray or pale-yellow loamy sand, which extends to a depth of about 12 to 20 inches. The subsoil typically is dominantly a friable sandy clay of deep-yellow or cottonseed-meal color. In places where this soil is intimately associated with the Ruston sandy loam the subsoil is brownish or reddish yellow. Spots of Norfolk coarse sandy loam and Norfolk sand of insufficient size to be represented on the soil map were

mapped with the Norfolk sandy loam. Occasionally rounded quartz fragments are conspicuous on the surface, and in places there are markedly gravelly spots an acre or two in extent.

The Norfolk sandy loam occurs in scattered areas throughout the southern part of the county. Patches of this type occur throughout the Norfolk coarse sand and sand.

The topography is level to undulating or gently rolling. Most of the type occupies rather high ridges with an undulating surface which becomes rolling nearer the natural drainage ways. The natural drainage, surface and internal, is well established throughout all areas of this type. The open, porous character of the surface soil allows free percolation of rain water and reduces surface erosion to a minimum.

The Norfolk sandy loam is considered one of the most desirable general-farming soils in the county, and most of it has been cleared and put in cultivation. The forested areas support a growth of hickory, oak, shortleaf pine, rosemary pine, and scattered longleaf pine. The principal crops are cotton, corn, and cowpeas. Early truck crops, including watermelons and cantaloupes, and peanuts, chufas, rye, bright tobacco, crimson clover, and soy beans are also produced. Owing to the remoteness of the type from tobacco markets, this crop is grown only to a small extent. Cotton, with an acreage application of 400 to 600 pounds of an 8-3-3 fertilizer, yields from one-half bale to 1½ bales per acre. Corn yields 12 to 30 bushels per acre, depending upon the quantity of fertilizer used as a side dressing. Cowpeas are sowed at the last cultivation of corn. Sweet potatoes do remarkably well, yielding from 100 to 300 bushels per acre. Scuppernong and Misch grapes, apples, and peaches give profitable returns.

The Norfolk sandy loam, as its light color indicates, is generally deficient in organic matter, especially where it has been continually cropped to cotton. It responds freely to fertilizing and manuring and the turning under of leguminous crops, and improvements made in it are quite lasting. The soil is naturally mellow and easy to cultivate and its topography is favorable for the use of labor-saving machinery. Land of this type ranges in price from \$25 to \$50 an acre.

#### RUSTON SANDY LOAM.

The surface soil of the Ruston sandy loam is typically a light-gray loamy sand, which passes into a yellowish or reddish-yellow loamy sand or light sandy loam at about 6 inches. The subsoil, beginning at a depth of about 10 to 15 inches, is a reddish-yellow, brownish-yellow or mottled red and yellow, friable sandy clay extending to a depth of several feet. The mottlings of red and yellow

are more pronounced at about 3 to 5 feet. Gravel is occasionally scattered over the surface, and in places tracts of gravelly sandy loam an acre or two in extent are encountered. Included with this type are patches of Ruston coarse sandy loam and coarse sand too small and unimportant to be separated on the soil map. Near McCullers there is a small area of Ruston sandy loam in which the surface soil is grayish brown in color and shallower than usual and with only a small content of gravel.

This type occurs in numerous small areas throughout the southern part of the county. It prevailingly occupies broad divides and narrow ridges, and has a gently rolling topography. Bordering the stream courses it is developed in a few level to undulating and sloping areas which present a conspicuous variation in the topography of this type. By reason of the open structure of the soil and its high position and rolling topography, natural surface drainage is excellent. The mellow structure of this soil renders it easy to cultivate and its topography is favorable for the use of modern farm machinery.

About one-half of the aggregate area of the Ruston sandy loam is under cultivation. The remainder supports a growth of hickory, post oak, and white oak, with some longleaf and shortleaf pine. Cotton, corn, tobacco, oats, rye, sweet potatoes, watermelons, cantaloupes, Scuppernong and Misch grapes, and truck crops do well on this soil. Its remoteness from large towns, however, precludes its profitable use for trucking. Cotton, with an acreage application of 400 to 500 pounds of an 8-3-3 fertilizer mixture, yields from one-half to 1 bale per acre, and tobacco, when treated with 600 to 800 pounds per acre of an 8-3-3 or 8-4-4 mixture, yields from 600 to 900 pounds. Corn yields from 15 to 30 bushels per acre. Fall-sowed oats give good returns. This soil responds readily to fertilizing and manuring.

The price of land of this type ranges from \$25 to \$45 an acre.

In the following table are shown the results of mechanical analyses of samples of the Ruston sandy loam:

*Mechanical analyses of Ruston sandy loam.*

| Number.     | Description. | Fine gravel.     | Coarse sand.     | Medium sand.     | Fine sand.       | Very fine sand.  | Silt.            | Clay.            |
|-------------|--------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
|             |              | <i>Per cent.</i> |
| 232915..... | Soil.....    | 2.4              | 15.1             | 11.0             | 41.2             | 17.4             | 9.9              | 2.9              |
| 232916..... | Subsoil..... | 1.0              | 8.8              | 7.8              | 27.4             | 13.4             | 11.6             | 30.2             |

ORANGEBURG SANDY LOAM.

Small areas within the Ruston sandy loam indicated by inclusion symbol consist of Orangeburg sandy loam, which would have been

mapped as a separate type had its development warranted it. The surface soil of this type consists of a gray or brown sandy loam or loamy sand, grading at about 6 inches into a reddish-yellow sandy loam. The typical subsoil, encountered at about 8 to 15 inches, is a bright-red friable sandy clay having a depth usually of several feet.

There were encountered only two small bodies of this soil, one lying immediately southwest of Holly Springs and the other south of Mount Pleasant Church. The topography is gently rolling, and both surface drainage and underdrainage are good. All of this type has been cleared and is now under cultivation. It is a good soil for cotton, corn, oats, tobacco, cowpeas, sweet potatoes, and garden vegetables. Cotton is the principal crop grown, yielding from two-thirds to 1 bale per acre with an acreage application of about 400 pounds of an 8-3-3 fertilizer.

The Orangeburg sandy loam is considered one of the best soils of the county. Owing to its small extent, it is held in conjunction with adjoining types.

#### CONGAREE FINE SANDY LOAM.

The surface soil of the Congaree fine sandy loam is a light-brown or brownish-gray fine sandy loam ranging in depth from about 8 to 12 inches. The subsoil varies, but is predominantly a fine sandy loam or silt loam of a light-brown, yellowish-brown or chocolate-brown color. Alternating layers of fine sand and silt are of frequent occurrence in the subsoil. Characteristic finely divided mica scales appear throughout both the soil and subsoil. Included with this type are low ridges and hummocks of brown fine sand and slight depressions where the soil is a chocolate-brown silt loam, as well as a few level bodies of sandy loam, all of which variations are so intermixed with the typical soil and so small in extent that their separation on the soil map is not warranted.

The Congaree fine sandy loam occurs in long strips in the first bottoms along Little and Neuse Rivers, and Crabtree, Swift, Middle, and Smiths Creeks, and other smaller streams.

This topography is prevailingly flat and level, with an occasional hummock or shallow troughlike swale. This soil lies only a few feet above the stream channels and all of it is subject to overflow during high water stages. In ordinary dry seasons, however, it can be cultivated with little danger of injury to crops by inundation.

Most of the Congaree fine sandy loam supports a forest growth consisting of gum, elm, poplar, ash, maple, sycamore, and some pine, together with a dense undergrowth of alder bush, bamboo brier, and cane. Much of the cleared land is now used for summer pasture for cattle.

Corn and watermelons are the principal crops grown. Corn yields from 15 to 30 bushels per acre without the application of commercial fertilizer or manure. Watermelons do exceptionally well when the soil is thoroughly pulverized and manure or commercial fertilizer is placed in the hills. Cotton is grown in a few fields and gives fair yields. The liability to injury by early frost in the fall and by overflows prevent the more general production of cotton. By straightening, deepening, and widening the stream channels and cutting a few lateral ditches practically all of this type can be used for the production of crops. It is a very easily tilled soil.

The Congaree fine sandy loam is held in connection with adjoining upland soils.

#### MEADOW.

The areas mapped as Congaree fine sandy loam with inclusion symbol comprise narrow bands of Meadow. The Meadow classification represents material so variable in character that no definite type distinction can be made. Meadow includes all grades and textures of material, ranging through a loose, coarse sand to a heavy loam or silt loam and presenting all shades of color from gray to brown and red, and in places, where it contains much organic matter, almost black.

In the Coastal Plain section of the county there are included with this classification a few narrow strips of bottom land which would have been mapped as Swamp had they been of sufficient extent to warrant their separation. In texture the soil of these areas ranges from coarse sand to silt loam. The surface soil is generally gray, black or brown, and where underlain by clay the latter is usually gray or gray mottled with yellow and brown.

Meadow occurs in narrow strips in the first bottoms along the smaller streams. It is subject to frequent inundation, and part of it remains saturated during most of the year. It is mainly alluvial in origin, but in places it has been modified by colluvial wash material which has been spread out over the original reworked material deposited by the streams.

The surface of the Meadow areas is not so uniformly flat and smooth as that of the Congaree types. There are many slight depressions or low swales and intervening low sandy ridges.

Practically all of the Meadow is covered with a growth of elm, willow, alder bush, and briers, and in places there is a luxuriant growth of water-loving grasses. The principal use of this land is for summer pasture.

#### CONGAREE SILT LOAM.

The surface soil of the Congaree silt loam consists of a light-brown to reddish-brown silt loam of a mellow, friable structure, ranging in

depth from about 6 to 10 inches. The subsoil of the typically developed areas is a light-brown, yellowish-brown or chocolate-brown compact silt loam, which usually grades into a silty clay loam or clay in the lower part of the 3-foot section. In places the subsoil at about 24 to 36 inches is a mottled yellow and gray or bluish, sticky, silty clay. This type is so closely associated with the Congaree fine sandy loam that in places it is difficult to draw a distinct boundary between the two types, and consequently the inclusion of small spots of fine sandy loam and fine sand is unavoidable. Patches of brown loam are also included. Bordering the Granville types, in areas too small to map, erosion has exposed the underlying Indian-red clay, and an admixture of this material gives the Congaree silt loam a purplish shade. Most of this type contains mica scales, and these are especially abundant along streams flowing through the Louisa soils.

The Congaree silt loam is developed in rather continuous strips bordering the Neuse River and other streams. An important area lies near Morrisville.

The type occupies uniformly flat areas, some of which have an appreciable slope toward the stream. A few depressions or swales are conspicuous in the topography, particularly along Swift Creek. Although this type, like the Congaree fine sandy loam, is subject to frequent inundation, a large acreage is cultivated. Occasionally crops are damaged by overflows, but they are seldom a total loss. By straightening, deepening, and widening the stream channels and cutting a few lateral ditches practically all of the type can be reclaimed.

This is naturally a strong and productive soil. It produces good crops of corn, grasses, pumpkins, forage crops, and sorghum cane. Corn is the principal crop grown and yields from 20 to 60 bushels per acre without the use of fertilizer.

Land of this type is generally sold in connection with adjoining upland soils and enhances their value. It is a highly prized soil, and if sold separately would bring a fancy price.

#### ALTAVISTA SILT LOAM.

The areas within the Congaree silt loam shown on the map by inclusion symbol represent small bodies of Altavista silt loam, which would have been shown as a separate type had the areas been larger. The surface soil of the Altavista silt loam is a brownish-gray to yellowish-gray silt loam, having a depth of about 8 to 15 inches. The subsoil consists of mottled yellow and gray silty clay, which becomes quite heavy and tough in the lower part of the 3-foot section. Frequently the subsoil is a yellow, firm clay, becoming mottled with gray and heavier in texture with depth, and in places the surface soil is a fine sandy loam.

The Altavista silt loam is confined to a few strips of second-bottom land or low terraces along Crabtree, Brier, Beaver, Ledge, and Whiteoak Creeks. The surface is uniformly flat, with a gradual gradient toward the stream course. Drainage is fairly well established, and only upon the broader areas are open ditches necessary. The type is not subject to inundation, except during periods of extremely high water. Its topography is favorable for tillage and by reason of the mellow character of the surface material can be cultivated with ease.

The Altavista silt loam is considered one of the good farming soils of the county and practically all of it is cultivated. Corn, oats, and grasses do well. Corn is grown to the exclusion of almost all other crops. The yields range from about 15 to 30 bushels per acre, without the application of manure or fertilizer.

Following are the results of mechanical analyses of the Altavista silt loam:

*Mechanical analyses of Altavista silt loam.*

| Number.     | Description. | Fine gravel.     | Coarse sand.     | Medium sand.     | Fine sand.       | Very fine sand.  | Silt.            | Clay.            |
|-------------|--------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
|             |              | <i>Per cent.</i> |
| 232929..... | Soil.....    | 0.3              | 0.8              | 0.9              | 8.8              | 19.6             | 53.6             | 15.8             |
| 232930..... | Subsoil..... | .2               | 1.0              | 1.0              | 8.0              | 20.6             | 64.4             | 4.6              |

SUMMARY.

Wake County is situated in the central part of North Carolina. It is one of the largest counties in the State, containing approximately 840 square miles, or 537,600 acres. It has a population of 63,229, of which about 70 per cent is rural. Raleigh, the State capital, is the county seat and most important town.

The surface ranges from level to hilly and broken. The elevation varies from 315 to 497 feet above sea level. The climate is mild and healthful. The rainfall is ample and well distributed throughout the year.

The Neuse River and its numerous tributaries furnish a comprehensive drainage system for the entire county, except the extreme northeastern and southwestern parts.

The county has good transportation facilities. Several railroad lines traverse it. Public highways are being improved. Churches and schoolhouses are numerous. All parts of the county have rural mail delivery and telephone service.

Wake County lies partly in the Piedmont and partly in the Coastal Plain province. The Piedmont soils are residual in origin, i. e., have been derived from the weathering of the underlying rock formation. The Coastal Plain soils are sedimentary in origin and have been

formed, through weathering, from deposits of sand and clay probably of marine origin. The Piedmont soils are embraced in the Cecil, Durham, Louisa, Appling, Granville, and Iredell series, and the Coastal Plain series are the Norfolk and Ruston.

The Cecil series is the most important. It includes eight types. On the lighter soils of this series cotton, tobacco, peanuts, and truck crops, including sweet potatoes and watermelons, do well, while the heavier types are well adapted to such crops as corn, wheat, oats, clover, and grasses.

The Durham series is represented by three types. These soils are well suited to tobacco, truck crops, and berries.

Of the Appling series three types are mapped, the coarse sandy loam, sandy loam, and gravelly sandy loam. These soils are used for practically the same crops as the Durham soils, with cotton and corn in addition.

Five types of the Granville series are mapped. The medium or coarse textured members are best used for the production of tobacco, corn, vegetables, and peanuts, and the finer textured types for corn, wheat, oats, rye, and grasses.

Of the Louisa series the sandy loam, gravelly loam, and clay loam are mapped. On the shallower areas of the sandy loam cotton, corn, cowpeas, oats, and sorghum succeed, while on the areas of deeper sandy surface soil truck crops do well. Corn, wheat, oats, clover, and grasses do well on the clay loam.

Only one member of the Iredell series, the loam, is recognized. On this soil cotton, corn, wheat, oats, and grasses are grown.

The Norfolk series is represented by three types, the coarse sand, sand, and sandy loam. These soils are adapted to cotton, corn, tobacco, peanuts, truck crops, peaches, and grapes.

The Ruston series is represented by one type, the sandy loam. The shallower areas of this type are best used for cotton, corn, tobacco, and peanuts, and the areas of deeper sandy surface soil for truck crops, rye, peaches, and grapes.

The Congaree soils are first-bottom alluvial types. Two types are mapped, the fine sandy loam and the silt loam. On the fine sandy loam corn and watermelons do well, while the silt loam produces good yields of corn, pumpkins, grasses, forage crops, and sorghum cane.

The value of farm lands varies considerably over the county. In the more remote and rougher localities land can be bought for \$15 an acre, while near some of the towns it sells for as much as \$150 an acre.

[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 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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