

SOIL SURVEY OF JOHNSTON COUNTY, NORTH CAROLINA.

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DESCRIPTION OF THE AREA.

Johnston County is situated in the east-central part of North Carolina. It is bounded on the northeast and east by Nash, Wilson, and Wayne Counties, on the south by Wayne and Sampson Counties, on the west and southwest by Harnett and Sampson Counties, and on the north and northwest by Wake County. It has an area of 778 square miles, or 497,920 acres.

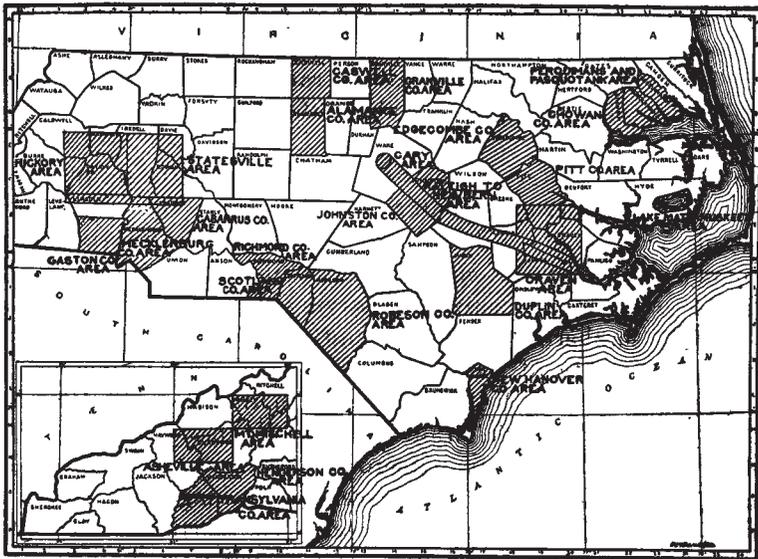


FIG. 9.—Sketch map showing areas surveyed in North Carolina.

The surface features consist of high, rolling uplands and gently undulating, broad interstream areas in the wide, level stretches. There is a fairly well-defined slope to the point where the Coastal Plain merges into the Piedmont Plateau, the entire Coastal Plain section throughout the county being gently sloping. Elevations vary from about 350 feet through the central part of the county to about 80 feet at the southeast corner, where the Neuse River leaves the area. In the northern section of the county and extending southwest

across the Neuse River, including the Durham and Cecil types of the Piedmont Plateau, and along the western border near the larger streams, the surface consists of gently rolling to rolling areas which become hilly and broken as the streams are approached. The greater part of the rough topography is embraced in this section.

The general surface of the Coastal Plain section consists of flat, undulating to gently rolling interstream areas, in places becoming rough and hilly as the streams are approached. Some of the more prominent of these areas lie to the southeast of Benson; others are found around Princeton, to the northwest of Kenly, between Moores Crossroads and Hares Crossroads, and to the east and south of Clayton. The more level bodies of upland occur along the Atlantic Coast Line Railroad near Smithfield, extending to within 4 miles of Selma on the northeast and thence in an easterly direction to Oliver. The lowest land in the area is commonly known as "The Neuse River flats," embracing a strip some 4 miles wide extending along the Neuse River from a point about $1\frac{1}{2}$ miles below the Atlantic Coast Line Railroad bridge to the county boundary. The general elevation of this section varies from 105 to 80 feet. The Neuse River, except over the area known as "The Flats," and the other streams of the county have cut deep channels, leaving rather narrow bands of level bottom land with contiguous rolling slopes and hilly to broken escarpments.

The surface drainage of the area is effected through the Neuse River and the numerous tributaries which empty into it, either in the county or at a few miles distant on the east. This river enters the county about midway on the northwest boundary line, following a general southeasterly course and leaving the area at the southeast corner. The southern half of the county is drained by a network of creeks, the majority of which head in Wake County, flowing east and emptying into the Neuse River within the area. Of these the most important are Swift, Middle, Black, Hannah, Stone, and Mill Creeks. These, with their numerous tributaries in the form of branches and streamlets, afford excellent drainage for all of the county lying south of the Neuse River. The northern and eastern sections are drained by Little River and its tributaries, Buffalo, Cat Tail, and Little Creeks, Long Branch, and Moccasin Creek, the latter forming part of the northeast boundary of the county, and by Moccasin Swamp and Bowdy Creek, which flow through the southeastern section. All of these waterways furnish ample drainage for that part of the county lying to the north of the river. The county, with the exception of a small area lying along the lower part of the Neuse River, possesses excellent natural surface drainage.

Many of the streams in the county are swift flowing, and considerable water power has been developed along their courses to operate cotton gins and sawmills.

Johnston County has a population of 41,401, of which nearly 90 per cent are native born. The population in 1900 was 32,250, showing an increase for the decade of 9,151. There is a large negro population. Smithfield, the county seat, with a population of 1,347; Clayton, with 1,441; and Selma, with 1,331, are the three largest towns. Some sections of the county are thickly populated, the farms in such areas being small. Other sections are composed of large individual holdings owned by wealthy planters, and in some localities there are large tracts of undeveloped land.

The county is traversed by the main line of the Atlantic Coast Line Railroad and by the Greensboro and Goldsboro branch of the Southern Railway. A branch of the former line, known as the Midland Railroad, runs from Smithfield to Goldsboro. The Neuse River is navigable as far up as Smithfield for small boats at certain seasons of the year. Large quantities of logs are floated down this stream.

Clayton Township possesses the best roads in the county. The central highway leading from Beaufort, on the coast, to the western end of the State, passes through the county. Five townships are now working the public roads by special tax. Good sand and clay or gravel roads can be constructed cheaply and maintained at a low cost. Rural free-delivery routes have been established throughout the county and telephone lines are being extended to the rural districts.

The bulk of the cotton grown in the county is shipped to outside points, only a small proportion going to local mills. Clayton is the most important cotton market in the county, from 12,000 to 15,000 bales being sold here annually. Smithfield, Selma, Benson, Kenly, Princeton, and Pine Level are also cotton markets. Smithfield is now the center of what tobacco business there is in the county.

CLIMATE.

The climate of the area as a whole is mild and equable, the mean annual temperature being 60° F. The average snowfall is about 8 inches and the rainfall about 50 inches, fairly well distributed throughout the year, the heaviest precipitation occurring during June, July, and August.

The eastern and southern portions of this county are low and flat, as compared with the western side near Raleigh, the rainfall being slightly heavier and the temperature a little higher in the former region. The humidity is also greater, particularly in the flats along the Neuse River. The growing season is long enough for maturing all crops. Cover crops, cabbages, and a few other crops can be grown during the winter months, and considerable farm work can be carried on during this period. Complete crop failures are rare.

The excellent drainage and high, rolling country make the county salubrious. The use of water from driven or bored wells in the lower areas, especially on the Neuse flats, has greatly improved the health conditions of those sections. Good well water can be secured in all parts of the county.

There is no established Weather Bureau station in Johnston County, but the accompanying table, compiled from the records of the station located at Raleigh, represent in a general way the local conditions:

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.	Snow, average depth.
	° F.	° F.	° F.	Inches	Inches.	Inches	Inches.
December.....	43	75	9	2.9	2.6	1.2	1.5
January.....	41	76	2	3.6	2.2	4.0	2.3
February.....	43	80	-2	4.4	4.4	5.1	4.1
Winter.....	42			10.9	9.2	10.3	7.9
March.....	50	89	16	4.3	4.8	7.2	0.3
April.....	58	95	30	3.6	4.7	3.0	0.3
May.....	68	98	38	5.1	2.8	9.2	0.0
Spring.....	59			13.0	12.3	19.4	0.6
June.....	76	101	46	4.6	3.4	4.1	0.0
July.....	79	103	54	6.3	4.9	11.0	0.0
August.....	77	99	52	5.8	1.9	10.4	0.0
Summer.....	77			16.7	10.2	25.5	0.0
September.....	71	100	39	3.2	0.7	1.8	0.0
October.....	60	89	31	3.8	2.6	2.6	T.
November.....	51	82	17	2.3	3.4	3.7	0.1
Fall.....	61			9.3	6.7	8.1	0.1
Year.....	60	103	-2	49.9	38.4	63.3	8.6

AGRICULTURE.

Johnston County was one of the first to be settled in the State, its original territory being much in excess of the 778 square miles which constitutes its present area. The crops of the early settlers consisted of corn, wheat, oats, barley, and rye. Hogs, sheep, and a few cattle were kept, the sheep for wool and the stock for sale on the hoof at nearby markets.

The census of 1880 showed 45,000 acres devoted to corn, 3,000 to oats, 4,000 to wheat, and 32,000 to cotton. In 1910 there were 61,639

acres in corn, producing 951,441 bushels; 53,037 acres in cotton, from which 34,795 bales were secured; 5,862 acres in tobacco, yielding 3,960,831 pounds of leaf; and 3,853 acres in sweet potatoes, which produced 475,483 bushels.

Cotton has been the main dependence of the planters as a money crop since the Civil War. The turpentine industry flourished until a few years ago, and the yellow-pine forests have been extensively cut over for lumber. The growing of bright-yellow tobacco on a commercial scale assumed considerable importance about 1897, the industry reaching its highest point in 1902. By 1905 a reaction set in and a marked decrease in acreage was noted. The growth and decline of tobacco production is accounted for in part by fluctuations in the price of cotton. The tobacco acreage was extended during the period from 1893 to 1896, when the price of cotton was low. When the price again advanced planters once more turned their attention to the cotton crop.

At present cotton is the money crop, the output for 1911 being in the neighborhood of 55,000 bales, the largest in the history of the county. The business of the area depends practically on this crop, financial transactions from year to year being liquidated at the season of its harvesting.

Corn is the second crop in importance. It is grown in all parts of the county, and in most cases with uniformly good results (see Pl. I). Cowpeas are extensively grown, most of them being sown broadcast in the corn after the last plowing or after small grain and truck crops. Some are planted in hills between the corn, and in such cases the peas are usually allowed to mature for seed. A large quantity of cowpea hay is annually cut and cured. A considerable quantity of oats is grown, but practically none of the crop is thrashed, being cut for forage and fed to the work stock during the late spring and summer months. Wheat is grown to a limited extent in the northern section and along the northwest border of the county.

In 1911 tobacco was grown to a small extent as compared with the previous years. The prices, however, were high, and its production on this account promises to be increased in the near future. The principal varieties are the Warn, Hickory, Prior, Tilley, and Gooch. These bright tobaccos are used in the manufacture of cigarette and pipe tobacco.

Of the miscellaneous crops peanuts are grown to some extent, and their production will in all probability increase. Watermelons are produced particularly in the vicinity of Clayton. From this point more than 100 carloads are shipped annually to the northern and western markets. The Tom Watson and Rattlesnake are the favorite varieties. Cantaloupes are grown to a small extent, and shipments

are made to outside markets from various points in the county. Sweet potatoes form a crop on every farm for home use, and some are grown for market. Crimson clover, chufas, rape, soy beans, vetch, velvet beans, and rye are other crops giving profitable yields. Irish potatoes and garden vegetables are found on nearly every homestead. Sorghum is grown in patches throughout the county, and the juice is manufactured into sirup for home use.

Apple, peach, pear, and cherry trees and a large number of fig bushes are scattered throughout the county. Scuppernong, James, and Misch grapes are found in practically all parts of the county, and some of these are marketed or made into wine. Some nursery stock is grown, particularly in Cleveland Township.

In many localities practically all the above-mentioned crops are grown upon the same type of soil without regard to adaptation. It is generally recognized, however, that the heavier soils of the Cecil types are better suited to wheat, oats, corn, cowpeas, and clovers than are the types of other series. Tobacco is grown most extensively on the Durham soils and upon the Norfolk sandy loam, Norfolk fine sandy loam, and Orangeburg sandy loam, though to a small extent also upon the Cecil sandy loam. It is claimed by some that the heavier Cecil soils cause the leaf to freckle and show openings known as "frog eyes."

Peanuts¹ give excellent results upon the mellow sandy loams where well drained and given applications of lime and manure. Peanuts could be advantageously rotated with tobacco and cotton. The truck crops, watermelons, and cantaloupes, are found to do best upon the light sandy loams or loamy sands.

Cotton, although grown upon every upland soil in the county, seems to reach its best development upon the Norfolk sandy loam, including its shallow phase, Orangeburg sandy loam, and Ruston coarse sandy loam. The King's Improved and Simpkins are varieties extensively planted.

The soils of Johnston County are adapted to a large number of crops, and to secure the best results suitable crop rotations should be established and maintained and the practice of one-crop farming abandoned. Some farmers now rotate cotton and corn, sowing cowpeas at last plowing of the corn or planting them in hills between the corn. A few others plant tobacco, cotton, and corn alternately, while some work in wheat and other crops with the cotton, but in general more attention should be given to this question. A practical rotation for the Norfolk, Orangeburg, Ruston, and Susquehanna soils would be cotton, peanuts, or tobacco, sowing cowpeas after the tobacco crop is gathered and crimson clover after peanuts, followed the third year by corn, sowing cowpeas at last plowing. A good three-year rotation

¹ Farmers' Bul. No. 25, U. S. Dept. of Agr., "Peanuts: Culture and Uses."

for the Cecil and Durham types would be wheat or oats, sowing cowpeas after the crops are harvested and following with a winter cover crop of rye or clover; second year, cotton or tobacco; and third year, corn, sowing cowpeas at last cultivation. In this rotation cotton, which is a clean cultivated crop, would follow a leguminous crop.

On some of the large plantations and many of the small farms the agricultural methods in practice are good, but on many others, where the tenant system is followed, there is room for considerable improvement. Much improved labor-saving machinery is now in use. Disk plows and harrows, stalk cutters, cotton and corn planters, fertilizer distributors, horse cultivators, weeders, and manure spreaders are operated on some of the better farms. The surface features and the mellow character of the soils over the greater part of Johnston County allow the use of all kinds of machinery. The heavier types of the Cecil, Durham, and Norfolk series are not plowed to a sufficient depth to secure the most profitable returns, as the one-horse plow is still used on many farms. The light sandy loams and sands, owing to their loose structure, do not require such deep plowing and are handled in a very satisfactory manner.

Large sums are spent annually for commercial fertilizer. It is applied to various crops and upon the different soils, regardless of any peculiar requirements they may have. The common fertilizers in use are 8-3-3 and 8-2-2 mixtures, in addition to which top dressings of nitrate of soda are also used. Some of the more progressive farmers buy acid phosphate, potash, and cottonseed meal, and do their own mixing. This method, in some instances, is preferable. Better results can be secured than with the complete fertilizer where the individual needs of the soils have been determined through experimentation. For the small farmers the complete, ready-mixed fertilizer is more convenient. Upon the light sandy loams and sands it is best to give the fertilizer in two applications, from one-half or two-thirds at time of planting and the remainder at the second cultivation.

In buying or mixing fertilizers for tobacco it should be borne in mind that muriate of potash, owing to the presence of chlorine, has a bad effect on the burning quality of tobacco. For this crop the potash should be supplied in the form of sulphate only. A good fertilizer for tobacco on the Norfolk soils would be 800 pounds of an 8-3-3 mixture and 100 pounds of sulphate of potash.

Cantaloupes and watermelons require from 600 to 1,000 pounds of high-grade fertilizer, approximating a 7-8-5 or 8-5-5 mixture. By using large quantities of barnyard manure, or planting on land where cowpeas have been previously turned under, the proportion of nitrogen may be lessened.

Sweet potatoes need large quantities of phosphoric acid and potash and a small quantity of nitrogen to insure a proper start in growth. A good fertilizer for this crop is secured by mixing 400 pounds of cottonseed meal, 1,200 pounds acid phosphate, and 400 pounds of sulphate of potash. Acreage applications of this mixture should not exceed 500 pounds.

Peanuts will probably become an important crop in Johnston County in the near future. The first requirement of this crop upon any soil is lime. If this is not by nature present in the soil it must be supplied in sufficient quantity to give a slightly alkaline condition. When this is done, from 300 to 500 pounds of a 10-4-1 fertilizer will give good results.

Cowpeas, also being a nitrogen-gathering crop, require but a small quantity of nitrogen in the fertilizer. A good mixture would be 300 pounds acid phosphate and 25 pounds muriate of potash per acre.

For corn from 300 to 500 pounds of a 4-8-2 mixture gives good results. Where crimson clover has been grown and turned under in the spring 400 pounds of acid phosphate and 50 pounds of muriate of potash, with a side application of nitrate of soda in midseason, will insure larger yields.

Cotton requires a complete fertilizer. From 400 to 600 pounds of an 8-3-3 mixture, with a side dressing of nitrate of soda, has proved satisfactory. When cotton follows crimson clover or a heavy crop of cowpeas, about 400 pounds of acid phosphate and 25 pounds of muriate of potash will usually insure good yields.

Wheat and oats, in order to make their best development, should have a complete fertilizer, unless the land has been fairly well manured, and then only a small quantity of nitrogen is necessary. From 60 to 100 pounds of nitrate of soda applied to the oats in the spring increases the yield greatly.

Crimson clover is, perhaps, the best winter cover crop for the soils of Johnston County. Being a legume, it is a good crop to precede cotton and corn, and if plowed under in the spring the yields of the staple crops are greatly increased. For clover the soil should be limed at the rate of 1,500 to 2,000 pounds per acre and inoculated with soil from a field where clover has been grown. About 15 pounds of seed per acre should be sown between the middle of September and the middle of October, using from 200 to 400 pounds of acid phosphate and 50 pounds of potash per acre.

Bur clover can be handled in practically the same manner as the crimson. It can be sown, however, as early as the last working of the corn and cotton. It improves the soil, but does not make good hay. Hairy vetch is also another legume which fills the soil with humus and supplies nitrogen. Soy beans make a good growth on

the sandy land, stand up well, and are easy to cut and cure. They also add nitrogen to the soil. The Mammoth Yellow is a good variety. Rape (the Dwarf Essex variety) makes fine winter grazing for hogs, becoming available in 8 or 10 weeks.

Farm labor is scarce throughout the county. Most of the laborers are negroes. A considerable part of the work of the farm is done by the women and children. Day laborers receive from 75 cents to \$1.25, while the monthly rate varies from \$15 to \$20. Women receive about 60 cents a day. It is a difficult matter to secure a sufficient number of hands to pick the cotton. The usual price paid at the beginning of the season is 50 cents a hundredweight. This price is gradually increased to 75 cents, and even \$1, before the season ends. There is a desire on the part of the farm laborers to become tenants as soon as possible.

A large number of the smaller farms throughout the county, particularly around Kenly, Princeton, northeast of Selma, and southeast of Benson, are operated by the owners. Upon many of these farms no help is hired at all, the men being assisted by the women and children. Very few of the farms are operated entirely by hired labor and an extensive tenant system is developed in many sections of the county. Under this system the landowner furnishes the land and one-half of the fertilizer and receives one-half of the crop. Sometimes, instead, one-half the fertilizer, the stock, feed, and implements are supplied. A few of the farms are operated on a cash rental basis or for a stated rent, say 1,000 pounds of lint cotton for 30 acres, or a one-horse farm.

The farms in Johnston County vary greatly in size, the smaller ones containing from 30 to 50 acres and the larger ones from 100 to 300 acres. It frequently happens that one person owns several farms, their aggregate holdings amounting to 1,000 acres or more. In a few cases from 5,000 to 10,000 acres are held in this way. There is a large undeveloped section lying along the Neuse River southeast of Smithfield, and here the individual holdings are large.

All land in Johnston County has increased in value within the last 8 or 10 years. According to the assessed valuations the cheapest lands lie in Bentonsville Township, where the average is about \$5 an acre. In Selma Township it is \$16.50 an acre. In some of the more remote sections of the county the poorer kinds of soil are held at \$8 to \$15 and the better kinds at \$15 to \$30 an acre. Near Kenly and Princeton the price ranges from \$30 to \$60 an acre, and in the vicinity of Selma, Clayton, Smithfield, and Benson from \$30 to \$100 an acre.

The natural resources of Johnston County are great and the soils capable of sustaining a highly developed intensive form of agricul-

ture. One farmer about 2 miles north of Hares Crossroads produced nearly 3 bales of cotton upon one acre of Norfolk sandy loam. His methods should prove instructive. In March the land was plowed to a depth of 15 inches and given a liberal application of barnyard manure. Prior to planting the seed 800 pounds of an 8-3-3 fertilizer was added to the soil. About the second week in June 400 pounds of the same mixture and 200 pounds nitrate of soda were added, and July 1, 400 pounds of fertilizer and 200 pounds of nitrate of soda, thus making a total of 1,600 pounds of 8-3-3 fertilizer and 400 pounds nitrate of soda. The rows were 6 feet apart and the stalks from 2 to 3 feet apart. King's Improved seed was used.

About three-fifths of Johnston County has no stock law. This includes the greater part of the eastern side and practically all of the southern half of the county. In this no-stock-law section cattle, hogs, sheep, and goats run at large over all the land that is not fenced. Under such conditions no improved strains of cattle or hogs can be raised. There is also no means of controlling disease.

Large quantities of hay, corn, oats, and meat are brought into the county for local consumption. All of these products can easily be grown and should be grown at home. More live stock should be kept, and there are plenty of crops suited to the soils and climate to provide feed not only for hogs, but for beef cattle, and sheep as well. Increasing the number of farm animals fits in nicely with the plan of rotating crops, which has already been shown to be necessary to a proper development of farming.

On the Cecil soils and portions of the Durham and Norfolk types deeper plowing, subsoiling, and a thorough pulverization of the soil are essential. Most of the cultivation should be done before planting. A deep, loose seed bed insures better drainage, more moisture, and a better stand than can possibly be secured upon a cloddy and shallow-plowed soil. Careful and systematic rotation of crops should be more largely practiced, so that a nitrogen-consuming crop will follow a legume. In this section winter cover crops should be grown extensively.

In the cultivation of cotton geese are very useful in keeping down the grass. Three geese suffice to keep the grass eaten out of two acres of cotton and upon some soils one goose to the acre will be enough. Low woven-wire fences, which can easily be moved from place to place, will keep the geese within bounds. This method of keeping down the grass is less expensive than the use of hired labor.

SOILS.

Johnston County lies on the border of the Piedmont Plateau and Coastal Plain provinces. Approximately one-sixth of the county,

embracing the northern end and parts of the western side, belongs to the Piedmont Plateau region. Tongues of this province also reach down the Neuse River and some of the larger streams for a distance of several miles, mingling with areas of Coastal Plain material which extend farther inland on the ridges and high interstream areas. Such alternating ridges of Coastal Plain material and rolling slopes and hillsides of Piedmont material occur along the western border of the county. This intermingling of the two regions is due to the removal of a surface covering of the Coastal Plain material along the line of contact with the uplands, where it was comparatively shallow. The streams have cut through this material and have also eroded the rocks to a considerable depth.

The soils of the Piedmont Plateau section are of residual origin, i. e., derived from the weathering of the underlying rocks. Coarse-grained granites predominate, with small quantities of gneiss, schist, diabase, diorite, and slate.

Two distinct soil series have been formed from these rocks, the Cecil and the Durham. The Cecil soils are characterized by gray to red surface soils, with stiff red clay subsoils, and are formed largely through the weathering of granites and to a less extent of gneiss, schist, diorite, and shale. These rocks carry iron-bearing minerals which, upon oxidation, impart the red color to the soil and subsoil. Slate is seen only in the extreme northeastern corner of the county, so that its influence upon the soils of this county is slight. The soils of the Durham series, with light-colored to gray surface soils and yellow, friable, and sometimes sandy clay subsoils, are derived from coarse-grained granite, slightly more siliceous and usually lower in iron-bearing minerals than the rocks giving the Cecil soils.

The Coastal Plain section of the county includes unconsolidated sands, clays, and gravel of sedimentary origin, brought down from the Piedmont and Appalachian regions and deposited while the present area was a part of the sea floor. These sediments have been more or less altered by weathering agencies since their deposition. The Norfolk, Portsmouth, Orangeburg, Susquehanna, and Ruston soils are formed from this material.

The Norfolk soils have yellowish-gray, light-gray to white surface soils and yellow, friable sandy clay or sand subsoils. These soils are usually well drained. The Portsmouth series is derived from the same materials as the Norfolk, but modified by very different conditions since emergence above the sea. They occupy flat areas in the uplands that have been in a semiswampy condition for a long time, thus favoring the accumulation of large quantities of vegetable matter, which is one feature that distinguishes them from the Norfolk. The swampy condition has also prevented weathering through

aeration. These soils are dark gray to black, with gray, sandy clay subsoils, mottled with brown or yellow. Mottled subsoils are not found in the true Norfolk types.

The Orangeburg, Susquehanna, and Ruston series, although small in extent, are typically developed. The Orangeburg series is represented by only one member, the Orangeburg sandy loam. This soil differs from the Norfolk soils mainly in the distinctive red color of its subsoil. Two members of the Ruston series were mapped. The soils are gray to grayish brown and the subsoils are brownish to reddish in color. The Susquehanna series presents one well-developed type, the coarse sandy loam, derived from the clays underlying the beds giving rise to the Norfolk, Portsmouth, Orangeburg, and Ruston series, and possibly representing the weathered product of the Potomac formation. The surface soil has the appearance of Norfolk, the subsoil being a dull-brown, tough, plastic clay, showing considerable mottling in the lower portion.

Along the contact of the Piedmont and Coastal Plain there are encountered areas where a thin covering of sandy or gravelly sedimentary material lies upon residual clay. This condition has given rise to the Bradley soils, which consist of gray to reddish-colored surface soils, containing rounded quartz gravel and stones, underlain by a stiff red clay subsoil. The Bradley series is intermediate between the Cecil and Norfolk soils, and it was difficult in many places to locate definite boundary lines.

The alluvial deposits along the streams, and particularly in the Neuse River flats, are the most recently formed soils of the county. These sediments have their origin in both the Piedmont Plateau and Coastal Plain, but have been reworked and redeposited by the streams. They constitute the first and second bottom lands, which include several distinct and important types of soil.

Many of the soils mapped in Johnston County are widely distributed throughout the Coastal Plain and Piedmont sections of the State. The Durham and Cecil types are but the beginning of prominent areas extending across the Piedmont Plateau. The Norfolk and Portsmouth series comprise familiar types of the Coastal Plain. The Orangeburg, Ruston, and Susquehanna, on the other hand, are seldom found in the Coastal Plain in North Carolina. The Bradley types have been encountered elsewhere along the contact between the Piedmont and Coastal Plain regions.

The following scheme shows the general grouping of the soils according to origin :

Origin.	Material.	Drainage	Color.	Type.
Residual; derived from underlying rocks.	Granites, gneisses, and schists interspersed with little diorite, diabase, and slate.	Good surface drainage.	Gray to red soils; stiff red subsoils.	Cecil stony sandy loam.
				Cecil coarse sandy loam.
In part residual from underlying rocks.	Coarse - grained granites; little gneiss.	Good surface drainage.	Gray soils; yellow friable clay subsoils.	Cecil sandy loam.
				Cecil fine sandy loam.
In part residual from underlying rocks.	Soils from Coastal Plain material; subsoils granite, gneisses, schists, and slates.	Good surface drainage.	Gray to reddish soils; stiff red clay subsoils.	Cecil clay loam.
				Durham coarse sandy loam.
Sedimentary; Coastal Plain deposits.	Unconsolidated sands and clays.	Drainage well established for most part.	Gray to yellowish-gray and white soils; yellow friable sandy clay or sand subsoils.	Durham sandy loam.
		Drainage well established.		Norfolk coarse sand.
Sedimentary; Coastal Plain deposits.	Unconsolidated sands and clays.	Drainage well established.	Gray to brownish soil; red friable sandy clay subsoil; oxidation more complete than other Coastal Plain soils.	Norfolk sand.
		Drainage well established.		Norfolk coarse sandy loam.
Sedimentary; Coastal Plain deposits.	Clay beds underlying unconsolidated sands and clay beds of Norfolk, Orangeburg, and Ruston soils.	Drainage well established.	Gray to brownish soils; reddish-yellow to dark-red friable sandy clay subsoils; oxidation advanced to stage between Norfolk and Orangeburg.	Norfolk sandy loam.
		Drainage poorly established.		Norfolk fine sandy loam.
Sedimentary; Coastal Plain deposits.	Clay beds underlying unconsolidated sands and clay beds of Norfolk, Orangeburg, and Ruston soils.	Drainage well established.	Dark-gray to black soils; gray or mottled gray, yellow and brownish subsoils; oxidation very incomplete.	Norfolk silt loam.
		Drainage well established.		Orangeburg sandy loam.
Sedimentary; Coastal Plain deposits.	Clay beds underlying unconsolidated sands and clay beds of Norfolk, Orangeburg, and Ruston soils.	Drainage well established.	Gray to brownish soils; reddish-yellow to dark-red friable sandy clay subsoils; oxidation advanced to stage between Norfolk and Orangeburg.	Ruston coarse sandy loam.
		Drainage well established.		Ruston gravelly sandy loam.
Sedimentary; Coastal Plain deposits.	Clay beds underlying unconsolidated sands and clay beds of Norfolk, Orangeburg, and Ruston soils.	Drainage poorly established.	Dark-gray to black soils; gray or mottled gray, yellow and brownish subsoils; oxidation very incomplete.	Portsmouth sandy loam.
		Drainage well established.		Portsmouth fine sandy loam.
Sedimentary; Coastal Plain deposits.	Clay beds underlying unconsolidated sands and clay beds of Norfolk, Orangeburg, and Ruston soils.	Drainage well established.	Gray soil; stiff, mottled red and gray clay subsoil.	Susquehanna coarse sandy loam.
		Drainage well established.		Susquehanna coarse sandy loam.

Origin.	Material.	Drainage.	Color.	Type.
Old alluvial; stream terraces above normal overflow.	Material largely washed down from Piedmont soils.	Well drained.....	Brown to reddish soils; yellowish-brown to reddish-brown subsoils; usual coarse substratum.	Wickham coarse sand. Wickham sandy loam.
		Rather poorly drained.	Gray soil; mottled yellow, gray, and brownish subsoil; oxidation not so complete as Wickham.	Altavista fine sandy loam.
Recent alluvial; first bottoms subject to overflow.	Largely from Piedmont.	Drainage poorly established; overflows.	Grayish soil; mottled gray, yellow, and brown subsoil.	Wehadkee silt loam.
	Material wholly or almost wholly from Piedmont.	Wet land; overflows at every rain.	Dark-colored brown to reddish undifferentiated soils of variable texture.	Meadow.
	Material partly from Coastal Plain and partly from Piedmont.	Covered with water greater part of year.	Grayish, brownish, and black undifferentiated soils of variable texture.	Swamp.
	Material largely Coastal Plain.	Drainage poorly established.	Black to dark-brown soil; mottled yellow, gray, and brownish subsoil.	Johnston loam.

The following table gives the actual and relative extent of the several soils mapped in Johnston County. Their distribution is shown by means of colors on the accompanying map.

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Norfolk sandy loam.....	146,496	33.7	Durham coarse sandy loam...	8,576	1.7
Shallow phase.....	21,440		Portsmouth fine sandy loam...	7,616	1.5
Norfolk sand.....	38,784	7.8	Portsmouth sandy loam.....	7,616	1.5
Swamp.....	31,104	6.3	Durham sandy loam.....	6,912	1.4
Norfolk fine sandy loam.....	30,080	6.0	Cecil coarse sandy loam.....	6,720	1.4
Norfolk coarse sandy loam....	28,864	5.8	Johnston loam.....	6,528	1.3
Cecil sandy loam.....	21,376	4.3	Orangeburg sandy loam.....	5,440	1.1
Susquehanna coarse sandy loam.....	19,136	3.8	Wickham sandy loam.....	5,248	1.1
Wehadkee silt loam.....	18,560	3.7	Bradley sandy loam.....	4,480	.9
Meadow.....	17,408	3.5	Altavista fine sandy loam....	3,968	.8
Cecil fine sandy loam.....	12,544	2.5	Ruston coarse sandy loam.....	3,392	.7
Norfolk silt loam.....	11,456	2.3	Wickham coarse sand.....	2,816	.6
Norfolk coarse sand.....	10,112	2.0	Ruston gravelly sandy loam..	1,728	.4
Cecil stony sandy loam.....	9,664	1.9	Cecil clay loam.....	768	.2
Bradley gravelly sandy loam..	9,088	1.8	Total.....	497,920

CECIL COARSE SANDY LOAM.

The surface soil of the Cecil coarse sandy loam consists of a yellowish-gray to light-brown loamy coarse sand to coarse sandy loam, ranging in depth from 5 to 12 inches. The subsoil is a stiff red clay, continuing to a depth of 36 inches and varying frequently in color from slightly yellow to reddish yellow to red. These variations are not typical, but represent a gradation toward another type, possibly the Appling coarse sandy loam.¹ Over some areas the surface soil consists mainly of fine sand mixed with silt and clay, with sufficient coarse sand and gravel to justify the classification of the type as a coarse sandy loam. Spots of gravelly sandy loam too small to be separated on a map of the scale used were included with the type.

The largest bodies of this type are situated in the northern and western parts of the county. It is well developed northwest and south of Hocutts Crossroads, to the south of Sealey Mill, northwest of Clayton, and on the south side of Swift Creek, in Cleveland Township. The type occurs as gently rolling upland areas in the vicinity of Hocutts Crossroads and as slope and hillside areas in other sections. Surface drainage is excellent, no ditching being necessary. Terracing to prevent erosion is needed on the steeper slopes.

This type is derived from the weathering of coarse-grained granite and gneiss. On the slopes erosion has been active, and much of the weathered material has been washed off, leaving the bedrock exposed in places or within 3 feet of the surface.

The type is suited to cotton, corn, oats, wheat, clover, and cowpeas. On the more sandy and deeper areas peanuts, rye, melons, and truck crops would do well. Corn ordinarily yields from 15 to 25 bushels per acre, but as high as 40 bushels can be obtained. Cotton produces from one-half to 1 bale when fertilized with applications of 400 to 600 pounds of an 8-3-3 mixture. A little sorghum is also grown. Peaches, pears, and cherries, while grown to a limited extent, can be made profitable around the home. Oats, cowpeas, and sweet potatoes do well.

A few bodies of the original timber growth remain, consisting of white, red, and post oak, some hickory, pine, and poplar. Some of the cut-over areas have grown up to old-field pine.

Land values range from \$15 to \$40 an acre, depending upon location and improvements.

CECIL SANDY LOAM.

The soil of the Cecil sandy loam consists of a yellowish-gray, light-brown or reddish-brown, medium to fine sandy loam, ranging

¹ See description of the Appling soils in the soil-survey reports on Columbia County, Ga., and Fairfield County, S. C.

in depth from 6 to 10 inches. The subsoil of the typical areas is a bright-red stiff clay, continuing to a depth of 3 feet or more, sticky when wet, and inclined to bake and crumble when dry. Over many areas quartz fragments and rounded gravel are present in small quantities in the surface soil. "Galled spots" of red clay loam exposed by surface washing are also occasionally noted. This type as a whole is mellow and easily tilled and in many situations lies well for the use of machinery.

In a few places on the slopes a yellowish to reddish-yellow and sometimes mottled clay is encountered in the subsoil. Such areas are not typical and represent patches probably of the Appling sandy loam too small to map.

The Cecil sandy loam is most extensively developed in the northern end of the county and along its western border. Large bodies of this soil are found around Emit, to the north and west of Bethel Church, on the south side of Buffalo Creek, in the vicinity of Barnes Crossroads, north of Clayton, along Whiteoak Creek, and to the east and south of Mount Zion Church. Other areas are encountered throughout this general region.

The topography is gently rolling to rolling and hilly. The more level and gently rolling areas occur around Emit and to the south. The greater proportion of the areas in other parts of the county are more or less sloping, hilly, or broken. Surface drainage is good and practically no ditching is necessary. On some of the hillsides terracing is practiced. Means to prevent washing should be more generally employed.

The Cecil sandy loam owes its origin largely to the disintegration and weathering of granite and gneiss. To some extent schistose rocks enter into its composition and in local areas diorite or diabase have had some influence. Outcrops of these rocks are found on slopes and in road cuts. The rocks are composed chiefly of feldspar, quartz, with a small quantity of mica, and their weathered product is a medium to fine sandy loam or loam. Surface wash has changed somewhat the texture of this soil in many places. The red color of the subsoil is due to oxidized iron compounds.

A considerable proportion of this type is cleared and cultivated, although many bodies are still forested with pine, oak, hickory, and other hardwoods.

The deeper and more sandy areas are suited to truck crops, berries, and peanuts, while the heavier areas are better adapted to corn, cotton, tobacco, grain, clover, and cowpeas. Cotton yields from one-half to 1 bale per acre, corn 15 to 25 bushels, and tobacco from 600 to 1,000 pounds. Oats, wheat, cowpeas, sweet potatoes, sorghum, and garden vegetables all give satisfactory returns. Apples, peaches, cherries, and figs are grown for home consumption. The larger

yields of tobacco and cotton are secured by heavy applications of commercial fertilizer. Farmers use practically the same fertilization for this type and other soils of the Cecil series as for the Norfolk types.

Some of the yields of cotton, corn, and tobacco indicate what this soil and the associated types of the Cecil series are capable of producing under favorable conditions. When properly manured, fertilized, and cultivated these respond readily in increased yields, the improvement being quite lasting on account of the clay subsoil, which prevents leaching. By plowing a little deeper each year, thoroughly pulverizing the soil, and by turning under leguminous crops or coarse manures to supply the much needed organic matter, a better seed bed can be formed. The soil will thus become more retentive of moisture and much larger yields will be the result. The decay of the organic matter will furnish, to a large extent, the needed nitrogen, while the fresh material brought up from the subsoil will supply additional plant food. By this method the expenditures for fertilizers may be reduced. Systematic crop rotation should be practiced upon this type. A good three-year rotation would be, cotton, followed by corn, sowing cowpeas at last plowing, and oats, sowing cowpeas or clover after this crop is cut. This would allow cotton, a clean cultivated crop, to follow a nitrogen-gathering crop.

By deeper plowing and the use of winter cover crops these soils will not erode or wash to any great extent and terracing may be largely eliminated.

The Cecil sandy loam is considered a good general farming soil and sells at prices ranging from \$20 to \$40 an acre.

CECIL FINE SANDY LOAM.

The surface soil of the Cecil fine sandy loam consists of a yellowish-gray to light-brown, mellow, fine sandy loam, extending to an average depth of 8 inches. The subsoil consists of a bright-red, stiff, brittle clay, 36 inches or more in depth. It is generally somewhat greasy to the touch and in a few localities a slight sand content is noticed. Spots of light-colored very fine sandy to silty loam are encountered near the base of the slopes and also in the vicinity of Moccasin Creek. These areas are not shown as a different type on the map as they are too small to be indicated without great exaggeration. Gravel and fragments of rock are occasionally found scattered over the surface of the type. In places the subsoil is reddish yellow and even yellowish in color, but such areas represent zones of gradation toward another type rather than a phase of this soil and are also too small to map. Small scales of mica are of frequent occurrence in the subsoil.

This type is confined to the western and northern parts of the county, the most important areas lying to the east of Emit, along the county line, to the north of the Iron Bridge on Neuse River, on Little Creek south of Clayton and scattered throughout the north-western section of the county.

The topography is gently rolling to rolling, becoming broken and hilly near the larger streams. This is particularly noticeable along Moccasin Creek, in the northern part of the county. The type has good natural surface drainage over its entire area. Terracing is necessary on some of the steeper slopes to prevent extensive and damaging surface washing.

This soil is derived from the decay of mica schist, gneiss, and fine-grained granite. In the northern part of the county a few spots derived from shales have been included.

The native forest growth consists of oak, hickory, and a few less important hardwoods.

Corn, oats, wheat, clover, cowpeas, and cotton do well on this soil. Corn produces from 10 to 25 bushels per acre, but yields of 40 to 50 bushels have been reported. Cotton yields from one-third to 1 bale per acre, depending largely upon the quantity of fertilizer used. Apples, peaches, and figs do well. Cowpeas give good returns. Irish potatoes, sorghum, and garden vegetables make good yields. The soil treatment outlined for the Cecil sandy loam applies equally to this type. Land values range from \$15 to \$50 an acre.

CECIL STONY SANDY LOAM.

The surface soil of the Cecil stony sandy loam consists of a gray to light-brown fine sandy to silty loam, varying in depth from 6 to 10 inches. The subsoil is a bright-red, stiff, brittle clay, 36 inches or more in depth and changing in spots to reddish yellow. Angular fragments of quartz and of the underlying rocks are mixed with the soil in proportions varying from 15 to 40 per cent. Rounded stones in considerable quantities and a medium to coarse textured soil characterizes a few small areas included with this type, and in the northern part of the county a red silty clay loam surface soil is encountered. Here and there, where erosion has been active, the subsoil grades into a mass of disintegrated rock 30 inches below the surface.

This type occurs in the northwestern and northern parts of the county. There are no very extensive areas. The more prominent bodies lie along the Neuse River, Mill Creek, east of Emit, and in the extreme northern part of the county near Moccasin Creek. A few small bodies are also found south of Clayton, east of Whiteoak Creek, and along Buffalo Branch.



Report of Bureau of Soils, U. S. Dept. of Agriculture, 1911.

PLATE I.

A GOOD CROP OF CORN ON PORTSMOUTH SOIL DRAINED BY DITCHING.

[The "tops" (portion of stalk above ears) have been cut for forage.]



FIG. 1.—POOR CROP OF COTTON ON THE NORFOLK SAND EAST OF SMITHFIELD.
[The type is better suited to early vegetables and watermelons than to the general farm crops.]

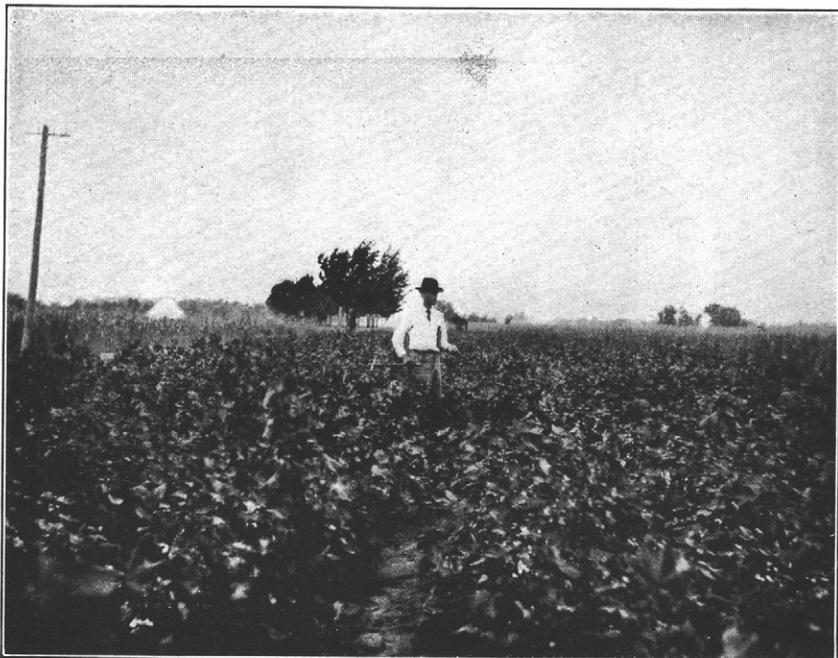


FIG. 2.—A GOOD CROP OF COTTON, FERTILIZED AND PROPERLY CULTIVATED, ON A SMOOTHER AND BETTER AREA OF THE NORFOLK SANDY LOAM, 2.5 MILES SOUTH-EAST OF CLAYTON.

The topography is rolling to hilly and broken. Some of the roughest and most hilly sections of the county are found on this type near Moccasin Creek and along the Neuse River. Owing to the surface features, drainage is thorough and in places excessive. Erosion has been active, and many hillsides are badly gullied.

The type is derived through the weathering from gneiss, schist, diabase, and granitic rocks, more or less influenced in the north-west corner by slate. These rocks have disintegrated to a depth of many feet in most places, but on some of the slopes erosion has kept such close pace with weathering that only a few feet of soil material has accumulated. These rocks outcrop in many places, and in certain sections large rounded boulders are found on the surface.

The greater proportion of this type is forested with oak, hickory, dogwood, other hardwoods, and heart pine. Some of the rougher areas should remain in forest or, if cleared, should be seeded to grasses and used only for pasture.

This is naturally a strong, productive soil, well suited to clover, grasses, corn, wheat, oats, and cowpeas. Cotton and corn are the principal crops now grown on it. On some of the more level areas, in the vicinity of Clayton, from one-half bale to 1½ bales of cotton per acre are obtained with the use of 600 to 800 pounds of fertilizer. Good yields of corn are also obtained where proper cultural methods are practiced. Cowpeas and oats do well. Of the fruits the apple will give the best results. Suggestions given for the improvement of the Cecil sandy loam apply equally to this type.

More remote and isolated areas of the stony sandy loam are held at prices ranging from \$10 to \$25 an acre, while the more favorably located areas command \$50 an acre.

CECIL CLAY LOAM.

The Cecil clay loam consists of about 4 or 5 inches of red to brownish loam or clay loam, underlain by a bright-red stiff clay, somewhat plastic when wet and hard and crumbly when dry. The subsoil usually extends to a depth of 3 feet or more, but occasionally grades into the disintegrated rock at about 30 inches. Small scales of mica are conspicuous in both the soil and subsoil in many places, and small gravel and fragments of quartz and of the parent rock are frequently present on the surface.

Only a few small spots of this type occur in the county, mainly in Oneals and Clayton Townships. These occupy the knolls, slopes, and occasionally gently rolling upland areas. Drainage is in most places good. In some level areas ditching is necessary.

The Cecil clay loam has been formed from the weathering of the underlying rocks, mainly gneiss, schist, diabase, and granite. Ero-

sion has played an important part in the development of the type, as the sandy mantle forming the Cecil sandy loam has been washed off, exposing heavier material giving the clay loam type.

Oak, hickory, a few other hardwoods, and heart pine constitute the forests on areas of this type.

This soil is adapted to wheat, corn, oats, clover, and grasses. Corn yields from 20 to 40 bushels per acre, and the other crops give fair returns. Cowpeas and clovers do well. To increase its productivity the soil should be loosened up, aerated, plowed deeply, and well supplied with organic matter. Applications of barnyard manure and the plowing under of cowpeas and clovers produce lasting results on this soil.

The Cecil clay loam occurs in small areas and is usually held in conjunction with other types of soil. The price ranges usually from \$15 to \$40 an acre.

DURHAM COARSE SANDY LOAM.

The surface soil of the Durham coarse sandy loam consists of a light-gray coarse sandy loam, grading in color at a depth of 6 inches into a yellowish gray, which continues to a depth of 10 to 12 inches. The subsoil, to a depth of 36 inches, consists of a yellow, friable clay, with a noticeable content of coarse sand particles. It usually extends to a depth of several feet, but in some places the clay grades into disintegrated granite at 24 to 30 inches. Fine mica flakes are occasionally found in the soil and subsoil and in some localities a reddish-yellow color is noted in the soil, particularly adjoining areas of Cecil soils. Over the wooded areas and fields which have been heavily manured the surface soil is a darker gray color. Angular fragments of the underlying rocks and a few rounded quartz pebbles are present in some areas of this type but not in sufficient quantity to interfere seriously with cultivation. A few spots of gravelly sandy loam were found, but not of sufficient size to separate on a map of the scale used.

This type is confined almost exclusively to the northern part of the county and along the northwest boundary. It is well developed along the Wake County line, along Cat Tail Creek, in the vicinity of Richardson Mill, and around Clyde Chapel. A few small bodies are found north of Clayton.

The surface features vary from gently rolling to rolling, and near some of the larger streams the type becomes hilly and broken. In a few places the hillsides are sufficiently steep to cause damaging erosion. The open texture of the soil, with the rolling topography, insures excellent drainage and practically no areas require ditching or tiling.

The type is of residual origin and derived chiefly from the weathering of coarse-grained granites, though influenced in places by dikes

of diorite and diabase. The granite is composed largely of feldspar, quartz, and mica. The feldspar breaks down, forming clay, while the quartz remains as sand, the resultant product being a loose, coarse-textured, sandy loam.

The original forest growth consisted of white, post, and red oak, hickory, dogwood, and some cedar. Reforested areas carry a growth of loblolly and old-field pine.

Owing to its excellent drainage and open texture, tillage operations are easy. A fairly large proportion of the type is now under cultivation. It is well adapted to the production of bright tobacco, rye, corn, sweet potatoes, and truck crops. Tobacco yields 600 to 1,000 pounds per acre, with applications of 600 to 800 pounds of 8-3-3 fertilizer. The yield of corn ranges from 10 to 30 bushels per acre. Cotton yields from one-third to two-thirds of a bale, depending upon the quantity of fertilizer used. Rye and sweet potatoes give good and garden vegetables fair results. Apples, peaches, pears, and Scuppernong and Misch grapes do well.

This soil contains very little organic matter and can be greatly improved by applications of barnyard manure or by turning under green manuring crops, such as cowpeas and rye. Such vegetable matter, incorporated in the soil, considerably increases the yields and the effects of such treatment are seen in the soil for several years thereafter.

Land values range from \$10 to \$40 an acre, depending on location and improvements.

DURHAM SANDY LOAM.

The surface soil of the Durham sandy loam consists of a light-gray medium sandy loam, extending to a depth of 6 to 8 inches, grading into a pale-yellow medium to fine sandy loam, which continues to a depth of 15 inches. The subsoil consists of a yellow sandy clay, compact but friable, extending to a depth of 36 inches or more. In some areas a few small gravel and angular stones are present on the surface. The presence of bedrock within 3 feet of the surface is rare, but small mica scales are commonly present in all typical bodies in both soil and subsoil. No sharp line could be drawn between this type and the Norfolk sandy loam, as the two merge into each other so gradually as to make the placing of boundaries more or less arbitrary. Where this type borders the Norfolk sandy loam considerable quantities of small rounded gravel are usually found.

Durham sandy loam occurs along the northwest border and in the northern part of the county. The more prominent bodies lie around Earpsboro, Salem Church, west of Sealey Mill, and between Whiteoak and Swift Creeks.

The surface of this type is gently rolling to rolling, becoming more broken and hilly along the larger streams. The surface drainage is good. Terracing is necessary on some of the slopes to prevent erosion.

In origin this type is similar to its associated type, the Durham coarse sandy loam. The textural difference is due to the finer texture of the parent rock, outcrops of which occur in many places.

The present forest growth consists of loblolly pine, oak, hickory, sweet gum, dogwood, and some cedar. Much more of this type could be easily brought under cultivation and only the rougher and steeper spots need to remain forested.

The Durham sandy loam is admirably suited to the growing of bright tobacco, and with the Durham coarse sandy loam constitutes the finest tobacco land in the bright-tobacco belt of North Carolina and Virginia. The yields range from 500 to 1,000 pounds per acre. From 400 to 800 pounds per acre of an 8-3-3 fertilizer is the usual application for this crop. Cotton generally gives a low yield, but with proper cultural methods fair yields can be obtained. The type is an excellent sweet potato soil. Even the thin spots when properly manured produce large yields. Oats and rye also do well. Apples, peaches, berries, garden vegetables, and sorghum cane are grown for home use. Corn is one of the leading crops. The yields of this grain range from 10 to 30 bushels per acre.

The soil is deficient in organic matter, which can be supplied by applying coarse stable manures or turning under green manuring crops. Such treatment will be necessary before large crops of corn and cotton can be secured without the use of heavy applications of commercial fertilizers.

Land of this type of soil ranges in price from \$15 to \$50 an acre, depending largely upon location and improvements.

BRADLEY SANDY LOAM.

The Bradley sandy loam consists of a light-gray to yellowish-gray medium to fine sandy loam, varying in depth from 6 to 20 inches. The subsoil is a yellow or red stiff clay, mottled in places with bright red and pale yellow. It grades into disintegrated rock at depths ranging from 30 to 36 inches.

The Bradley sandy loam is of minor importance, occurring in narrow strips in the northeastern part of the county. Most of these lie along Little Buffalo and Buffalo Creeks, with small areas along the Little and Neuse Rivers. A few spots are also encountered in Wilsons Mills Township.

This type occupies the slopes, hillsides, and rolling areas lying between the upland Norfolk soils and the bottom lands adjacent to the streams. It has good surface drainage.

Erosion has played an important part in the formation of this soil. The surface consists of a thin layer of sedimentary material similar to that giving the Norfolk soils, and the subsoil of residual material derived from the Piedmont rocks.

Practically all of this type is forested to oak, hickory, and pine. Where cultivated cotton yields from one-half to two-thirds bale per acre. Corn gives low yields. Sweet potatoes do well where the soil is heavily fertilized. Erosion is a constant source of damage to cultivated areas and the type should be left in forest or permanent pasture.

BRADLEY GRAVELLY SANDY LOAM.

The surface soil of the Bradley gravelly sandy loam consists of a yellowish-gray to light-brown or reddish medium to fine sandy loam from 6 to 12 inches deep. The subsoil is almost identical with that of the Cecil soils, consisting of a stiff red (occasionally reddish-yellow or light-brown) clay, reaching to a depth of 36 inches or more. Small quantities of mica scales are sometimes found in the subsoil. From 25 to 50 per cent of the surface material consists of rounded gravel and stones, mostly of quartz. Patches of light-gray sandy loam and occasional "galled spots" of clay loam are included in the typical areas.

The type is developed along the contact of the Cecil with the Norfolk soils, the largest areas occurring in the neighborhood of Clayton, around Thanksgiving Church, north of Wilsons Mills, and west of Bethesda Church. Other areas are found in the western and north-central parts of the county.

The type lies upon knolls, ridges, and hillsides, most of which can be easily cultivated. The surface drainage is excellent, the rolling surface and loose structure of the soil permitting ready run-off.

The Bradley gravelly sandy loam owes its origin to the overlapping of Coastal Plain material upon that of the Piedmont Plateau. The subsoil is of residual origin, being derived from the weathering of granite, gneiss, and schist. The surface is mainly Coastal Plain material, but is more or less mixed with the weathered product of the rocks. The numerous small "galled spots" seen throughout this type are due to the removal of the sandy surface layer by wash, leaving the red clay subsoil exposed. In a number of instances it was difficult to separate this type from the Cecil stony sandy loam. In some places beds of almost pure gravel exist.

By far the greater part of this type has been cleared and is now under cultivation. The remaining areas support a growth of oak, pine, and other trees common to the region. This soil is well adapted to cotton, corn, oats, cowpeas, clovers, sweet potatoes, and rye. Cotton yields from one-half bale to $1\frac{1}{2}$ bales per acre. From

400 to 800 pounds of an 8-3-3 fertilizer is generally applied to this crop. Corn yields from 15 to 40 bushels and is always fertilized, about 300 pounds per acre of the same mixture being used. Cowpeas make a good growth. They give large yields where fertilized with acid phosphate. Oats are grown to a very limited extent, but the yields are satisfactory. Garden vegetables, as well as Irish potatoes and sweet potatoes, are successfully grown for home use. Scuppernong grapes, figs, apples, peaches, and berries are grown to a small extent.

This soil in the main is easily tilled, but in certain areas where the percentage of gravel is high and where there is a large quantity of rounded stone tillage is carried on with difficulty. These gravelly and stony areas are very wearing on farm machinery. The type can be improved and made fairly productive by the use of green manuring crops and coarse manures. The underlying subsoil of red clay tends to make improvements along this line fairly lasting in effect. The incorporation of vegetable matter and deeper plowing will result in a more favorable seed bed, and larger returns may be expected.

Land values for this type vary widely, the determining factors being nearness to rail transportation and towns. Prices range from \$15 to \$75 an acre.

NORFOLK COARSE SAND.

The surface soil of the Norfolk coarse sand consists of a light-gray to yellowish-gray, coarse, incoherent sand, varying in depth from 6 to 8 inches. The subsoil is of similar material and extends to a depth of 36 inches or more. In places the sand of the subsoil is slightly sticky and grades into a sandy loam at a depth of 30 inches. Considerable fine sand is present in both soil and subsoil in the typical areas of this soil, and small rounded quartz gravel is frequently encountered on the surface. Where cultivated for a considerable length of time without the addition of organic matter the soil gradually becomes white in color. Some of the flat, wooded areas, particularly near the Little Dismal Swamp, have a shallow surface of black loamy sand. Other spots are slightly brown in color.

The type is found principally in the extreme southern part of the county. It is well developed in Meadow Township, and particularly along the county line at the head of McCullers Branch. Areas are also found in the eastern part of the county to the northeast of Barkers Mill and about a mile north of Rayns Crossroads.

The topography varies from flat to gently rolling and rolling. In the vicinity of Mill and Stone Creeks it occupies the slopes and rolling hillsides. The flattest area lies around Little Dismal Swamp.

Excepting in this place, the surface drainage is excellent. The soil dries quickly, warms early, and can be tilled immediately after a rain.

This soil represents old marine sedimentary material. In some places the topography is suggestive of an old beach formation. On the slopes probably a large part of the finer material originally present has been washed out of the soil by the rain waters. Wind action has changed the location of this sand in a few localities.

The Norfolk coarse sand was originally forested with longleaf pine, but most of this has been cut. The present timber growth consists of old-field pine, scrub oak, and sweet gum bushes. Some abandoned fields are covered with broom sedge. A little turpentine is carried on where the native pine still remains.

This soil is too light for general farming purposes. It is well suited to the production of early truck crops, blackberries, dewberries, Scuppernong and Misch grapes, peaches, and watermelons. Of the staple crops rye gives the best returns. Cotton under normal conditions yields about one-fourth bale per acre, but when heavily fertilized and with favorable seasons 1 bale per acre is obtained. Corn yields from 5 to 8 bushels, but as much as 25 bushels per acre has been secured with the use of both manure and fertilizer. With proper culture, sweet potatoes give good returns. Early garden vegetables are grown very successfully.

The Norfolk coarse sand varies in value from \$5 to \$30 an acre, depending upon location and improvements.

NORFOLK SAND.

The surface soil of the Norfolk sand, to a depth of 5 to 8 inches, consists of a yellowish-gray or gray to nearly white medium sand. The subsoil is of similar material and extends to a depth of 36 inches or more. Occasionally a reddish-yellow sand is encountered, but such areas represent a gradational soil toward some other type. Both soil and subsoil are ordinarily loose, porous, and incoherent. Gravel is found on the surface over a few areas. Where it borders the sandy loam member of the series the type becomes slightly sticky in the subsoil at depths of 28 to 80 inches. In spots the surface soil has a dark-brown or gray color and frequently on the knolls a white, loose, porous sand is encountered. The most pronounced of these spots lies on the Smithfield Road a few miles northwest of Bentonsville. Patches of coarse and of fine sand too small to map separately are found throughout the type.

The Norfolk sand occurs in large irregularly shaped areas throughout the county, and in smaller bodies in the areas of Norfolk sandy loam. Some of the best developed and largest unbroken areas are situated in the vicinity of Bentonsville, Long Branch School, Corinth

Church, Strickland Crossroads, Pisgah Church, and Pleasant Grove Church.

The topography varies from level and gently rolling to rolling. A few knolls and ridges exist, the type sometimes extending over a steep slope. It occupies, in the main, high upland, interstream areas. The porosity of this soil, combined with its topographic features, insures excellent drainage over its entire extent. Only in a few of the level places is artificial drainage advantageous.

The Norfolk sand is derived from Coastal Plain sediments. Wind action has played some part in the formation of the knolls. A few of these spots are now locally spoken of as "sand blows." Water erosion has not changed the character of this material to any great extent since its deposition, except in a few spots where the sand has been transported a short distance and redeposited. This soil, like the Norfolk coarse sand, is decidedly deficient in organic matter.

By virtue of its position, loose and rather incoherent texture, it warms up early in the spring. The rapidity with which rain waters pass through this soil and quickness with which it dries out make tillage operations possible after a summer rain. One of the peculiar features of this soil is its power to withstand drought. Its loose, open structure would lead one to expect it to be droughty, but the best crops are secured in dry seasons.

The original forest consisted of longleaf pine, most of which has been cut. There are at present in some places, particularly near Beasley, some red, white, and post oak, while considerable areas are covered with a second growth of old-field pine. Upon the more dune-like areas small scrub oak, forked-leaf oak, sweet gum bushes, and a few pines are seen.

The Norfolk sand lends itself admirably to the production of early truck crops, Scuppernong and Misch grapes, sweet potatoes, rye, chufas, peaches, watermelons, and vegetables. The yields of the staple crops, such as corn and cotton, are extremely low under normal conditions, with fertilization (see Pl. II, fig. 1). About one-fourth bale of cotton and from 8 to 10 bushels of corn per acre are ordinary yields from this soil. However, with liberal to heavy applications of fertilizer from one-half bale to 1 bale of cotton and from 15 to 25 bushels of corn can easily be grown. Sweet potatoes yield from 100 to 300 bushels, depending upon the quantity of manure or fertilizer used. Rye does well and makes a good cover crop during the winter months, to be turned under in the spring. Watermelons and Scuppernong and Misch grapes are successfully grown. Cowpeas and oats are almost a failure unless fertilized. Cowpeas, however, make a good growth when 200 pounds of acid phosphate and 25 pounds of muriate of potash per acre are used. Sweet potatoes are commonly fertilized with 600 to 800 pounds of bone meal and potash mixtures when heavy

yields are desired. Corn receives 400 pounds and cotton from 400 to 800 pounds of an 8-3-3 fertilizer. From 50 to 75 pounds of nitrate of soda is applied to cotton as a top dressing about the second cultivation. Frequently the corn receives this additional fertilization. Few peaches or other fruits are grown.

The Norfolk sand and Norfolk coarse sand would be greatly improved by turning under green manuring crops or by adding large quantities of coarse stable manure. A winter cover crop such as rye and crimson clover may be grown and turned under in the spring before planting to corn or cotton. Much larger yields of corn and cotton would be secured if this practice were followed more generally.

The Norfolk sand ranges widely in value from \$8 to \$15 an acre for areas in the southeastern corner of the county to as high as \$40 an acre for areas located near the towns.

NORFOLK COARSE SANDY LOAM.

The surface soil of the Norfolk coarse sandy loam consists of a coarse loamy sand to light coarse sandy loam, usually gray to yellowish gray or white in the first few inches and grading below into a pale yellow. The subsoil is encountered at a depth varying from 12 to 16 inches and consists of a yellow, coarse, sandy clay, usually friable in structure and in many places slightly sticky. In the lower-lying, poorly drained areas some gray mottling is seen, and on some of the slopes a reddish-yellow or brown sandy clay is encountered. This material represents an approach to the Orangeburg or Ruston series. In some of the wooded and more level areas and in cultivated fields where it has been heavily manured the soil is dark gray in color. In a few localities the surface soil is almost a loamy sand. Generally a few quartz gravel are present in the soil mass. This is particularly noticeable in the southern part of the county in Banner and Pleasant Grove Townships.

Prominent areas of Norfolk coarse sandy loam are found south of Black Creek, in Pleasant Grove and Elevation Townships, and to the north and northwest of Beulah town. Several bodies occur in Boonhill Township, along Moccasin Swamp, near Barkers Mill and to the west of Smith Chapel.

The surface of the type varies from level or gently rolling to rolling areas. The more level bodies occur on the broad divides and the rolling and slightly hilly areas along the swamps bordering the larger streams. The open texture of this soil, with its rolling topography, insures good drainage in practically all areas, and only a few of the more level places require artificial drainage.

The Norfolk coarse sandy loam, like its associated types, has been formed from the weathering of sedimentary sands and clays. In the case of this type, however, the material has been modified con-

siderably by erosion, as a large part of the finer sediments have been carried away in suspension by storm waters, leaving a coarse, loose, sandy loam as the result. This soil is deficient in organic matter. It warms up early in the spring, drains out readily, and is easy to cultivate and handle.

Some longleaf pine, a few oak and hickory trees, and some old-field pine constitute the forest growth.

The Norfolk coarse sandy loam is adapted to cotton, tobacco, cowpeas, chufas, peanuts, corn, truck crops, grapes, peaches, watermelons, and cantaloupes. The principal crops grown are corn, cotton, cowpeas, a little tobacco, sweet potatoes, and rye. Cotton yields from one-third bale to $1\frac{1}{4}$ bales per acre and corn from 10 to 35 bushels. Only a small acreage is in tobacco, but the yields are entirely satisfactory. Cowpeas, rye, and sweet potatoes are successfully grown. All these crops are fertilized, the general practice in this respect being about the same as upon the Norfolk sandy loam. The general suggestions for soil improvement for the latter type apply equally to this type.

Land values range from \$20 to \$50 an acre, depending upon location and improvements.

NORFOLK SANDY LOAM.

The surface soil of the Norfolk sandy loam varies in depth from 12 to 30 inches and consists of a light-gray to yellowish-gray, medium to light sandy loam or loamy sand. Below the surface 6 inches and extending to the sandy clay subsoil a pale-yellow, light, sandy loam or loamy sand is encountered. The subsoil to a depth of 36 inches or more is a bright-yellow, friable sandy clay, usually sticky. In a few instances where the internal drainage is insufficient deeper portions of the subsoil show a slight mottling of gray. On some of the slopes a reddish-yellow to slightly mottled sandy clay occurs, and noticeably in the vicinity of Benson and throughout Pleasant Grove Township. This reddish to brownish coloration in the subsoil makes the soil of such areas resemble the Ruston sandy loam, which has been mapped in some of the Southern States. Brilliant mottlings and streakings of red and yellow are noticeable at depths of 3 to 5 feet throughout many areas of the type. In some areas which have been cultivated for a considerable time without the addition of any vegetable matter the surface soil is nearly white.

Rounded gravel is sometimes found on the slopes, although the more uniform and typical areas are free from it. In a few localities, particularly on slopes, a rather large quantity of coarse sand is found, while upon some of the more level to gently rolling areas the soil closely approaches in texture a fine sandy loam or loamy sand. In the vicinity of Oakland Church, to the south and east of Shiloh

Church, to the south of Archer, and in many other localities a yellowish-gray medium loamy sand to a depth of 20 to 30 inches is encountered. In many instances it was difficult to draw any distinct boundaries between this phase and the true Norfolk sand, as they gradually merge into each other through a wide gradation zone.

The Norfolk sandy loam is the most extensive and most important type in the county. It occurs in large, irregular-shaped areas throughout the county, with the exception of the extreme northern point and the area embraced by the Neuse River flats. Some of the more prominent and uniform areas lie south and east of Clayton, around Archer, to the east of Hares Crossroads, southeast of Kenly, northwest of Selma, around Wilsons Mills, Elizabeth, Oakland, and Rehobeth Churches, in the vicinity of Four Oaks, Blackmon Crossroads, and around Princeton.

The surface is level, undulating, or gently rolling to rolling. Most of the type is found in broad interstream areas, which become rolling as the larger streams are approached. Some of the more level and gently rolling areas are situated to the east of Kenly, east of Hares Crossroads, around Archer, between Clayton and Wilsons Mills, near Baptist Center Church, in the vicinity of Four Oaks, and to the southwest of Princeton. Owing to the loose structure and depth of the surface soil and the favorable topography the type is generally well drained and only a few of the level areas would be improved by ditch or tile drains.

The Norfolk sandy loam is derived from the weathering of old marine sediments. Erosion has not affected the type to any very marked degree, except on the slopes, where some of the finer sediments have been washed out, leaving a slightly coarser and more porous soil. Oxidation of the iron compounds is noticeable in places on the slopes where adequate drainage and aeration have been active. There is a general deficiency of organic matter throughout the type. This is due in part to the open, porous, and well-aerated nature of the soil, which gives rise to rapid oxidation of such plant remains as may become incorporated with the soil from time to time.

This type was originally forested with longleaf pine, but only a few bodies of this merchantable timber are now seen. Some oak, hickory, dogwood, persimmon, and old-field pine are found on the areas not under cultivation.

The Norfolk sandy loam is adapted to the widest range of crops of any type in the county. The deeper areas are admirably suited to the production of early truck crops, watermelons, cantaloupes, berries, peaches, peanuts, chufas, and rye. Where the soil is from 15 to 22 inches deep the best quality of bright tobacco is produced, and, taken as a whole, the type is the best cotton soil in eastern North

Carolina. (See Pl. II, fig. 2.) Corn, cowpeas, crimson clover, rye, grapes, sweet potatoes, and other crops which thrive under the climatic conditions of this section are also well suited to this soil.

Cotton ordinarily yields from one-half bale to 2 bales per acre, and as much as 3 bales has been produced. From 500 to 1,000 pounds of an 8-2-2 or 8-3-3 fertilizer per acre is commonly applied on land prepared for this crop with a top dressing of 50 to 75 pounds of nitrate of soda when the plants are partly grown. The usual yield of corn is from 12 to 25 bushels. Under exceptionally favorable conditions 60 bushels per acre have been produced. From 300 to 500 pounds of fertilizer is generally used for this crop, with a little top dressing of nitrate of soda. Tobacco, although extensively grown in the past, now occupies only a small acreage. The yields are satisfactory, ranging from 500 to 1,000 pounds per acre. From 600 to 1,000 pounds of an 8-3-3 mixture, with 25 to 50 pounds of nitrate of soda applied 15 days after transplanting, is the usual fertilizer application. Wheat is grown on this soil by a few of the best farmers. It is always sown on land in a high state of productiveness or which has been heavily manured and fertilized, and large yields are commonly obtained. Oats are grown to a very limited extent, but fair yields are obtained when an application of nitrate of soda is given in the spring. A little rye and a few chufas are grown. Peanuts, although a good crop for this soil, are given only a small acreage. Cowpeas are more extensively grown. They are sown after the truck and small grain crops or in the corn at the last cultivation. They do best when an application of acid phosphate and potash has been given the land. From 10 to 20 bushels of peas per acre can be obtained or from 1 ton to 1½ tons of hay. A mixture of cowpeas and crab grass makes excellent hay. Large quantities of watermelons and a few cantaloupes are grown for shipment. These crops yield well when given from 800 to 1,000 pounds of high-grade fertilizer. Sweet potatoes do well and are grown on every farm for home use. Some are marketed. They do best on rather poor soil when heavily manured or fertilized with acid phosphate, potash, and a little nitrogen to start their growth. Sorghum is grown in small patches on most of the farms with satisfactory results. Irish potatoes and cabbages are successfully produced. Scuppernong, James, and Misch grapes do exceedingly well, and large vines are seen around every well-established home. Other fruits, including peaches, pears, figs, summer apples, and berries, succeed on this soil. Besides these crops, all kinds of garden vegetables are grown for home use.

Like its associated types, the Norfolk sandy loam is deficient in organic matter, especially where it has been continually cropped to cotton. A winter cover crop of crimson clover, rye, or vetch

would help replenish this necessary constituent. By growing these crops during the winter, leaching is prevented and by turning them under in the spring considerable vegetable matter will be added to the soil, greatly increasing the yields of corn and cotton. Coarse manures are also very beneficial in supplying the needed nitrogen and organic matter, but the supply is entirely inadequate. The manure and green crops also improve the texture of the soil, making it more loamy and more retentive of moisture. On the shallower areas deep plowing will aid considerably in increasing the productiveness of the type. The soil is naturally mellow and easy to cultivate, and, owing to its even surface, all kinds of labor-saving machinery can be used upon it advantageously.

Embracing, as it does, a large part of the county, the type varies widely in value. In some of the more remote sections it is held at \$20 to \$40 an acre, while near Clayton, Smithfield, Selma, and some of the other more important towns prices range from \$40 to \$100 an acre.

Norfolk sandy loam, shallow phase.—The surface soil of the shallow phase of the Norfolk sandy loam consists of a gray to grayish-brown, medium sandy loam, varying in depth from 6 to 12 inches and occasionally grading into a yellow sandy clay below 6 inches. The subsoil extends to a depth of 36 inches or more and consists of a sticky sandy clay, varying in color from yellow to reddish brown. In sections where oxidation has been active the subsoil is more friable and of reddish-yellow color. Both soil and subsoil are slightly heavier in texture, and the brown color more pronounced than in the typical soil. In some of the more level, wooded areas the first 2 or 3 inches of the surface soil are dark gray.

The most important area of this phase lies to the northeast of Selma along the Atlantic Coast Line Railroad. Other bodies occur in the vicinity of Benson, to the southwest of Princeton, in the vicinity of Pine Level, and east and south of Kenly.

This soil differs from the typical Norfolk sandy loam in its topographic features, shallower depth of soil, and drainage conditions. It occupies level, undulating, or gently rolling areas, well suited for the use of improved machinery. The surface drainage is not as good as that of the typical Norfolk sandy loam. Natural drainage has not been perfectly established and no streams flow through it, but as it occupies high upland areas, good drainage can easily be effected by means of open ditches. On a few of the areas, where the surface is undulating to gently rolling, no ditching is necessary.

The Norfolk sandy loam, shallow phase, has been formed from the same material and in the same way as the typical Norfolk sandy loam, except that erosion has not been so active an agent. The seepage waters, however, have carried some of the finer material to

lower levels. The soil contains a slightly larger quantity of organic matter than the Norfolk sandy loam.

Considerable areas of longleaf pine exist on this phase. Some oak, hickory, and gum are also found. One noticeable feature of the soil is the fact that it is either farmed or remains forested with its original growth. This is due to the fact that when once cleared and cultivated it produces so well that it is seldom "turned out."

The Norfolk sandy loam, shallow phase, is naturally a strong and productive soil, being well suited to cotton, corn, peanuts, cowpeas, sorghum, and oats.

Cotton yields from one-half bale to 1 bale per acre, the average being about three-fourths of a bale. Most of the farmers use from 400 to 600 pounds of 8-3-3 fertilizer, or 600 pounds of a mixture of 800 pounds cottonseed meal, 800 pounds acid phosphate, and 400 pounds potash per acre. Corn yields from 20 to 50 bushels per acre. It is also fertilized, but not as heavily as cotton. A side dressing is applied to both corn and cotton. Peanuts yield from 20 to 40 bushels and cowpeas from 1 to 2 tons of hay per acre. Sorghum yields well, but only small patches are grown for home use. Some tobacco is grown on the deeper and better drained areas. The plant on this soil tends to make too heavy a growth to give the desired bright colored leaf. Yields would naturally be heavier than upon the lighter soils.

Subsoiling, particularly on the shallow areas, proves profitable, as it gives a deeper seed bed and enables the soil to withstand drought much better. Drainage is also improved in this way.

This phase of the Norfolk sandy loam is one of the best soils in the county. Little of it is changing hands and it is held at prices ranging from \$35 to \$100 an acre.

NORFOLK FINE SANDY LOAM.

The surface soil of the Norfolk fine sandy loam consists of a yellowish-gray, light-gray, or pale-yellow fine sandy loam, extending to a depth of about 6 inches, where it grades into a yellow fine sandy loam, continuing to depths ranging from 12 to 20 inches. It rests upon a subsoil of yellow sandy clay, usually friable, but sometimes sticky, and becoming heavier in the lower portion. This subsoil is 36 inches or more in depth. Over poorly drained areas slight mottlings of gray and yellow occur, the content of silt and clay being heavier than in the areas of typical soil. In a few places, particularly on the slopes, an appreciable quantity of medium sand particles is found in the soil mass. There are a few depressions in this type where the surface soil is a silty to very fine sandy loam. Between Selma and Smithfield a fine to very fine sandy loam relatively high in silt and of a gray color through the surface 2 or 3 inches is encountered.

This type is limited in extent as compared with the Norfolk sandy loam, although numerous bodies and small tracts occur throughout the county. About two-fifths of its area lies in Beulah Township. Extensive bodies are situated between Selma and Smithfield and many smaller tracts to the northwest of that town on the road to Clayton. Small, isolated areas occur throughout the eastern and central parts of the county.

The topography is flat and undulating to gently rolling. Some of the more level bodies lie between Selma and Smithfield, to the east of Smithfield, south of Micro, and along the Wilson County line in the vicinity of Kenly. The more gently rolling areas occupy slopes bordering the streams or swamp areas. As a rule such areas possess good natural surface drainage, while the more level areas require ditching or the use of tile. All of the type can be easily and adequately drained by such means.

The Norfolk fine sandy loam represents the finer materials of the Coastal Plain deposits. Some changes have been brought about in this material on the slopes as the result of erosion and washing out of the finer soil particles.

The native forest growth consists of loblolly and longleaf pine, with some oak and hickory. A considerable proportion of the type has been cleared and put under cultivation.

This soil is adapted to a variety of crops. The deeper and better drained areas are particularly well suited to bright tobacco, truck crops, watermelons, cantaloupes, sweet potatoes, peanuts, chufas, grapes, and peaches. On the heavier areas cotton, corn, oats, cowpeas, crimson clover, and other crops common to the county may be grown. Cotton yields from one-half bale to 2 bales per acre, corn 15 to 40 bushels, cowpeas from 1 ton to 1½ tons of hay or from 10 to 15 bushels of shelled peas. Tobacco yields from 500 to 900 pounds per acre when given applications of 400 to 800 pounds of commercial fertilizer. The leaf is of excellent quality. Sweet potatoes and sorghum yield well, while cantaloupes, watermelons, grapes, and figs give very profitable returns. The fertilizer suggestions made with reference to the Norfolk sandy loam apply equally to this soil.

Land values range from \$25 to \$60 an acre, depending on location and improvements.

NORFOLK SILT LOAM.

The surface soil of the Norfolk silt loam consists of a mellow silt loam to a very fine sandy loam, the surface few inches being usually gray to dark gray and over wooded areas sometimes black, as the result of accumulations of organic matter. Below 6 inches the soil grades into a yellow silty loam or silt loam. The subsoil to a depth of 36 inches or more consists of a rather compact yellow silty loam to silty

clay loam, slightly mottled with gray, brown, and reddish brown in the more level areas, the mottlings being particularly pronounced where the type merges into the Portsmouth soils. On the slopes a reddish-yellow clay loam is encountered. A considerable quantity of fine sand is present in the surface soil. The boundary lines between this type and the Norfolk fine sandy loam are rather indistinct, the two types merging gradually into each other.

The largest areas of this type are situated in Ingrams Township, around Selma, and between Oliver and Smithfield. A few smaller bodies are scattered throughout the south-central part of the county.

One of the characteristic features of this type is its flat or undulating topography. It lies either between the rolling uplands and the loam areas or in depressed, flat areas within the other upland Norfolk soils. Owing to its level surface and the fairly compact texture of the soil and subsoil, the drainage is poor. However, its position is such that open ditches or tile drains would furnish adequate drainage for all the areas.

The Norfolk silt loam is composed of the finer sediments of the Coastal Plain deposits. It has undergone but little change through washing and retains to a large extent its original uniform texture.

Most of the native longleaf pine forest has been removed and the type, where forested, now supports a growth of scrub oaks, sweet gum bushes, and old-field pine. A few bodies, however, of the original forest of pine remain.

Only a small proportion of this type is under cultivation. The crops grown are mainly corn and cotton. Corn yields from 15 to 25 bushels per acre, and cotton from one-half bale to 1 bale. Oats and cowpeas do fairly well.

This soil when properly cultivated works into good tilth. When it is drained, limed, and fertilized good yields of cotton, corn, oats, peanuts, cabbage, crimson clover, and Irish potatoes may be obtained. The incorporation of vegetable matter would improve the texture and add needed nitrogen and humus. Applications of lime are required to counteract acidity, especially when large quantities of green manure have been added. This type ranges in value from \$15 to \$40 an acre.

The following table shows the results of mechanical analyses of samples of soil and subsoil of this type:

Mechanical analyses of Norfolk silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
232621.....	Soil.....	0.3	0.7	0.6	7.3	19.0	57.4	14.4
232622.....	Subsoil.....	.0	.8	.4	6.9	16.6	55.7	19.4

PORTSMOUTH SANDY LOAM.

The surface soil of the Portsmouth sandy loam consists of a dark-gray to black, medium to sandy loam, varying in depth from 10 to 20 inches. The subsoil extends to a depth of 36 inches and consists of a heavy, sticky sandy clay, usually gray mottled with yellow and brown, and in places grading into a sticky sandy loam or loamy sand. Occasional patches appear as a gray and yellow stiff clay. Pockets of sand and lenses of clay are found frequently throughout the subsoil. In wooded areas and old "bays" the color of the surface soil frequently grades from black to gray in the first few inches, cultivated areas being generally dark gray. This soil, as a rule, contains a high percentage of organic matter.

This type is of limited development in the county, occurring in numerous patches and relatively small bodies throughout the Norfolk types. Some of the largest bodies lie northwest of Wilsons Mills, north of Selma, west of Johnson Crossroads, and southwest of Flowers Store.

The surface of this type is generally level. It commonly occupies depressions and old "bays," generally lower than the surrounding soil types. On account of its flat surface, the natural drainage is poor and artificial drainage is necessary to fit the land for farming. Open ditches are usually sufficient for this purpose.

The Portsmouth sandy loam has been formed from the same materials as the Norfolk soils, altered somewhat by poor drainage and the accumulation of a large quantity of vegetable matter. Its occurrence in wet, low situations has favored the growth of reeds, bushes, and grasses, which in decaying have imparted a dark color to the soil.

Those areas which are underlain by whitish sand are much less valuable than those having a clay subsoil. Practically all of the type is undeveloped and supports a thick growth of gum, oak, pine, maple, and some cypress, with an undergrowth of gallberry, huckleberry, reeds, bamboo, and briars.

When properly drained this soil is well adapted to corn, oats, cabbage, strawberries, and cotton. Spanish peanuts are also grown. On the few fields under cultivation fairly good crops of corn and oats are obtained. Liberal applications of lime will materially improve this soil and produce better yields of the above-mentioned crops. Owing to the large quantity of organic matter present in the soil, the only other fertilizer constituents necessary are potash and acid phosphate, which should be applied as necessary.

Land values for this type depend entirely upon the associated types with which it is sold.

PORTSMOUTH FINE SANDY LOAM.

The surface soil of the Portsmouth fine sandy loam consists of a dark-gray to black fine to medium sandy loam, varying in depth from 8 to 15 inches. The subsoil is a gray heavy fine sandy clay, slightly sticky and mottled with yellow or brown, extending to a depth of 36 inches. Occasionally a gray fine sandy loam, a loamy fine sand, or a heavy gray to bluish clay is encountered. Cultivated areas of this soil show a dark-gray surface, while those under forest have a black surface soil, extending to a depth of 6 or 8 inches, with a gray fine sandy loam in the lower portion. Spots of loam or silty loam occur throughout the type. The soil is mellow and easily tilled.

This type is found only in small spots and narrow strips, being confined mainly to the northeastern part of the county. It is well developed in Beulah Township, and many bodies of it occur in the immediate vicinity of Selma and to the east of Smithfield. Smaller bodies are also found throughout the Norfolk soils. The natural surface drainage is poor and open ditches are necessary to fit the land for cultivation.

The Portsmouth fine sandy loam has been formed in the same way as the Portsmouth sandy loam and under practically the same conditions.

Small bodies of this soil are under cultivation, but by far the greater part of it is still forested with pine, sweet gum, black gum, a few oaks, and in the wetter areas with cypress. Gallberry and huckleberry are characteristic plants of smaller growth. Some of these spots in the southern end of the county are locally termed "huckleberry swamps." In many places there is a thick growth of reeds, bamboo, and briers.

Corn, oats, cotton, Spanish peanuts, cabbage, and onions would be profitable crops for this type. Corn yields from 25 to 60 bushels per acre and cotton one-half bale to 1 bale. Oats also do well. All of these crops are fertilized more or less heavily. The soil is naturally acid in character and requires a considerable quantity of lime to make it suitable for crop production. Fertilizers should be high in acid phosphate and potash and low in nitrogen. Land values depend largely upon the associated soils, as few farms contain extensive bodies of this soil. Where included with the Norfolk soils it usually brings prices ranging from \$10 to \$50 an acre, depending upon location and improvements.

ORANGEBURG SANDY LOAM.

The surface soil of the Orangeburg sandy loam consists of a light-gray or brownish to reddish-brown medium sandy loam, extending

to a depth of 6 or 8 inches, where it grades into a yellowish or brownish medium textured sandy loam, reaching to a depth of 12 to 15 inches. The subsoil extends to a depth of 36 inches and more and consists of a rather stiff red sandy clay, heavy but friable. Slight mottlings of yellow are noticed near the boundaries of this type with the Norfolk soils. On the road between Clayton and Benson the subsoil shows a very bright red color. A few rounded, iron-stained gravel are occasionally seen on the surface, particularly near Moores Crossroads and in the vicinity of Benson.

The type occurs in small patches and bodies scattered throughout the Coastal Plain section of the county. Such areas are particularly noticeable in Beulah, Ingrams, Pleasant Grove, and Cleveland Townships. The largest unbroken body lies in Cleveland Township in the vicinity of Willow Springs Church and along Cow Branch.

Ordinarily the Orangeburg sandy loam occupies the knolls and ridges, usually a few feet higher than the surrounding soils, the slopes extending to the streams. It lies well for farming. The occurrence of many spots of this soil along the main roads is explained by the fact that the highways naturally follow the highest divides, where this soil is found. The surface drainage is excellent, the gently rolling topography allowing rain water to run off gradually without erosion.

The type represents an advanced stage of weathering in the materials of the Coastal Plain deposits, oxidation apparently having advanced further than in the Norfolk soils. The material has been modified further by rainwash. Much of the finer material has been washed out, leaving a loose, medium, easily tilled surface soil.

The original forest growth consisted of pine, oak, and scattering hickory. Practically all of this has been cleared away, and the land is now in cultivation.

This soil is especially suited to cotton, tobacco, peanuts, sweet potatoes, and vegetables. Corn can also be produced profitably. Cotton yields from one-half bale to 1½ bales per acre with 400 to 800 pounds of commercial fertilizer. Tobacco produces 700 to 1,200 pounds per acre with an application of 800 pounds of 8-3-3 mixture, and 50 pounds of cottonseed meal per acre. Corn, sweet potatoes, oats, rye, and vegetables give good returns, the yields depending upon the methods of cultivation and fertilization. Scuppernong, Misch, and James grapes, figs, and peaches also thrive on this soil. The suggestions for soil improvement made in connection with the Norfolk sandy loam apply equally to this soil.

The Orangeburg sandy loam is a highly prized soil and is held at prices ranging from \$25 to \$100 an acre.

RUSTON COARSE SANDY LOAM.

The surface soil of the Ruston coarse sandy loam consists of a gray to brownish, medium to coarse sandy loam, varying in depth from 8 to 18 inches. The subsoil is a reddish-yellow, reddish-brown or dark-red sandy clay, slightly sticky but friable and crumbly when dry. In many places the subsoil shows mottlings of red and yellow. Typical areas of this soil contain from 5 to 25 per cent of rounded quartz gravel, some of which is found in the subsoil. In places this gravel is almost sufficient to justify the classification of the type as a gravelly sandy loam. In the deeper areas the surface soil below 6 inches is yellowish or yellowish brown in color.

This type is confined mainly to Banner Township. The largest area is located between Benson and Creech Mill, while many smaller bodies lie to the north and west of this large area.

The Ruston coarse sandy loam occurs as level to gently rolling high upland areas. It becomes slightly rolling near the heads of small streams. As a rule it lies favorably for farming. There is no waste land included in this type. It possesses good natural surface drainage and only in the more level areas is ditching necessary.

The Ruston coarse sandy loam owes its origin mainly to the weathering of the sand and clay of Coastal Plain deposits. It has undergone considerable change since its deposition, the finer material in many places having been carried away in suspension by rain waters or settled down to lower depths in the soil and subsoil. The coarser areas of this soil are confined to the slopes, while the heavier and finer textured bodies commonly occur in the more nearly level areas.

The original forest growth consisted of longleaf pine, practically all of which has been removed. The type is naturally one of the most productive soils in Johnston County. It is especially adapted to cotton, peanuts, tobacco, corn, and potatoes. The yield of cotton depends largely upon the amount of fertilizer used and the cultural methods employed, and ranges from one-half bale to 2 bales per acre. Corn yields from 20 to 75 bushels, tobacco about 1,000 pounds, while cowpeas, potatoes, oats, and all other crops common to the county give excellent returns. The usual fertilizer applications are used for crops on this soil.

The Ruston coarse sandy loam, considered as a whole, is the best improved land in the area. Owing to its natural productiveness and its proximity to Benson it is the highest-priced land in the county, selling at prices ranging from \$50 to \$150 an acre.

Mechanical analyses of Ruston coarse sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
232634.....	Soil.....	7.2	19.0	14.8	24.7	12.8	12.8	8.6
232635.....	Subsoil.....	4.2	12.6	10.1	12.9	6.6	9.9	43.9

RUSTON GRAVELLY SANDY LOAM.

The surface soil of the Ruston gravelly sandy loam consists of a yellowish-gray to pale-yellow gravelly sandy loam or loamy sand, 12 to 20 inches deep, containing from 15 to 50 per cent of small gravel. In spots the surface soil is almost pure gravel. The subsoil is a reddish-yellow to dull-red gravelly sandy clay to a depth of 36 inches or more, in places grading into yellow mottled with red. Beds of very gravelly material 2 or 3 feet in thickness, resting upon a sandy clay, are frequently encountered. In a few places the gravel has been cemented by iron salts forming a hardpan.

This is an unimportant type, occurring only in a few small patches among the Norfolk soils. The largest areas are found near the mouth of Poplar Branch, Johnsons Union Church, and north of Benson. It occupies knolls and slopes. Surface drainage is good, and where the gravel content is high it is inclined to be excessive. In the main the soil is not materially different in origin from the Norfolk coarse sandy loam.

Most of this soil is cleared and cultivated. It warms up early in the spring and is well suited to the production of light truck crops. Sweet potatoes and peanuts do well when manured or fertilized. Cotton and corn give fair returns where the percentage of gravel is low. Grapes would also do well on this soil.

WICKHAM COARSE SAND.

The surface soil of the Wickham coarse sand consists of a light-brown to reddish-brown coarse, loose sand, extending to a depth of 6 inches. The subsoil is a yellowish-brown, reddish-brown, or pale-yellow, coarse, incoherent sand. Occasionally at 3 feet a gravel stratum is encountered. In some places both soil and subsoil are somewhat loamy. Some brown quartz gravel is present in places.

This type occurs as small, isolated spots in the Neuse River "flats" and also in larger bodies farther up the river in the vicinity of Smithfield. It occupies rounded knolls and ridges standing from 3 to 4 feet above the surrounding soils. It possesses excellent drainage and warms up early in the spring. It is surrounded by water at times of normal overflow of the Neuse River and some portions may be submerged at times of exceptionally high water.

The Wickham coarse sand consists of reworked coarse sand deposited by the Neuse River.

This soil is especially well suited to watermelons. When fertilized fairly good yields of corn and cotton can be obtained. Early vegetables do remarkably well on this type.

WICKHAM SANDY LOAM.

The Wickham sandy loam, in its typical development, consists of a brown to slightly reddish-brown sandy loam, about 6 inches deep, underlain by a reddish-brown, friable sandy clay, which at lower depths, frequently between 28 and 36 inches, grades into a reddish or yellowish-brown coarser stratum, consisting principally of sand and gravel. This coarser material may not be encountered within the 3-foot section, especially in the case of some of the lighter-colored phases, but it occurs at some depth under the greater proportion of the type. In places the soil is of a grayish-brown color, the sub-surface of pale yellow or yellowish brown, and the subsoil reddish yellow or yellowish brown mottled with reddish yellow. Rounded gravel is generally present. Some patches of coarse sandy loam too small to map were included with the sandy loam.

This type is developed largely in the southeast corner of the county south of Riverside Church and between Raccoon and Moccasin Swamps. Several areas are also found along the lower portion of Little River.

The type occupies the terraces or second bottoms along the Neuse River. The areas are flat to undulating. Drainage for the most part is well established, particularly where the gravel substratum underlies the sandy clay at depths approximating 3 feet. The more level areas can be easily drained by open ditches. Some areas are occasionally overflowed, but only in times of exceptionally high water.

This soil is of alluvial origin and consists largely of materials brought down from the Piedmont and redeposited by the Neuse River. Since their deposition they have been changed considerably by the action of storm waters, especially by the washing out of the finer particles or by the translocation of these particles to lower depths.

Most of the Wickham sandy loam is under cultivation. The remaining area is forested with pine, oak, and gum. Cotton, corn, oats, cowpeas, peanuts, chufas, and sweet potatoes can be successfully grown. Cotton yields from one-half bale to $1\frac{1}{2}$ bales per acre, corn 15 to 35 bushels, while oats, cowpeas, sorghum, and the other crops do well. About 300 pounds of commercial fertilizer is used per acre for corn and from 300 to 600 pounds for cotton. The same methods of cultivation and fertilization are used upon this terrace soil as upon the upland soils.

Within the last few years the Wickham sandy loam has become one of the most popular farming soils of the section and is being rapidly populated. It is now held at prices ranging from \$20 to \$50 an acre.

SUSQUEHANNA COARSE SANDY LOAM.

The surface soil of the Susquehanna coarse sandy loam consists of a coarse loamy sand to coarse sandy loam, varying in depth from 8 to 24 inches and averaging 14 inches in depth. The surface 6 to 8 inches is usually light gray, grading below into a pale yellow, which color is uniform to a depth of about 24 inches. Spots of slightly brownish medium sandy loam are found throughout the type. The subsoil extends to a depth of 4 or 5 feet. The upper part consists of a slightly friable, brown to reddish sandy clay, but this grades within a few inches into a dull-red to drab-brown sticky plastic clay, slightly mottled with gray or yellow. Occasionally a stiff brownish clay fairly uniform in color and texture is encountered. Where the type borders the Norfolk soils the subsoil is more sandy and yellowish brown in color. Gravel is occasionally present in the subsoil and in some places a thin layer of ferruginous sandstone lies between the soil and the subsoil. In places the brown clay subsoil at a depth of 4 to 5 feet grades sharply into a blue, laminated, jointed clay, tough and very plastic. In many areas, owing to erosion, the surface soil is shallow. Throughout the type patches occur where the proportion of quartz gravel on the surface is sufficient to justify their classification as a gravelly sandy loam. These areas, being small, were not mapped separately.

This type is confined to the southern part of the county and finds its greatest development in Bentonsville, Meadow, and Ingrams Townships. It occupies slopes between the level upland areas and the lower-lying soils along the streams. Its surface is quite rolling and in some places steep. This gives excellent surface drainage. The relatively impervious clay subsoil and the hardpan stratum interfere with the downward percolation of rain water and with the upward movement of moisture from lower depths.

This soil type owes its origin mainly to the weathering of underlying clay beds, which give rise to the other Coastal Plain soils, and it possibly represents a development of the Potomac clays. In the formation of this type erosion has played an important part, as the streams have washed off the greater part of the material forming the surface soil, cutting through the Columbia material. Active and long-continued weathering has also changed the texture of this soil.

The native vegetation consists of pine, post oak, blackjack oak, some hickory, gum, and other hardwoods. Only a small proportion of its area is under cultivation. The more rolling and steeper areas, on account of their susceptibility to erosion and the difficulty with

which they are tilled with farm machinery, should remain forested or devoted to pasture. The more level and gently rolling areas are fairly well adapted to cotton, sweet potatoes, peanuts, cowpeas, watermelons, grapes, berries, and apples, and in some places to corn. On the smoother, better drained areas cotton yields from one-half to 1 bale per acre when well cared for, corn from 15 to 35 bushels per acre, and oats 20 to 40 bushels. Sweet potatoes and cowpeas give good returns. From 400 to 600 pounds of an 8-3-3 or 8-2-2 fertilizer is applied to the cotton, with small applications of nitrate of soda as a top-dressing when the plants are partly grown. Smaller quantities are used for corn.

Land of this type is held at prices ranging from \$10 to \$50 an acre, depending upon location and improvements.

ALTAVISTA FINE SANDY LOAM.

The Altavista fine sandy loam consists of a gray to light-gray mellow fine sandy loam from 6 to 10 inches deep. The subsoil to a depth of 36 inches consists of a stiff, compact, and heavy fine sandy clay or clay loam, varying in color from pale yellow to yellow slightly mottled with shades of gray or brown. The typical yellow clay is found on the higher, better drained areas, while the mottling occurs in the more level spots, where drainage is poorly established. Where the type is forested the surface material for a few inches is dark gray, while some of the cultivated areas in the river bends have a brownish tinge in the surface soil.

This type lies principally near Little River, occurring in small areas scattered for a distance of several miles along that stream. Other areas are situated in the Neuse River bottoms near Richardson Bridge and farther up the river.

The Altavista fine sandy loam occupies the second bottoms along the Neuse and Little Rivers. Its surface is flat and level, lying only a few feet above the swamp land and the Wehadkee silt loam. It is subject in places to occasional overflow, but the crops are seldom destroyed. The drainage is poor, owing to the flat surface and compact character of the subsoil. Open ditches are necessary to keep the fields in condition for cultivation.

This type is of alluvial origin. The material is apparently derived largely from the soils of the Piedmont, the areas occurring too near the Piedmont boundary to have received a very large quantity of wash from the Coastal Plain deposits.

A considerable proportion of the Altavista fine sandy loam is now under cultivation. The remainder is forested with pine, or in the lower parts with pine, gum, and oak. Cotton does well, yielding from one-half bale to 1 bale per acre on the better drained areas. Corn yields from 15 to 25 bushels per acre, and oats, cowpeas, rye,

and other crops can be successfully grown. Grass and forage crops should thrive. About the same quantities of commercial fertilizer are applied to crops on this soil as upon the upland types.

The best developed farms composed of this type of soil lie in the vicinity of Richardson Bridge. As high as \$50 an acre is asked for such land. For most of the type, however, the prices are much below this figure.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Altavista fine sandy loam:

Mechanical analyses of Altavista fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
232611.....	Soil.....	0.1	0.4	2.0	31.8	34.6	24.4	6.4
232612.....	Subsoil.....	.0	.2	1.1	21.6	19.0	33.0	25.0

WEHADKEE SILT LOAM.

The surface soil of the Wehadkee silt loam consists of a dark-gray or dull grayish brown compact silt loam to silty clay loam, frequently slightly mottled with shades of rusty brown. The subsoil is encountered at an average depth of 8 inches and consists of a dark-gray to drab compact silty clay loam to silty clay, usually mottled with shades of brown or yellow. The subsoil of many of the poorly drained, lower-lying areas is strongly mottled with drab, gray, and yellow or yellowish brown. Streaks of dull-brown to almost black material, rich in organic matter, are also encountered in the subsoil. The surface soil in a few of the higher elevations is a gray to yellowish gray or light brown, while in the lower situations it is dark drab. Near the river a considerable quantity of very fine sand is present in the soil. Patches of fine sandy loam, too small to map, were also encountered.

At present the land is pastured and is packed and hard. Its texture would indicate that under cultivation a good, mellow seed bed could be formed without difficulty.

This type occurs extensively in the Neuse River flats, beginning near the Atlantic Coast Line Railroad, where it is from 2 to 3 miles wide, and extending along the Neuse River to the southeastern extremity of the county. Other areas west of Smithfield are encountered on both sides of the river for a short distance. A small area is also found on Little River north of Princeton.

The type consists of broad, level areas, broken by swales forming temporary stream channels when the Neuse River is in flood. In wet years water stands over a large part of the type, particularly in the lower situations. This soil forms first bottoms and slightly

higher areas, which may be considered either as high first bottom or as very low second bottom. The drainage is poor, on account of the low position and flat or depressed surface. Artificial drainage can not be easily effected. Probably the only way in which complete reclamation can be accomplished will be to dike the Neuse River.

This type is of alluvial origin and probably consists largely of Piedmont material transported and deposited by the Neuse River. The texture and stratification of the material indicate that it has been formed in comparatively quiet water and has been built up by degrees during successive overflows of the river.

The Wehadkee silt loam supports a heavy growth of gum, water oak, ash, poplar, hickory, beech, elm, pine, and in a few of the wetter areas cypress. None of the type is cultivated at present, and the only present revenue is derived from lumbering timber and the pasturage afforded. Many hogs and cattle are fattened upon the mast and grasses in this open range. The soil is naturally very fertile, and when drained will be one of the most productive soils in Johnston County. It is especially adapted to the production of corn, oats, and grasses. Areas which are not heavily forested support a luxuriant growth of grasses, which affords excellent grazing.

The results of mechanical analyses of samples of the soil and subsoil of the Wehadkee silt loam are given below:

Mechanical analyses of Wehadkee silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
232618.....	Soil.....	0.0	0.5	1.4	10.2	5.3	49.7	32.7
232619.....	Subsoil.....	.0	1.2	1.8	20.4	17.9	38.4	20.2

JOHNSTON LOAM.

The surface soil of the Johnston loam consists of a black, mucky loam from 15 to 24 inches deep. The subsoil is generally a heavy gray sandy clay, mottled with yellow, though in places it is a brownish clay containing considerable quartz gravel, in which an occasional gravel bed is encountered at depths ranging from 30 to 36 inches. Over some of the lower-lying areas the black surface soil extends to a depth of 3 feet, but along the contact with the uplands it becomes shallower and the typical black color changes to dark brown. The type as a whole is high in organic matter, productive, mellow, and easily tilled.

This type occurs extensively in the southern part of the county, in Meadow and Bentonsville and also in Ingrams Townships. It occupies flat areas along the streams, lying slightly above the level of the

swamp areas and between them and the uplands. It is subject to frequent overflow. The long, narrow strips along Hannah, Stone, and Mill Creeks are the largest areas. During dry seasons part of this type can be cultivated with safety. A considerable proportion of it can be permanently reclaimed by diking.

The Johnston loam is mainly of alluvial origin, but modified somewhat in places by the addition of colluvial material. Its low situation and former swampy condition account for the accumulation of large quantities of vegetable matter. In some places it forms low terraces, but in others it is essentially a first-bottom type.

Most of this type was cleared and cultivated at one time, but now only the higher areas are farmed. The remainder is covered with old-field pine and gum bushes or is used for pasture land.

The soil is especially adapted to the production of corn, oats, and grasses. Corn yields from 25 to 50 bushels per acre with only small applications of commercial fertilizer. Oats do well, but are usually fed on the farm and not thrashed. When properly drained and limed this soil will be one of the most productive types in the county. Owing to its naturally high content of organic matter it will require little nitrogenous fertilizer. Onions, cabbage, and celery would prove profitable crops on reclaimed areas.

No accurate valuation can be assigned to this type, as it occurs only in narrow bodies and is usually sold in conjunction with other soils.

A mechanical analysis of a sample of soil gave the following results:

Mechanical analysis of Johnston loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
232627.....	Soil.....	3.4	6.8	6.8	17.6	7.3	19.5	38.6

MEADOW.

Meadow includes a variety of soil materials, occupying such small areas as to make separation impracticable on a map of the scale used. The texture ranges from coarse sand to heavy loam.

Along Buffalo Creek and some of the other larger streams in the northeastern part of the county the soil consists of a grayish very fine sand to silty loam, underlain by a yellow to brownish or mottled subsoil, slightly heavier in character than the surface soil.

In some of the broader bottom areas along Swift and Middle Creeks a light-brown medium sandy loam or fine sandy loam about 10 inches deep is encountered. The subsoil under such areas is commonly a yellowish-brown to reddish-brown medium sandy clay.

In the extreme northeast corner of the county along Moccasin Creek a red to reddish-yellow silty loam about 10 inches deep is found. This is underlain to a depth of 36 inches by a red silty clay. Both soil and subsoil contain a noticeable content of mica.

In many places, particularly on Neuse River, and along Swift, Whiteoak, and Middle Creeks, the surface soil is a brown or gray silty to very fine sandy loam. This material varies in depth from several inches to 2 or 3 feet before passing into a light-brown silty loam or clay loam.

Along the Neuse River and some of the larger creeks narrow bands or strips of fine to medium sand, varying in color from nearly white to light brown, are found. This sand usually extends to a depth of 3 feet or more, and is sometimes underlain by coarse sand and gravel. Frequently a fairly heavy loam is encountered at 1 to 2 feet. Throughout Meadow, as a rule, finely divided particles of mica are present in varying quantities.

Meadow occurs as long strips of various widths up to one-half mile on Middle, Swift, Buffalo, and Cat Tail Creeks and the upper portions of Little and Neuse Rivers. The lower-lying areas of this material occupy a position which corresponds in many respects to the swamp areas in the southern portion of the county.

Meadow finds its greatest development in the first bottoms of streams. A large part of it is subject to frequent overflow and some of it is in a semiswampy condition the year round. Some areas, however, lie sufficiently above normal high water to be subject only infrequently to overflow. The surface is flat and level in the lower-lying areas and undulating in the higher portions. It is upon these higher places that crops can be cultivated and harvested with safety. Open ditches are necessary on such areas in order to drain them for crop production.

Meadow is of alluvial origin, being formed from materials washed from the Cecil types and deposited by streams. It is modified in a few localities by the washings from the Norfolk types and by coluvial deposits. The areas which have been in a swampy condition for a long time contain considerable organic matter. Practically all of this type is fertile and would be very productive when drained and reclaimed.

Only a very small area of this soil is under cultivation. The larger bodies are forested to gum, oak, hickory, pine, beech, poplar, and maple, or are used as summer pasture for cattle. It makes excellent pasture lands. Upon the cultivated areas corn and oats are the common crops. Corn yields from 25 to 50 bushels per acre and oats from 20 to 40 bushels. When this soil is reclaimed it will be found well suited to corn, oats, and grasses. The sandy ridges will produce excellent watermelons.

SWAMP.

The areas mapped as Swamp in Johnston County consist of a heterogeneous mixture of soil material, of which no definite textural classification was possible. A few of the more noticeable bodies are described in detail and the remaining portions are considered a mixture of or gradation from them.

In many places a black sandy loam, loamy sand, or mucky loam high in organic matter is encountered at a depth of 1 to 3 feet, but frequently the material below 1 foot becomes lighter in color, with more sand or clay. Again, spots of fine sandy to silty loam are found which have a gray subsoil mottled with yellow and brown. Along Black Creek narrow bodies and strips of this type are noticeable. These have a gray surface soil, about 8 inches deep, of very fine sandy to silty loam, underlain by a yellowish, brownish, or mottled loam to clay loam. In many places spots of coarse sandy or gravelly material containing, in some places, considerable organic matter are encountered, especially where the Swamp areas are bordered by the sand types.

The Swamp occurs, for the most part, in the southern half of the county. The most extensive areas are located along Black, Hannah, Stone, and Mill Creeks. There are also extensive strips in the eastern section of the county along Little, Little Buffalo, and Buffalo Creeks, Spring Branch, Bowdy Creek, and Raccoon and Moccasin Swamps. Many narrow strips border the smaller streams and branches having their origin in the Norfolk and Portsmouth types.

Most of the Swamp is saturated with water or inundated during the greater part of the year, and all of it is subject to overflow when the streams rise above normal water level. Much of the Swamp could be drained and reclaimed by straightening and deepening the natural drainage ways and cutting open ditches.

The forest growth consists of gum, water oak, beech, hickory, cypress, poplar, and a few large pines. Gallberry and huckleberry are characteristic plants of smaller growth.

Part of the Swamp area is used for pasture and furnishes excellent grazing during the summer and fall months. Hogs run at large over the larger bodies and secure a living during the fall months from the mast. None of the area included as Swamp is cultivated. Some of this soil, however, particularly the black loamy and fine sandy loam areas and also spots of mucky material which have a clay subsoil, are naturally very fertile and when drained and reclaimed would produce large crops of corn, oats, and grasses with very little fertilization. At present, however, this land is valuable mainly for its merchantable timber.

SUMMARY.

Johnston County is situated in the east-central part of North Carolina, about 15 miles southeast of Raleigh, the State capital. It is one of the largest counties in the State, with an area of approximately 778 square miles, or 497,920 acres.

The topography is rolling to hilly in the western and northern parts, and level, undulating, or gently rolling country, becoming rolling and slightly broken as the larger streams are approached, in the eastern and southern sections. The general slope of the county is toward the southeast. The drainage waters are carried by the Neuse River and its various tributaries.

The soils of Johnston County belong both to the Piedmont Plateau and Coastal Plain provinces. In the northern section and along part of the northwestern boundary the soils have been derived from the weathering of the underlying rocks. Over the remainder of the area they owe their origin mainly to the weathering of sedimentary deposits of the Coastal Plain, consisting of sands and clays. The overlapping of the sedimentary deposits upon the Piedmont rock formations has given rise to a number of soil types not found in many areas in this part of the State.

Twenty-eight soil types, including Meadow and Swamp, were mapped in this survey. Of these the most prominent type is the Norfolk sandy loam. This soil is well adapted to truck crops, cotton, corn, and tobacco, all of which give good yields. In this same series five other soils were mapped—the coarse sand, sand, coarse sandy loam, fine sandy loam, and silt loam.

The Cecil soils, of which the coarse sandy loam, sandy loam, fine sandy loam, stony sandy loam, and clay loam are found, are well suited to the production of oats, wheat, corn, clover, cowpeas, and, to some extent, to tobacco and cotton.

The Durham soils, including a coarse sandy loam and sandy loam, will also grow cotton, corn, and the minor general farming crops, but are best adapted to bright tobacco. The Orangeburg soils, of which one type, the sandy loam, was mapped, and the Ruston coarse sandy loam are well suited to the production of cotton. Tobacco and peanuts can also be grown with good results. The light sandy loams and sands constitute the best soils for early truck crops, water-melons, chufas, rye, and peaches.

Land values vary widely throughout the county, ranging from \$10 an acre for the less productive and remote areas to as high as \$100 to \$150 for some of the better cultivated and more productive soils located near the towns and suited to intensive cultivation. A fair range for land now under cultivation may be given as \$20 to \$60 an acre.

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