

Issued October 14, 1915.

U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF SOILS—MILTON WHITNEY, Chief.

IN COOPERATION WITH THE NORTH CAROLINA DEPARTMENT OF AGRICULTURE,
W. A. GRAHAM, COMMISSIONER; B. W. KILGORE, STATE CHEMIST
AND DIRECTOR OF TEST FARMS.

SOIL SURVEY OF BLADEN COUNTY,
NORTH CAROLINA.

BY

R. B. HARDISON, RISDEN T. ALLEN, AND B. B. DERRICK, OF
THE U. S. DEPARTMENT OF AGRICULTURE, AND L. L. BRINK-
LEY, S. O. PERKINS, AND R. C. JURNEY, OF THE
NORTH CAROLINA DEPARTMENT OF AGRICULTURE.

W. EDWARD HEARN, INSPECTOR, SOUTHERN DIVISION.

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



WASHINGTON:
GOVERNMENT PRINTING OFFICE,
1915.

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS,
Washington, D. C., April 23, 1915.

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

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

Respectfully,

MILTON WHITNEY,
Chief of Bureau.

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

CONTENTS.

	Page.
SOIL SURVEY OF BLADEN COUNTY, NORTH CAROLINA. By R. B. HARDISON, RISDEN T. ALLEN, and B. B. DEBRICK, OF THE U. S. DEPARTMENT OF AGRICULTURE, and L. L. BRINKLEY, S. O. PERKINS, and R. C. JURNEY, OF THE NORTH CAROLINA DEPARTMENT OF AGRICULTURE.....	
Description of the area.....	5
Climate.....	7
Agriculture.....	8
Soils.....	11
Norfolk series.....	13
Norfolk sand.....	13
Norfolk fine sand.....	14
Norfolk sandy loam.....	15
Norfolk fine sandy loam.....	17
Norfolk very fine sandy loam.....	18
St. Lucie series.....	19
St. Lucie sand.....	20
Ruston series.....	20
Ruston sand.....	20
Ruston sandy loam.....	21
Ruston fine sandy loam.....	22
Susquehanna series.....	22
Susquehanna fine sandy loam.....	22
Lufkin series.....	23
Lufkin sandy loam.....	23
Coxville series.....	24
Coxville fine sandy loam.....	24
Coxville very fine sandy loam.....	25
Portsmouth series.....	26
Portsmouth sand.....	26
Portsmouth sandy loam.....	27
Portsmouth fine sandy loam.....	27
Hyde series.....	28
Hyde loam.....	28
Kalmia series.....	29
Kalmia sand.....	30
Kalmia sandy loam.....	30
Wickham series.....	31
Wickham fine sandy loam.....	31
Congaree series.....	32
Congaree silt loam.....	32
Johnston series.....	33
Johnston silt loam.....	33
Miscellaneous material.....	34
Swamp.....	34
Summary.....	34

ILLUSTRATIONS.

FIGURE.

	Page.
Fig. 1. Sketch map showing location of the Bladen County area, North Carolina.....	5

MAP.

4	Soil map, Bladen County sheet, North Carolina.
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SOIL SURVEY OF BLADEN COUNTY, NORTH CAROLINA.

By R. B. HARDISON, RISDEN T. ALLEN, and B. B. DERRICK, of the U. S. Department of Agriculture, and L. L. BRINKLEY, S. O. PERKINS, and R. C. JURNEY, of the North Carolina Department of Agriculture.

DESCRIPTION OF THE AREA.

Bladen County is situated in the southeastern part of the State of North Carolina. It is bounded on the north by Cumberland and Sampson Counties, on the east by Sampson and Pender Counties, on the south by Columbus County, and on the west by Robeson County. The county line follows South and Black Rivers on the east and Big Swamp on the west. Bladen County comprises an area of 847 square miles, or 542,080 acres.

The topography is prevailingly flat, undulating, or gently rolling. The greater proportion of the country lying between Cape Fear River and South River is predominantly flat and level, though broken here and there by low ridges and knolls. Numerous lakes form conspicuous natural features of this section. The southeastern corner of the county, or that part lying east of a line drawn from Rosindale to Carvers Creek Church and to the south of the Fayetteville and Wilmington road, is characteristically flat. The southwestern part of the county, especially in the vicinity of Bladenboro, is generally level to undulating. Some areas, more rolling and hilly, are developed west of the Cape Fear River, extending a distance of about 5 miles from a point about 3 miles southeast of Elizabethtown. The broad belt of country reaching from Clarkton and Rosindale to Elizabethtown and thence northwest to the Cumberland County line, also a strip on each side of Cape Fear River and a small area along the west side of South River, are undulating to gently rolling. Bordering the bottom lands west of Cape Fear River is a bluff line rising from about 75 to more than 100 feet above the normal water level of the stream. This bluff is steep and in a few places almost perpendicular. The Cape Fear River has carved out a beautiful valley through Bladen County and built up a varying flood plain along its course from one-half mile to 2 miles in width.

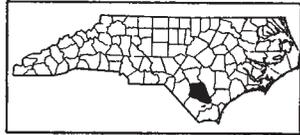


FIG. 1.—Sketch map showing location of the Bladen County area, North Carolina.

The Cape Fear, South, and Black Rivers, with their tributaries, carry most of the drainage of the county. The Cape Fear flows in a general southeast direction across the middle of the county and drains the greater part of its surface. The northeast corner and the eastern side of the county are drained by South and Black Rivers, Colly and Lake Creeks, and Lyon Swamp. The extreme western side and the southwest corner are drained westerly into Big Swamp and the extreme southern portion bordering the Columbus County line by Brown Marsh and Elkton Swamps and other smaller streams which flow southward out of the county. All portions of Bladen County are well watered, but the region is not adequately drained, so that one of the main problems is the reclamation of swampy areas.

The Cape Fear River has a considerable fall within the county. This has necessitated the construction of two locks along its course within Bladen County in order to maintain a sufficient depth of water for navigation the year round. Many of the smaller streams and swamps are also fairly swift flowing, and some of these have been dammed, the water power developed being used in operating grist mills.

Bladen County was formed in 1734 from a part of New Hanover County and embraced at first the whole western part of the State. The first white settlers were of English and Scotch descent. They located principally along the Cape Fear River. The population in 1910, according to the census, was 18,006, consisting mainly of descendants of the original settlers and others who have moved in from different sections of North Carolina. There is a large negro population, but only a very small number of foreigners.

Bladen County is one of the sparsely populated counties of North Carolina. It possesses large undeveloped areas which, if cleared and devoted to crop production, would support many times the present number of inhabitants. There are no large towns within the county. Elizabethtown, the county seat, with a population of 117, according to the 1910 census, and Clarkton and Bladenboro, each with a population of 276, are the three largest towns in the county. There are villages along the railroads and a few country towns or settlements in the northern half of the county.

The county has inadequate transportation facilities. The northern half of the county is not touched by any railroad. The southern end is traversed by the Seaboard Air Line Railway, and a branch of the Virginia & Carolina Southern extends from St. Pauls, in Robeson County, to Elizabethtown. The Cape Fear, Black, and South Rivers are navigable the greater part of the year. As soon

as the two locks in course of construction by the United States on the Cape Fear River are completed this stream will be navigable to Fayetteville, Cumberland County, during the entire year. Large quantities of logs are floated down these streams and much freight is also handled. Upon the completion of the locks the facilities for regular passenger and freight service on the Cape Fear River will have much effect on the development of the central and northern parts of the county.

In general, the dirt roads in Bladen County are not in good repair. The roads to the north of Cape Fear River are extremely sandy. In practically all sections to the south of the river and in a few places to the north good sand-clay roads can easily and cheaply be constructed. Considerable interest is being manifested in the improvement of highways.

Churches and schoolhouses are located throughout the county. Rural delivery of mail is in operation in the more thickly populated regions. A few telephone lines have been constructed to connect the most prominent places in the county.

The staple farm crops are sold at the small towns in the county, and most of the cotton eventually goes to Wilmington, either by rail or water. The truck crops grown around Clarkton and Bladenboro are for the most part shipped to northern markets.

CLIMATE.

The temperature is slightly lower and the precipitation slightly less in the northern part of the county than in the southern. At Lumberton, Robeson County, about 20 miles west of the center of Bladen County, the mean annual temperature is 61.5° F. and the mean annual precipitation about 50 inches. These figures represent the general conditions in Bladen County. The rainfall is well distributed through the year and crops seldom suffer from drought. Snows occur infrequently.

At the same station the average date of the first killing frost in the fall is October 31 and of the last in the spring April 6. This gives a comparatively long growing season. The date of the earliest recorded killing frost in the fall is October 10 and of the latest in the spring April 28.

Cover crops, cabbage, strawberries, and turnips can be grown during the winter months, and cattle can be grazed practically the entire year. The weather during the spring and fall months is pleasant, and even during the winter it is sufficiently open for farm work such as clearing land, ditching, and plowing.

The following table compiled from the records of the Weather Bureau station at Lumberton gives the salient features of the climate of Bladen County:

Normal monthly, seasonal, and annual temperature and precipitation at Lumberton, Robeson County.

Month.	Temperature.			Precipitation.		
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year.	Total amount for the wettest year.
	° F.	° F.	° F.	Inches.	Inches.	Inches.
December.....	44.1	78	13	3.36	3.28	5.65
January.....	42.9	80	6	3.31	2.15	4.02
February.....	41.2	74	1	4.65	5.92	2.18
Winter.....	42.7	.....	.....	11.32	11.35	11.85
March.....	54.2	96	18	3.85	2.52	3.56
April.....	61.3	92	26	3.47	2.98	4.25
May.....	70.8	98	37	4.14	3.42	12.52
Spring.....	62.1	.....	.....	11.46	8.92	20.33
June.....	77.2	101	49	5.31	2.29	5.47
July.....	80.3	102	55	5.94	2.63	6.54
August.....	78.9	101	53	6.25	4.49	6.97
Summer.....	78.8	.....	.....	17.50	9.41	18.98
September.....	72.9	97	35	4.28	3.32	9.38
October.....	61.7	92	28	3.10	4.44	1.21
November.....	52.0	82	15	2.22	4.34	1.01
Fall.....	62.2	.....	.....	9.60	12.10	11.60
Year.....	61.5	102	1	49.88	41.78	62.76

AGRICULTURE.

Bladen County is one of the oldest counties in North Carolina, and agriculture in this section dates back to the early days of the eighteenth or even to the latter part of the seventeenth century. The earliest agricultural pursuit was principally the grazing of cattle and sheep. The lowlands of the Cape Fear River are said to have afforded ample pasturage, and they were the first to attract the attention of settlers. At a somewhat later period the wire grass of the uplands began to be grazed also, and cattle and sheep herding spread rapidly over the county. Corn and wheat were the principal crops grown at first, these products being consumed at home. Flax was grown from the earliest times and used in the manufacture of

clothing. Grist mills were not common at that time, and the wheat and corn were made into breadstuffs by means of a mortar and pestle.

In 1840, according to the oldest inhabitants, a brisk trade had been built up between Bladen County and the merchants of Wilmington, and considerable produce was carried down the river on boats or rafts. The first products handled in this manner were corn, hides, pork, tallow, rice, and indigo. The production of turpentine began about 1844, and large quantities of turpentine spirits, tar, rosin, and lumber were rafted to Wilmington. It is said that tobacco and rice were grown for home use from the earliest times, and that the cereal was of considerable importance during the first half of the eighteenth century. For a period of 50 years prior to the Civil War tobacco was rolled into this section in hogsheads from the Piedmont counties of Carolina and Virginia.

Prior to the Civil War cotton was grown mainly for home use. After the war it became the crop of first importance, and its production has increased to the present time, though as late as 1885 turpentine, tar, rosin, and lumber were the chief sources of income. With the disappearance of the timber agriculture began to receive more attention.

According to the census, in 1879 there were 21,556 acres planted to corn, producing 188,208 bushels; 1,618 acres in cotton, producing 683 bales; 1,554 acres in sweet potatoes, producing 117,638 bushels; 362 acres in oats, 109 in wheat, 261 in rye, 473 in rice, 247 in hay, and 6 in tobacco.

By 1899 the acreage devoted to corn had increased to 29,110 acres and the production to 249,780 bushels. The growing of tobacco on a commercial scale was begun in 1898, and the following year 512 acres were devoted to it, from which 278,690 pounds were produced. In the same year (1899) 20 acres of strawberries were grown, yielding 38,180 quarts.

In 1909 the corn crop was larger than in 1899, amounting to 310,655 bushels, although the acreage devoted to it was less, being 27,450 acres. During this year 5,357 bales of cotton, 129,000 pounds of tobacco, 131,064 bushels of sweet potatoes, 7,887 bushels of oats, 4,944 bushels of Irish potatoes, 2,710 bushels of peanuts, and 14,833 bushels of dry peas were grown. Very little wheat, rye, and rice were produced. There were 169 acres planted to sorghum and 197 acres to strawberries in 1909, the latter yielding 390,153 quarts. Only a comparatively small acreage was devoted to grasses and grains for hay and forage.

From the foregoing figures it will be observed that corn and cotton are the two most important crops now grown in Bladen County. They are planted on practically every soil type. Corn is grown for home consumption only. Cotton is the chief money crop of the county and has a great influence on its commerce. Strawberries, Irish potatoes, and beans are also money crops, although not extensively grown. Oats are used mainly for forage. Cowpea vines are either made into hay or turned under for soil improvement.

Sweet potatoes are produced in small quantities in all sections of the county for home use and for local markets. Watermelons, cantaloupes, and Scuppernong and Misch grapes are successful. Small patches of sorghum are grown for the manufacture of sirup. This is all used in the home or by the local trade.

Not much interest is taken in fruit growing. There are many fig trees in the county, and a few apple, peach, and pear trees.

The animal industries are of little commercial importance. Some beef cattle, hogs, a few goats, and sheep are raised.

A number of sawmills are in operation, and the sale of lumber still brings in considerable revenue. The turpentine industry has not passed away altogether, as there are a few stills yet in operation. Tar is extracted annually to the extent of many barrels. A considerable number of crossties are cut and marketed.

The adaptation of certain soils to certain crops has to some degree been recognized by the farmers of the county. The Hyde loam is an excellent corn soil and has been largely used for this crop. The Coxville fine and very fine sandy loams, together with small areas of Portsmouth fine sandy loam and Norfolk fine sandy loam, constitute the main strawberry soils of the county. The Norfolk fine sandy loam and sandy loam are used more extensively than any other types for cotton, corn, cowpeas, sweet potatoes, and garden vegetables. These types and also portions of the Ruston and Susquehanna soils are well adapted to tobacco and peanuts. The well-drained upland soils along the Cape Fear River do well with early truck crops. In all these cases economic conditions enter into the question whether the soils can be used at present for the crops to which they are respectively naturally adapted.

No system of crop rotation is generally practiced in the county. The prevailing custom has been the production of cotton almost continuously on the same field. However, some of the best farmers practice a rotation consisting of cotton the first year; corn, with cowpeas sowed between the rows at the last cultivation, the second year; and oats, followed in the summer by cowpeas, the third year. Where Irish potatoes are produced for market the rows are usually about

5 feet apart, and either corn or cotton is planted between the rows. The potatoes are generally planted in February and gathered about the time for the first cultivation of corn or cotton. They are heavily fertilized, and the subsequent crops find a surplus of fertilizer in the soil amply sufficient for their growth.

Efficient farm help is scarce. Laborers receive \$15 to \$20 per month, together with the use of a dwelling house, firewood, and a garden patch. Men are usually paid 75 cents to \$1 and women 50 cents for ordinary day labor. For picking cotton laborers receive 40 to 75 cents per 100 pounds, the higher price prevailing near the close of the season.

In 1910, according to the census, 81.3 per cent of the farms in Bladen County were operated by the owners. Most of the remainder are rented. Under the tenant system the landowner in some cases furnishes stock, feed, implements, and one-half of the fertilizer and receives one-half of the crops. In others the owner receives one-third to one-fourth of the produce for the use of the land.

The farms vary greatly in size, the larger plantations containing 500 to 5,000 acres, though only a small proportion of such tracts is under cultivation. The majority of the farms range from 50 to 500 acres. In a few localities, especially in the negro settlements, the individual holdings are 5 to 50 acres.

In the northern half of the county, lying between Cape Fear and South Rivers, there are broad expanses of undeveloped land which can be bought for \$1 to \$3 an acre. The section of country beginning a short distance below Tarheel and extending northwesterly to the Cumberland County line and the section from Bladenboro to Clarkton, and thence to Elizabethtown, constitutes the most thickly settled and best-developed parts of the county. In these localities land values range from \$10 to \$50 an acre.

The large variety of soils, the favorable topographic position, and the equable climate of Bladen County are conducive to the development of a highly diversified agriculture. The clay subsoils, which lie close to the surface over much of the county, enable the soils to be built up to, and maintained in, a high state of productiveness.¹

SOILS.

Bladen County lies wholly within the Coastal Plain Province, and the soils have been derived from unconsolidated sands and clays, and locally from heavy clays of sedimentary origin. These

¹ For information concerning crops suitable for this section see Farmers' Bulletins 18, 77, 164, 193, 220, 257, 318, 324, 359, 431, 436, 477, and 579, and Bul. 143 B. P. L., U. S. Dept. of Agr.

sediments since their elevation above water have been more or less altered by drainage, oxidation, and erosion, and by plants and other forms of life. The percolating rain water has carried much of the finer material down from the immediate surface and running water and erosion have changed the texture of the original deposits. The many changes in color, such as to red, yellow, and brown, are due largely to the oxidation of the iron minerals. The gray and black colors are the result of the accumulation and decay of varying quantities of organic matter.

The many changes effected in the soil material since it was laid down have given rise to considerable differences in the existing soils. These differences lie in color, topography, drainage, and crop adaptation, and to bring out the broader relationships involved a grouping of the soils into series is made.

In the upland portion of the county there are eight such series—the Norfolk, Portsmouth, St. Lucie, Ruston, Susquehanna, Coxville, Lufkin, and Hyde.

Along the Cape Fear, South, and Black Rivers and a few of the larger streams and swamps there are developed some well-defined terraces and second bottoms, in addition to the broad and continuous first bottoms. The Cape Fear River has its origin in the Piedmont Plateau Province, material from which has been transported and deposited along the river in Bladen County. All the first bottoms along this stream consist of Piedmont material, and even a portion of the second bottoms or terraces is composed of reworked Piedmont material. On the terraces or second bottoms the Wickham and Kalmia series are developed, and in the first bottoms occur the Congaree and Johnston series and Swamp.

The names of the soils encountered in Bladen County are the same as those applied to similar soil types previously established in the Atlantic and Gulf Coastal Plain regions. Series and type descriptions covering all the soils found in the county are given in subsequent pages of this report.

The distribution of the soils is shown by means of colors on the accompanying soil map. It will be noted that in general the sandy and coarser textured soils have their main development north of Cape Fear River, and that the finer textured soils are confined more to the southern part of the county.

Marl appears in many places in the bluffs along the Cape Fear River, and is frequently seen on the banks of the deeper channels of the creeks. Some of this marl has been dug out and used on the fields.

The table following gives the name and the actual and relative extent of each of the several soil types mapped in Bladen County.

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Portsmouth sand.....	124,992	23.1	Johnston silt loam.....	8,320	1.5
Norfolk sand.....	90,880	16.8	Kalmia sandy loam.....	7,808	1.4
Norfolk fine sandy loam.....	68,224	14.2	Coxville fine sandy loam.....	7,168	1.3
Flat phase.....	8,576		Portsmouth sandy loam.....	7,040	1.3
Swamp.....	40,640	7.5	Susquehanna fine sandy loam.....	5,952	1.1
Portsmouth fine sandy loam..	35,072	6.5	Lufkin sandy loam.....	5,696	1.0
Norfolk sandy loam.....	21,184	5.7	Wickham fine sandy loam.....	4,928	.9
Deep phase.....	9,600		Ruston sand.....	4,032	.7
Hyde loam.....	17,792	3.3	Ruston fine sandy loam.....	2,688	.5
Norfolk fine sand.....	16,192	3.0	Kalmia sand.....	2,560	.5
Congaree silt loam.....	16,000	3.0	Ruston sandy loam.....	1,344	.2
Norfolk very fine sandy loam..	12,032	2.2			
Coxville very fine sandy loam..	11,776	2.2	Total.....	542,080	.....
St. Lucie sand.....	11,584	2.1			

NORFOLK SERIES.

The surface soils of the Norfolk series are prevailingly gray, ranging from light gray to grayish yellow. The subsoil is yellow sandy clay of friable structure. These soils occupy nearly level to rolling uplands throughout the Coastal Plain. The series is represented in Bladen County by the sand, fine sand, sandy loam, fine sandy loam, and very fine sandy loam. This series covers more than two-fifths of the county.

NORFOLK SAND.

The surface soil of the Norfolk sand consists of a gray or yellowish-gray medium sand having a depth of 5 to 8 inches. It is underlain by a yellow medium sand extending to a depth of 3 feet or more. Both the soil and subsoil are generally loose, open, and porous. In many places north of Cape Fear River the surface soil to a depth of a few inches is a white sand, closely resembling the St. Lucie sand. In spots south of the river 1 or 2 inches of the surface material is gray to dark gray in color, owing to the presence of more than the usual quantity of organic matter. Occasionally the subsoil is light gray in color throughout the 3-foot section. Frequently a reddish-yellow sand is encountered in the subsoil, and such areas would have been mapped as Ruston sand had they been of sufficient size. Patches of coarse sand and of fine sand too small to map separately are found throughout the type. Generally speaking, the Norfolk sand lying south of Cape Fear River is more uniformly light gray in color and is slightly more productive than that north of the river. This soil is decidedly deficient in organic matter.

The Norfolk sand has a rather extensive development in Bladen County. It lies chiefly east of Cape Fear River, though areas of considerable size are found throughout the county, except along the southern border. Some of the best developed and largest unbroken areas are situated east of White Lake, east of Singletary Lake, near Cypress Creek Church, in the vicinity of White Oak, and north to the Cumberland County line. A casual observation obtained in driving over the northern half of the county would indicate that the greater part of this section is Norfolk sand. This is due to the fact that the roads follow the sand ridges in avoiding the Portsmouth sand "bays."

The topography of this type is prevailingly level to gently rolling or hummocky. Areas of almost even surface occupy broad inter-stream divides, some of which comprise as much as 1,000 or 1,200 acres. Gently sloping ridges and a succession of knolls formed of this type occur as continuous strips throughout the Portsmouth sand in many sections. The porosity of the soil, with its rolling surface, insures excellent drainage over the entire type. This enables the soil to warm up quickly in the spring, and also renders tillage operations possible immediately after a rain.

The original forest consisted of longleaf pine, most of which has been cut. At present the characteristic growth is blackjack and scrub oak, with a scattering of longleaf pine. In some places the surface is covered with a thick growth of wire grass.

Much of the Norfolk sand on the east side of Cape Fear River is, in its natural state, considered a poor agricultural soil. However, some areas in this part of the county and the greater part of the type south of the river give fair yields of corn, cotton, and cowpeas. In a few places where the soil has been properly handled and fertilized as much as 1 bale of cotton and 25 bushels of corn per acre have been obtained. Early truck crops, Scuppernong and Misch grapes, sweet potatoes, rye, peanuts, watermelons, and small vegetables do well on this type. Cowpeas make a fairly good growth when fertilized with about 200 pounds per acre of phosphoric acid and 25 pounds per acre of muriate of potash. Rye does well and makes a good winter cover crop, to be turned under in the spring. By increasing the humus content of this soil the moisture conditions will be greatly improved and a larger amount of commercial fertilizer can be used profitably.

The value of the Norfolk sand depends upon its location and improvements. East of Cape Fear River it sells for \$3 to \$10 an acre. Near Elizabethtown it is held at \$10 to \$20 an acre.

NORFOLK FINE SAND.

The surface soil of the Norfolk fine sand to an average depth of about 5 inches consists of a light-gray or yellowish-gray fine sand.

It is underlain to a depth of 3 feet or more by a pale-yellow or yellowish-gray fine sand. This type throughout the 3-foot section is mellow and loose, but not so open and porous as the Norfolk sand. Fairly good capillary action exists and the soil does not dry out excessively. Like the Norfolk sand, this type is decidedly deficient in organic matter.

This type has its greatest development in the southern part of the county. The largest areas occur along the Fayetteville-Wilmington road in the vicinity of Mount Horeb Church, to the northeast and south of Rosindale, and to the north of Bladenboro. Numerous spots are distributed throughout the region west of Cape Fear River.

The Norfolk fine sand occupies high, level areas and rather low ridges and knolls. Bordering the streams the surface is rolling to hilly. Owing to its topographic position and loose structure, this soil is well drained.

Most of the original timber growth has been removed from this soil and a second growth of scrub oak, young longleaf pine, and some hickory and dogwood, with an undergrowth in which huckleberry is conspicuous, constitutes the present vegetation. Locally the slopes of this type are still forested with the original growth, which consists of red and post oak and cedar. Spanish moss grows heavily on the oaks. This growth is characteristic of the Norfolk fine sand.

A very small proportion of this type is under cultivation, the farmed area being used mostly for the production of corn and cotton. The yields are very low, except when the soil is heavily manured or fertilized. This soil warms up early in the spring and is very easily tilled. Early truck crops, watermelons, cantaloupes, sweet potatoes, rye, peanuts, chufas, and Scuppernong and Misch grapes are successfully grown on it. Fertilization is necessary for the profitable production of any crop. The Norfolk fine sand is valued at \$10 to \$15 an acre.

NORFOLK SANDY LOAM.

The surface soil of the Norfolk sandy loam is a light-gray or gray medium sandy loam or loamy sand, grading, at about 6 inches, into a pale-yellow loamy sand or sandy loam, which continues to a depth of 12 to 20 inches. The subsoil of the typically developed areas is a yellow or greenish-yellow friable sandy clay extending to a depth of 3 feet or more. In some of the wooded areas having a level topography the surface soil is dark gray in color and the subsoil frequently shows mottlings of gray or resembles in color the subsoil of the Lufkin sandy loam. Occasionally on the slopes and bluffs, where aeration and oxidation have proceeded to an advanced stage, the subsoil is reddish yellow. The areas of heavier and more uniform surface soil are found in the northwestern part of the county.

The Norfolk sandy loam is developed largely in the central, northwestern, and northeastern sections of the county. The more prominent bodies are situated between Tarheel and the Cumberland County line, on the west side of Cape Fear River, to the northwest of Elizabethtown, north and northwest of Ammon, and to the north and south of Antioch Church.

Much of the surface of this soil is level, undulating, or gently rolling. Bordering the streams in a few localities the surface is more rolling, but all of it is suitable for general farming. With the exception of a few of the flatter areas, which can be reclaimed by means of open ditches and tile drains, this type has good natural drainage.

The forest growth consists of longleaf and shortleaf pine, red oak, white oak, and post oak, hickory, dogwood, persimmon, and sweet gum. In contrast with the Norfolk sand, this type is practically free from the growth of wire grass.

The Norfolk sandy loam is one of the strong and productive soils of Bladen County. It is naturally mellow and easily cultivated, and owing to its even surface modern farm machinery can be used advantageously. This soil is held in high esteem for cotton, corn, and cowpeas, which are the principal crops grown on it. In addition to these staple crops, peanuts, bright tobacco, sweet potatoes, asparagus, Irish potatoes, English peas, snap beans, tomatoes, sweet corn, watermelons, and cantaloupes thrive. Oats, cowpeas, sorghum, and garden vegetables are also successfully grown. Among the native fruits are the Scuppernon and other varieties of grapes and mulberries.

Cotton yields from one-fourth bale to $1\frac{1}{4}$ bales per acre, with an acreage application of 200 to 800 pounds of an 8-2-2¹ or 8-3-3 mixture of fertilizer. Corn yields range from 10 to 40 bushels per acre, depending upon the quantity of fertilizer or manure applied.

The Norfolk sandy loam is deficient in organic matter, especially where it has been continually cropped to cotton.

In remote regions the cut-over and uncleared lands of the Norfolk sandy loam may probably be purchased for \$10 to \$15 an acre. Cleared and improved land near lines of transportation is held at \$20 to \$50 an acre.

Norfolk sandy loam, deep phase.—The deep phase of the Norfolk sandy loam occurs in close association with the typical soil, from which it differs essentially only in having a greater depth of loamy sand material overlying the friable sandy clay. Usually the latter lies 20 to 36 inches below the surface, though in a few localities the subsoil is a yellow, heavy sandy loam instead of sandy clay.

Most of this phase is found in the northwestern part of the county. The largest bodies are located on the west side of the Cape Fear

¹ Fertilizer formulas stated in order of phosphoric acid, nitrogen, and potash proportions.

River between Elizabethtown and the Cumberland County line, and other areas of moderate extent are encountered south and northwest of Ammon.

In topography the phase is similar to the typical soil and it possesses as good or better drainage. It is used for the same crops, but the yields are slightly less and it is not so easily maintained in a productive condition. Generally speaking, the Norfolk sandy loam, deep phase, is intermediate in agricultural value between the Norfolk sand and the typical sandy loam.

NORFOLK FINE SANDY LOAM.

The surface soil of the Norfolk fine sandy loam consists of a light-gray to yellowish-gray fine sandy loam or loamy fine sand, grading into a pale-yellow fine sandy loam at about 4 to 6 inches and extending to a depth of about 12 to 20 inches. The true subsoil is a yellow or greenish-yellow, friable fine sandy clay or friable clay, which extends to a depth of 3 feet or more. In the vicinity of Clarkton, and also bordering the Norfolk very fine sandy loam, the surface soil is finer in texture than usual. Over some of the flatter areas slight mottlings of gray and yellow occur in the subsoil, while on a few of the knolls and slopes the subsoil is a reddish-yellow friable clay, resembling the subsoil of the Ruston fine sandy loam.

The Norfolk fine sandy loam is one of the most important types in this survey, though it is confined largely to the south-central and southern parts of the county. The largest areas occur between Elizabethtown and Clarkton and eastward to Mount Horeb Church. Other large, typically developed areas are situated between Clarkton and Abbottsburg, to the west of Bladenboro, to the south of Porterville Station, and along the Fayetteville and Wilmington road, beginning northwest of Westbrook and extending southeast to the Columbus County line. Scattered bodies are developed around Tobermory, Dublin, Perth, and to the north and northeast of Black Lake.

The topography is characteristically undulating to gently rolling. Some of the larger interstream areas have an almost level to an undulating surface, sloping gently toward the streams. Natural drainage is well established over most of the type, and any further drainage necessary can be accomplished effectively by means of open ditches and tile drains on individual farms.

The greater part of the magnificent longleaf pine which originally covered this type has been cut. The present forest growth consists of shortleaf pine, a little longleaf pine, and in places a heavy growth of red oak, white oak, and hickory.

The Norfolk fine sandy loam is one of the best soils in the Coastal Plain region of North Carolina. It is easily cultivated and all kinds of labor-saving machinery can be used on it. Bright or lemon-yellow tobacco, cotton, peanuts (Spanish and Virginia varieties), corn, crimson clover, cowpeas, late truck crops, watermelons, cantaloupes, Irish potatoes, sweet potatoes, sorghum, oats, Scuppernong and Misch grapes, and mulberries are successfully grown on this soil. At present it is devoted principally to cotton, corn, cowpeas, oats, and strawberries. With an acreage application of 200 to 800 pounds of commercial fertilizer analyzing 8-2-2, 8-3-3, or 8-4-4 cotton yields one-half bale to $1\frac{1}{2}$ bales per acre. Corn yields 20 to 40 bushels per acre with an application of 200 to 400 pounds of similar mixtures. Strawberries are grown to a small extent around Clarkton, and the yields are fair. An application of 800 to 1,000 pounds per acre of an 8-3-2 $\frac{1}{2}$ or 8-4-4 mixture is usually made on strawberries in the fall. Some growers use a 6-4-8 mixture. A top dressing of 150 pounds per acre of nitrate of soda is usually applied about March 1. Irish potatoes are fertilized at the rate of 800 pounds per acre, and the yields vary from 30 to 60 barrels per acre.

This soil, like the sandy loam type, can be built up to a high state of productiveness through the addition of vegetable matter. It is similar to extensive areas in Robeson, Pitt, and other counties, and with the same cultivation and fertilization is capable of the same development.

Land of this type sells at \$15 to \$50 an acre, the higher prices being due to proximity to towns or shipping points.

Norfolk fine sandy loam, flat phase.—The flat phase differs mainly from the typical Norfolk fine sandy loam in having a prevailingly flat and level surface and poor natural drainage. The surface soil is generally darker in color than that of the typical soil, and the subsoil in many places is more or less mottled with gray in the lower part of the 3-foot section.

This phase is confined to the southeastern corner of the county, or that part of the Coastal Plain generally known as the "flat piney-woods region." A relatively small area is mapped, consisting of a few irregularly shaped bodies in the vicinity of Council, East Arcadia, and Carvers Creek Church.

Owing to its uniformly level surface, this phase requires artificial drainage. All of it, however, can be drained and reclaimed by means of small canals and open ditches. Some of it is now under cultivation, producing fair yields of corn, cotton, and oats.

NORFOLK VERY FINE SANDY LOAM.

The surface soil of the Norfolk very fine sandy loam consists of a yellowish-gray or light-gray very fine sandy loam to a depth of about

6 inches. Below this depth a pale-yellow very fine sandy loam extending to a depth of about 8 to 15 inches is encountered. The typical subsoil is a yellow or deep-yellow friable clay or a silty very fine sandy clay to a depth of 3 feet or more. In the wooded areas the surface soil in a few places is dark gray. On some of the slopes the subsoil has a reddish-yellow tinge or is mottled with red, while in some of the lower situations it is slightly mottled with gray. Occasionally a thin stratum of very fine sand is encountered in the lower part of the subsoil section.

This type is developed only in the extreme southern part of the county, mainly in one large area near Elkton, which is interrupted by narrow strips of Swamp. A smaller area lies a short distance to the northwest of Clarkton.

The topography is prevailingly level to gently rolling, with slightly steeper slopes along the streams. Practically all of the type possesses good natural surface drainage and only a few of the flatter bodies require ditching.

A considerable portion of this type is cleared and under cultivation. The remainder is forested with longleaf and shortleaf pine, red oak, white oak, blackjack oak, and hickory.

This soil is recognized as one of the best of the upland types. It is capable of being highly improved and its productiveness can be easily maintained. The surface features admit of the use of improved farm machinery. When plowed under proper moisture conditions the soil works up into a good tilth.

Cotton, corn, oats, and cowpeas are the most important crops grown on this soil. Oats are usually used for forage. Irish potatoes, sweet potatoes, and vegetables do well.

Cotton yields from one-half bale to 1½ bales per acre, with an acreage application of 600 to 800 pounds of an 8-3-3 or 8-2-2 fertilizer mixture. The ordinary corn yields range from 20 to 40 bushels per acre, although as much as 80 bushels has been produced on special plots with liberal fertilization.

The Norfolk very fine sandy loam is held in high esteem as a general farming soil, and none of it can be bought for less than \$20 an acre. Land in a high state of cultivation is valued at \$30 to \$50 an acre.

ST. LUCIE SERIES.

The St. Lucie soils are white and overlie subsoils of the same color. They occur in the Coastal Plain in situations similar to those in which the Leon soils are encountered. They differ from the latter only in the absence of the brown hardpan. The sand is the only member of the St. Lucie series in Bladen County.

ST. LUCIE SAND.

The St. Lucie sand consists of a white medium sand to a depth of 3 feet or more. It is very loose and incoherent throughout. In spots near its contact with the Portsmouth sand a brown sand is encountered at about 15 to 24 inches, and this may extend to a depth of 3 feet, or in turn be underlain within the 3-foot section by white sand.

All of this type occurs between the Cape Fear and the South and Black Rivers. No large areas appear, but there are many small ones, especially south of Suggs Mill Pond and north and south of Black Lake.

The St. Lucie sand is developed on the low ridges and slightly elevated flat areas usually surrounded by Portsmouth sand. The soil occupying the ridges is well drained, but the flat areas are commonly saturated with water a few inches below the surface.

None of this type is under cultivation. It supports a scattered growth of longleaf pine, together with a rather thick growth of scrubby oak. Along the boundaries between this soil and the Portsmouth sand the flat areas frequently support a growth of gallberry bushes and wire grass. In its present condition the St. Lucie sand is considered practically worthless for agriculture.

RUSTON SERIES.

The Ruston soils are gray, varying to grayish brown. The subsoils are reddish yellow to yellowish red or dull red and are moderately friable, consisting generally of sandy clay. Occasionally the lower subsoils are mottled with gray and shades of yellow. This series is intermediate between the Orangeburg and Norfolk series in the color of its subsoil, and between the Orangeburg and Norfolk on the one hand and the Susquehanna series on the other in point of subsoil structure. The Ruston soils are closely associated with the Orangeburg and Susquehanna. In Bladen County the sand, sandy loam, and fine sandy loam types are mapped.

RUSTON SAND.

The surface soil of the Ruston sand is a gray or brownish-gray medium sand having a depth of 5 to 8 inches. This is underlain to a depth of 3 feet or more by a reddish-yellow or brownish-yellow medium sand. Both the soil and subsoil are somewhat loamy in places, and the type as a whole is slightly more coherent than the Norfolk sand.

Only a small total area of this soil is found in Bladen County. It occurs along the western boundary of the county south of Goodman

Swamp. It is confined to the slopes and gently rolling areas contiguous to the swamps and larger streams. By reason of its rolling topography and open structure, all of it is well drained.

This soil is stronger and slightly more productive than the Norfolk sand and the greater part of it is under cultivation. The forested areas support principally a growth of longleaf and shortleaf pine, together with a scattering of oak and a few other hardwoods.

Most of the Ruston sand is now devoted to the growing of cotton and corn. Early truck crops, sweet potatoes, rye, and light farm crops are also successfully grown. Yields vary with the amount of fertilizer applied and the organic-matter content of the soil. This soil warms up very early in the spring and is one of the most easily tilled soils in the county. Land of this type sells at \$10 to \$20 an acre.

RUSTON SANDY LOAM.

The surface soil of the Ruston sandy loam consists of a gray or brownish-gray loamy medium sand, grading at about 6 inches into a pale-yellow loamy sand extending to a depth of 12 to 30 inches. The typical subsoil is a yellowish-red or reddish-yellow friable sandy clay reaching to a depth of 3 feet or more. In a few places the subsoil is a heavy stiff clay resembling in structure the subsoil of the Susquehanna series. The areas of deepest surface soil are frequently found at the base of the slopes. This is due largely to the translocation of the soil particles by heavy washing from the higher lands.

This type is the least extensive soil mapped. Only a few small scattered areas were encountered. Two of the largest ones are situated south of Elizabethtown and north of South River Church.

The Ruston sandy loam occupies the bluffs and slopes lying between the level and gently rolling Norfolk soils and the bottom lands along the streams. This position accounts largely for the wide range in the depth of sandy material overlying the subsoil. The type is thoroughly drained.

Practically all of this soil is under cultivation, being devoted to the production of cotton, corn, oats, sweet potatoes, and cowpeas. In productiveness it compares favorably with the Norfolk sandy loam.

Below are given the results of mechanical analyses of samples of the soil and subsoil of this type:

Mechanical analyses of Ruston sandy loam.

Number.	Description.	Fine grav ³ l.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
233229.....	Soil.....	6.7	12.6	7.2	58.7	5.0	6.6	2.9
233230.....	Subsoil.....	2.1	7.9	5.0	47.8	6.6	9.7	21.2

RUSTON FINE SANDY LOAM.

The surface soil of the Ruston fine sandy loam is a yellowish-gray or brownish-gray fine light sandy loam, passing into a pale-yellow fine sandy loam at about 6 inches. The typical subsoil, beginning at 10 to 24 inches, is a yellowish-red or brownish-yellow fine friable sandy clay. Along the line of contact between this type and the Susquehanna fine sandy loam the subsoil is rather plastic and tough.

Little of this soil occurs in Bladen County. Some comparatively large areas lie in the southwest corner of the county, south and north of Clarkton, and in the vicinity of Purdie Church and Owen Hill Landing.

The Ruston fine sandy loam is confined to the gently rolling areas and slopes, and for this reason natural drainage is well established.

As with the Ruston sandy loam, a large proportion of this type is under cultivation. The leading crops are cotton, corn, oats, sweet potatoes, and cowpeas. With a light application of commercial fertilizer, cotton yields one-half to 1 bale, and corn 15 to 25 bushels per acre. Oats do well and are grown for forage. Sweet potatoes are also successful. Cowpeas succeed, especially in rotation with corn and oats. The soil is deficient in organic matter.

Land of the Ruston fine sandy loam is valued at \$20 to \$40 an acre.

SUSQUEHANNA SERIES.

The Susquehanna soils are gray, ranging to reddish. The subsoils are mottled gray and red or gray, red, and yellow, and consist of plastic heavy clay. The color of the subsoil varies, often being white, drab, yellow, and sometimes purple, although red practically always predominates, the other colors appearing only as mottlings in the lower part of the soil section. The Susquehanna series is most extensively developed in the higher part of the Coastal Plain from the vicinity of Chesapeake Bay to central Texas. This series is represented in Bladen County by the fine sandy loam type.

SUSQUEHANNA FINE SANDY LOAM.

The surface soil of the typical Susquehanna fine sandy loam is a light-gray fine sandy loam to a depth of about 6 inches, where the color changes to pale yellow. The subsoil, which is encountered at depths between 8 and 18 inches, is a yellowish-red or dull-red, stiff, plastic clay, mottled in the lower part with red, yellow, and gray. In local spots the surface layer of fine sandy loam has been removed by erosion, exposing the raw clay subsoil. The subsoil in small areas is purple in color, but has the common structural characteristics. Included in the type as mapped are small spots of Ruston fine sandy loam.

This type is developed principally in one large area of irregular outline beginning about 3 miles southeast of Elizabethtown and extending for a distance of about 5 miles along the Fayetteville-Wilmington Road. It varies in width from 2 to 4 miles. A few isolated bodies occur elsewhere in the county.

The topography is prevailingly rolling to hilly. Inextensive inter-stream areas have a comparatively level to gently rolling surface, but the surface invariably becomes broken and hilly as the streams are approached, and where this type borders the terrace soils of Cape Fear River there is a narrow strip of considerable length with a decidedly hilly and precipitous surface. Surface drainage is well established, but the stiff, plastic underlying clay prevents the rapid downward percolation of rain water and as a result some of the more level areas dry out slowly.

Oak, hickory, and other hardwoods constitute the characteristic forest growth on the slopes, and pine and oak on the interstream areas.

Cotton, corn, and cowpeas are the principal crops grown on this type at present. Cotton produces one-fourth to 1 bale and corn 15 to 25 bushels per acre. Oats, cowpeas, crimson clover, sorghum, sweet potatoes, and garden vegetables give fair yields. The greater part of the type can be easily cultivated. The yields are improved where a proper supply of organic matter is maintained in the soil. This soil is often deficient in this constituent.

The Susquehanna fine sandy loam is held at \$10 to \$20 an acre.

LUFKIN SERIES.

The surface soils of the types in the Lufkin series are light gray, and are underlain by impervious, plastic, and gray to mottled gray and yellow subsoils. The difference in texture between the surface soil and subsoil in the case of the sandy members is very marked. The topography is prevailingly flat, and this, together with the impervious subsoils, renders surface and underdrainage poor, water often standing for long periods after heavy rains. These soils are locally known as "flatwoods land" and "dead lands." The sandy loam type represents this series in Bladen County.

LUFKIN SANDY LOAM.

The surface soil of the Lufkin sandy loam is a light-gray sandy loam or loamy sand grading into a dull-gray or yellowish-gray sandy loam at about 6 inches and extending to a depth of 10 to 24 inches. The subsoil of the typically developed areas is prevailingly a drab or brownish-drab mottled with brown or yellow, sticky, plastic sandy clay to a depth of 3 feet or more. Distributed throughout the soil

section are small, rounded, brownish-yellow nodules, formed through the cementation of sand particles by iron oxide. In local spots along the bluffs the subsoil is a heavy plastic clay of a dull-brownish color. The surface soil of the Lufkin sandy loam closely resembles that of the Norfolk sandy loam, but the subsoils of these types are decidedly different in color, texture, and structure. In the vicinity of Elizabethtown and about 3 miles northwest of that place there occur small spots of Lufkin fine sandy loam which were included with the sandy loam type.

This type has a small extent in Bladen County, being largely confined to scattered bodies in the vicinity of Elizabethtown and extending from this place up the Cape Fear River basin.

The topography is prevailingly level to gently rolling, except along the bluffs, where the surface is hilly and rough. The gently rolling areas are usually well drained, but the more nearly level areas require considerable ditching. Owing to the rather impervious structure of the subsoil, the downward percolation of rain water is greatly retarded.

Only a very small percentage of this soil is under cultivation. The remainder is forested with pine, oak, dogwood, sweet gum, and hickory. Near the Cape Fear River large oak and hickory trees predominate and furnish merchantable timber.

The Lufkin sandy loam is used for practically the same crops as the Norfolk sandy loam and requires the same treatment. Cotton yields one-fourth to 1 bale and corn 10 to 25 bushels per acre. The value of land of this type ranges from \$10 to \$20 an acre.

COXVILLE SERIES.

The Coxville series comprises dark-gray to nearly black soils, with subsoils ranging from moderately mellow, friable clay in the upper portion to yellowish, rather plastic, compact clay mottled with drab and bright red in the lower portion. The topography is prevailingly flat, with frequent sparsely timbered areas. The soils are derived from beds of sand and clay which underlie the low, flat coastal belt of the Coastal Plain. Two types, the Coxville fine sandy loam and very fine sandy loam, are mapped in this county.

COXVILLE FINE SANDY LOAM.

The surface soil of the Coxville fine sandy loam is a gray to dark-gray fine sandy loam with a depth of 5 to 8 inches. The subsoil consists of a mottled drab, ocherous-yellow, and bright-red, heavy, plastic clay extending to a depth of 3 feet or more. In a few places, owing to the presence of relatively large quantities of organic matter, the surface soil is almost black in color. Near the heads of

small streams and in the center of depressions the surface soil is a silty to very fine sandy loam, and locally the subsoil may be a drab or gray and yellow mottled plastic clay, becoming intensely mottled with bright-red spots in the lower part of the 3-foot section. In the vicinity of Abbottsburg the surface soil ranges in depth from about 10 to 15 inches and the subsoil shows only faint mottlings of red.

This type is inextensive. Its greatest development occurs between Bethel Church and White Oak. Other areas are found to the south of Elizabethtown, north of Council, in the vicinity of Rowan Church, and in other sections of the county.

The Coxville fine sandy loam occupies flat, level areas and slight depressions. It possesses poor natural surface and internal drainage. However, all of it can be easily drained and used for the production of crops.

Very little of this type is under cultivation. The greater part is covered with forests of gum, oak, shortleaf pine, and some dogwood and myrtle. Corn, oats, strawberries, and cotton do well on this soil, which sells for \$10 to \$30 an acre.

COXVILLE VERY FINE SANDY LOAM.

The surface soil of the Coxville very fine sandy loam is a gray to dark-gray very fine sandy or silty loam to an average depth of about 6 inches. The subsoil is a mottled gray, yellow, and bright-red, sticky, heavy silty clay. The red mottlings become more numerous at a depth of about 20 inches and continue throughout the 3-foot section. In a few of the depressions and in forested areas the surface soil is almost black in color, as a result of the admixture of a large quantity of organic matter. Included in this type as mapped are patches of Coxville fine sandy loam and Portsmouth fine sandy loam.

The Coxville very fine sandy loam has a rather extensive development in the vicinity of Bladenboro and Abbottsburg in the southwest corner of the county. Large bodies of it are also encountered to the north of Bladenboro, lying immediately south of Crawley Swamp.

The type occupies uniformly flat and level areas and faint depressions. The surface drainage is poor and the rather impervious character of the subsoil retards the subdrainage. A considerable proportion of the type has been drained by open ditches and the remainder can be reclaimed in like manner.

The forest growth consists of shortleaf pine, black gum, sweet gum, oak, and some dogwood. There is in many places an undergrowth of gallberry bushes.

Corn, cotton, oats, sorghum, and cowpeas are successfully grown on this soil. Cabbage and strawberries are truck crops cultivated.

Corn yields 15 to 30 bushels, cotton one-half to 1 bale, and strawberries 75 to 125 crates per acre. Land of this type sells for \$10 to \$40 an acre.

PORTSMOUTH SERIES.

The surface soils of the types in the Portsmouth series are dark gray to black and are high in organic matter. The subsoils are light gray to mottled gray and yellow, and the heavier members are always plastic, though usually carrying a noticeable quantity of sand. These soils are developed in flat to slightly depressed, poorly drained situations, and require ditching before they can be used for agriculture. The series is most extensively developed in the flatwoods or the low, seaward portion of the Coastal Plain east of the Mississippi River. Scattered areas are frequently found in the poorly drained depressions of the higher Coastal Plain country. The series is represented in Bladen County by the sand, sandy loam, and fine sandy loam types.

PORTSMOUTH SAND.

The Portsmouth sand, locally known as "bay land," consists of about 8 to 15 inches of black, medium sand carrying a considerable quantity of organic matter. This is underlain by a white or light-gray sand of a loose and incoherent structure. A brown compact sand, locally called "hardpan," is encountered about 20 inches below the surface. This layer may be an inch or several inches in thickness and is in turn underlain by a white or light-gray sand. In the center of a few of the "bays" a shallow surface covering of mucky material is encountered. As mapped the type includes small areas of coarse sand and of fine sand. Along the line of contact of this type with the Norfolk and St. Lucie sands the surface soil is a black sand to a depth of only a few inches, passing below into a gray sand.

The Portsmouth sand is mapped covering 23.1 per cent of Bladen County. It is the most extensive soil mapped, and covers practically half of the section east of Cape Fear River. Broad, continuous areas reach from the Cumberland County line on the north to the Pender County line on the southeast. Some of the more prominent bodies are known as "Cypress Creek Bay," "Big Colly Bay," "Big Bay," and "Tussock Bay." Many large bodies occur in the southern half of the county, the soil being conspicuous north and northeast of Rosindale, north of Bladenboro and Abbottsburg, west of Elizabethtown, and southwest of Perth.

The type is confined to uniformly flat and level areas lying usually 1 to 5 feet below the surrounding soils. The greater part of it is either saturated or covered with water during a considerable part of the year.

The Portsmouth sand is characterized by a dense growth of gallberry and huckleberry bushes and bay trees, with a few scattered slash pine.

None of this type is under cultivation. It is in general considered practically worthless for agriculture.

PORTSMOUTH SANDY LOAM.

The surface soil of the Portsmouth sandy loam consists of a dark-gray to black sandy loam about 6 to 18 inches deep, containing a large proportion of organic matter. In places a layer of gray sandy loam overlies the clay subsoil. The subsoil in its typical development is a gray, mottled with yellow or brown, sticky, heavy sandy clay to a depth of 3 feet or more. In a few localities the surface soil is a black to dark-gray sandy loam for 8 to 12 inches, passing into a gray loamy sand, which continues to a depth of 30 to 36 inches before the heavy sandy clay subsoil is reached. In places, usually just below the surface soil, a dark-brown, partially cemented sand hardpan is encountered.

The Portsmouth sandy loam is relatively small in extent, being developed only in a few isolated areas. The largest bodies are situated west of Elizabethtown, in the vicinity of Tobermory, and north, east, and southeast of New Light Church.

The type occupies flat and level areas and slight depressions and is poorly drained, a part of it being in a semiswampy condition. All of it can be drained by open ditches, the walls of which, owing to the firmness of the clay subsoil, do not cave as they do in the more sandy soils.

Only a small proportion of this soil has been cleared and farmed. The remainder is either forested with longleaf and shortleaf pine, sweet and black gum, and some oak, with an undergrowth of gallberry and other bushes, or lies as cut-over land.

Corn, cotton, and peanuts do well on this soil. Corn is the principal crop and gives yields of 15 to 40 bushels per acre. The soil is naturally in an acid condition.

The Portsmouth sandy loam sells at \$10 to \$35 an acre, depending upon its location and upon the character of the surrounding soils.

PORTSMOUTH FINE SANDY LOAM.

The surface soil of the Portsmouth fine sandy loam is a dark-gray to black fine sandy loam, with a depth of about 6 to 8 inches, below which the color changes to gray. The true subsoil, beginning at a depth of about 10 to 15 inches, consists of a mottled gray and yellow fine sandy clay, ordinarily continuing to a depth of 3 feet or more without change. Locally the lower part of the 3-foot section may be

drab in color and show considerable brown and occasionally red mottling. In a few of the slight depressions and forested areas the surface soil is a black fine sandy loam to a considerable depth, being underlain by a drab or brownish clay.

This type is comparatively extensive. A large and important area occurs in the extreme southeast corner of the county between Council and East Arcadia, along the Seaboard Air Line Railway. Numerous bodies and patches are distributed throughout the region west of the Cape Fear River, and a few bodies are encountered in the vicinity of Ammon.

The Portsmouth fine sandy loam occupies flat, level upland areas and slight depressions. The natural drainage is inadequate, but the type lies at a sufficient elevation to be readily drained by artificial means. As in the case of the Portsmouth sandy loam, the walls of open ditches stand up well, and this property facilitates drainage of the type.

Practically none of this soil has been cleared and drained. The native forest consists of longleaf and shortleaf pine, oak, sweet gum, and cypress, with an undergrowth of gallberry and huckleberry bushes. A part of this type, however, lying between Council and East Arcadia is devoid of tree growth, and is locally called "open savanna land." Upon these open areas the characteristic growth is broom sedge and pitcher plant. They afford some grazing for cattle and sheep during the spring months.

The Portsmouth fine sandy loam is held at prices ranging from \$10 to \$25 an acre.

HYDE SERIES.

The soils of the Hyde series are characterized by their high content of powdery, thoroughly decomposed vegetable matter, and by their black color throughout the 3-foot soil section. This color distinguishes them from the Portsmouth soils, which have gray to mottled gray and yellow subsoils. The members are developed in flat or slightly depressed, poorly drained situations. One type, the Hyde loam, was encountered in this survey.

HYDE LOAM.

The surface soil of the Hyde loam consists of a black loam or silty loam ranging in depth from 12 to 24 inches. The subsoil is prevailingly a dark-brown, sticky, silty clay. In a few places a black, mucky loam is encountered, and this material either extends to a depth of 3 feet or is in turn underlain by a brown or bluish-drab clay. Throughout the type there are slightly elevated knolls and ridges of black fine sandy loam or sandy loam which are underlain by a brown or black sandy loam or sandy clay. Patches of muck

are of frequent occurrence. Occasionally 2 or 3 inches of vegetable mold is encountered on the surface in the wooded areas. The typical soil and all the variations are underlain by a drab or bluish clay or silty clay. All of the type is characterized by a high content of organic matter. The soil possesses a mellow structure and is easily tilled, except in the case of mucky areas, which are occasionally boggy.

The Hyde loam in the aggregate has a moderately extensive development in Bladen County. The largest and most important areas occur in the southeastern part of the county. Prominent tracts are also found to the east and southeast of Bethel Church and north of Shady Grove Church and White Oak. Other fair-sized bodies are scattered throughout the northern and central parts of the county.

This type is confined exclusively to depressions and basinlike areas whose surface is prevailingly flat and level. It lies at a slightly lower elevation than the surrounding soils, and when it occurs near lakes its surface is only a few feet above the water level. Natural drainage is poor. Much of this type was formerly swampy in character, but it is being reclaimed by a system of canals and ditches. Several areas were drained and cultivated prior to the Civil War, and were held in high esteem for corn, the soil being naturally productive and durable, and especially lasting in organic matter. A considerable part of the type is now under cultivation and the remainder may be easily drained and reclaimed. The unreclaimed areas support a forest growth consisting of maple, gum, oak, and hickory, with cypress in the wetter situations and short-leaf pine in some of the areas of better natural drainage.

Corn and oats are very successful on this type. At present corn is the most important crop and yields of 25 to 75 bushels per acre are not uncommon. Liming and liberal applications of potash and phosphoric acid are essential for the best results. Land of this type is valued at \$10 to \$50 an acre.

KALMIA SERIES.

The surface soils of the Kalmia series are gray, ranging to grayish yellow, and the subsoils are mottled gray and yellow. The series is developed along streams of the Coastal Plain region on terraces lying largely above overflow. The Kalmia soils are derived largely from materials washed from Coastal Plain soils, although along the larger streams issuing from the Appalachian Mountains and Piedmont Plateau more or less material has been transported from those regions. In the better drained situations the subsoils are yellow, the types in such places resembling very

closely the corresponding members of the Norfolk series. The Kalmia soils are closely related to the Cahaba, differing mainly in their poorer drainage and the consequently less oxidized condition of their subsoils. The surface is usually flat and the drainage deficient. The Kalmia series is represented in this county by the sand and sandy loam types.

KALMIA SAND.

The surface soil of the Kalmia sand consists of a gray to brownish-yellow medium sand with a depth of about 8 inches. It is underlain by a pale-yellow or brownish-yellow sand to a depth of 3 feet or more. In its typical development both the soil and subsoil are loose and porous, but in a few of the depressions there is present a sufficient quantity of silt and clay to render the sand loamy in character.

Little of this soil occurs in the county, a few isolated bodies lying in the second bottoms and terraces along the Cape Fear River and a few of the other large streams. The topography is level to undulating, and the elevation above the first-bottom soil, the Congaree silt loam, 4 or 6 feet. The soil has good natural drainage, though it is subject to overflow during exceptionally high freshets.

Practically all of the Kalmia sand is under cultivation, largely to corn, cotton, and oats. The yields of these crops are usually low, except when heavily manured or fertilized.

KALMIA SANDY LOAM.

The surface soil of the Kalmia sandy loam consists of a gray to brownish-gray loamy medium sand, grading at about 6 inches into a pale-yellow loamy sand, which extends to a depth of 12 to 20 inches. The subsoil, to a depth of 3 feet or more, is a pale-yellow or brownish-yellow friable sandy clay. In a few slight depressions the surface soil is dark gray in color and the subsoil is yellow mottled with gray. Along the Cape Fear River northwest, east, and southeast of Elizabethtown are spots of Kalmia fine sandy loam which, owing to their small extent, have been included with the sandy loam.

This type is confined to the second bottoms and terraces of Cape Fear, South, and Black Rivers. The largest areas occur along South River.

A level to undulating topography is characteristic of this type. Practically all of it has good surface drainage.

Nearly all the type is under cultivation, though there are patches of forest of mixed pine, gum, and oak.

Corn, cotton, and oats are the principal crops. Corn yields 10 to 25 bushels and cotton one-half to 1 bale per acre. Oats are grown for forage.

Land of the Kalmia sandy loam type of soil sells for \$10 to \$20 an acre.

WICKHAM SERIES.

The surface soils of the Wickham series are reddish or reddish brown and contain a higher percentage of organic matter than the Norfolk series. They usually overlie reddish, micaceous heavy sandy loam or loam subsoils, which become coarser, looser, and more incoherent at about 30 inches. The soils occupy river terraces in the higher part of the Coastal Plain near the Piedmont Plateau boundary. This series is represented in Bladen County by one type, the Wickham fine sandy loam.

WICKHAM FINE SANDY LOAM.

The surface soil of the Wickham fine sandy loam consists of a gray or brownish-gray to reddish fine sandy loam having a depth of about 5 to 10 inches. The subsoil is a yellowish-red clay, rather compact and firm. Locally this clay grades into a reddish-yellow fine sandy loam or loamy sand at 24 to 30 inches. Small scales of mica are generally distributed throughout the subsoil.

Included in this type are spots of gray silty to very fine sandy loam and also bodies of brownish-gray sandy loam, too small to be represented on the soil map. Spots of loamy sand ranging in depth from 10 to 20 inches are also of frequent occurrence. The subsoil in these variations and phases ranges in texture from a sandy clay to stiff clay and in color all the way from yellow and gray to red.

The Wickham fine sandy loam is confined to the second bottoms along Cape Fear River. It is usually found as strips varying in width from a few hundred yards to more than a mile. The largest areas lie between Lyons Landing and the Cumberland County line.

The topography varies from flat to undulating. Drainage for the most part is well established, particularly upon the undulating areas. The flat portions of the type can be drained at small expense by open ditches. Like the Kalmia soils, this type is subject to overflow during exceptionally high water.

The greater part of the Wickham fine sandy loam is under cultivation. The remainder is forested with sweet gum, shortleaf pine, ash, and oak. The principal crops grown on this soil are corn, oats, cotton, sweet potatoes, peanuts, rye, sorghum, and cowpeas. Corn yields 15 to 30 bushels and cotton one-half to 1 bale per acre. Oats, sorghum, and cowpeas give fair returns. Commercial fertilizers are used in growing corn only by the best farmers, but for cotton their use is universal. The latter crop receives acreage applications of 200 to 600 pounds of an 8-2-2 or 8-3-3 mixture.

The Wickham fine sandy loam is considered one of the better farming lands of the county. It is usually sold in connection with the adjoining Norfolk sand.

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

Mechanical analyses of Wickham fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
233213.....	Soil.....	0.6	7.6	8.6	30.0	14.8	32.4	5.7
233214.....	Subsoil.....	0.4	2.1	3.6	20.9	10.9	31.8	30.1

CONGAREE SERIES.

The soils and subsoils of the Congaree series are brown to reddish brown, there being comparatively little change in texture, structure, and color from the surface downward. Occasionally grayish and yellowish mottling is encountered in the subsoil of the poorly drained areas. These soils are developed in the overflowed first bottoms of the streams of the Piedmont region and in similar positions in the Coastal Plain along streams issuing from the Piedmont. The material is derived from the soils of the Piedmont region, with some admixture of Appalachian material, and in the Coastal Plain a slight mingling of Coastal Plain material. In this county the Congaree series is represented by one type, the silt loam.

CONGAREE SILT LOAM.

The Congaree silt loam consists of a chocolate-brown or light-brown silt loam ranging in depth from 6 to 12 inches, underlain by a dark chocolate brown, compact, tough silt loam, which grades in some localities into a silty clay within the 3-foot section. Small scales of mica are usually present in both the soil and subsoil.

Included in the areas shown on the map as Congaree silt loam are numerous spots of Congaree fine sandy loam too small to be shown separately.

The Congaree silt loam is developed in the first bottoms along the Cape Fear River, where it occurs as a continuous strip from a few rods to over a mile in width.

The surface is prevailingly flat, having only a gentle slope toward the river and in the direction of flow. The fine sandy loam spots included in this type usually occupy low ridges and knolls. The type as a whole is subject to overflow, and some portions of it are covered with water many times during the year. The higher ridges and knolls are safe from inundation except during the heaviest freshets.

Occasionally crops are successfully grown, but generally they are likely to be damaged or entirely destroyed.

The Congaree silt loam is one of the strongest soils in Bladen County. Corn and oats are the principal crops grown on this soil. Corn yields 25 to 50 bushels per acre without fertilization. Oats do well, but are cut and fed in the straw. Grasses flourish and furnish excellent pasturage for sheep and cattle. In order to secure a good sod it is necessary to remove the native forest, which consists principally of gum, cypress, and ash, with some pine, sycamore, oak, and hickory. In some places a thick growth of reeds is found. These also furnish good grazing for stock.

The Congaree silt loam is sold in conjunction with the adjoining types, and its value depends somewhat on them.

JOHNSTON SERIES.

The Johnston series comprises soils of black color and high organic-matter content, with gray or mottled gray, yellow, and brownish subsoils. These soils occupy the first bottoms of streams in the Coastal Plain region. They are alluvial in origin and subject to overflow. The material is derived from the Coastal Plain soils, with a varying admixture of material from the soils of other provinces. Near the Piedmont boundary the component material is largely from the Piedmont soils. The Johnston series is represented in Bladen County by one type, the silt loam.

JOHNSTON SILT LOAM.

The surface soil of the Johnston silt loam consists of a black silty loam or loam ranging in depth from 8 to 24 inches. The subsoil is pre-vaillingly a bluish-drab or gray, sticky, heavy silty clay. Along some of the smaller streams and ditches a black silt loam, loam or sandy loam extends to a depth of 3 feet, and in a few localities along South River the subsoil shows considerable mottling with red. The type contains a relatively large proportion of organic matter. Generally it has a mellow structure, and is easily tilled and naturally productive.

This type is confined to the first bottoms along streams throughout the county. The largest area occurs as a strip fringing the swampy areas along Brown Marsh and Elkton Swamps. Numerous areas of considerable extent are found along South River.

The surface of the Johnston silt loam lies only a few feet above the normal water level of the streams and is subject to frequent overflows. The subsoil of the greater proportion of the type is saturated with water throughout the year. Only a few of the narrow strips bordering the small streams and ditches have been sufficiently drained

for crop production. However, all bodies of this type can be reclaimed by deepening and straightening natural drainage ways.

The Johnston silt loam supports a heavy forest of hickory, white oak, post oak, ironwood, gum, and elm. Corn is the principal crop and the yields range from 20 to 50 bushels per acre. The soil is naturally rich in nitrogen and responds readily to liberal applications of lime, potash, and phosphoric acid.

MISCELLANEOUS MATERIAL.

SWAMP.

Swamp includes areas either in a saturated condition or covered with water the greater part of the year. The soil material is variable in texture, structure, and color, and under existing conditions no type differentiation is practicable. The material ranges in texture from a sand or sandy loam through a loam to a silty clay, depending largely upon the character of the adjoining upland soils. The surface soil for a few inches and in some places to a depth of 3 feet is prevailingly black in color, large quantities of vegetable matter being present. The underlying material is either gray, drab, or brown and is frequently heavier in texture than the surface portion.

Bodies and narrow strips of Swamp occur throughout the county. The longest, widest, and most continuous areas are located along Colly Creek, Brown Marsh Swamp, Goodman Swamp, and Harrisons and Turnbull Creeks.

By constructing a system of canals and open ditches practically all of the Swamp could probably be drained and put in condition suitable for farming. The soils are naturally productive, and especially desirable for corn.

The forest growth on Swamp consists of gum, cypress, maple, ash, oak, hickory, and a few pines. There is invariably a dense undergrowth of briers, bay bushes, and various other water-loving shrubs.

SUMMARY.

Bladen County, situated in the southeastern part of North Carolina, has an area of 847 square miles. The topography ranges from level to undulating and gently rolling. The country to the west of the Cape Fear River is more favorable for agriculture than that portion of the county lying between Cape Fear and South Rivers. The latter region comprises numerous lakes and broad expanses of level and poorly drained lands.

All parts of the county are adequately watered. Much of the land possesses good natural drainage, and large areas, as yet undeveloped, can be drained by open ditches.

The county as a whole does not have adequate transportation facilities. Two railroads and the rivers carry the commerce.

Occupation dates back to Colonial times. The county has no large towns and is not thickly settled. It could support many times the present population.

The mean annual temperature is about 61.5° F. and the mean annual precipitation about 50 inches. Good water from deep driven wells, and in a few cases from flowing wells, is available throughout the county.

Bladen County lies in the Coastal Plain province, and the soils have been formed from the unconsolidated deposits of sands and clays. Twenty-two soil types and two phases, in addition to Swamp, were recognized and mapped.

The soils of Bladen County offer good opportunities for both general and specialized farming. The Hyde loam is preeminently a corn soil. The Norfolk types cover the largest area, and are the most important soils in the county. These and the Ruston soils are suited to a wide range of crops. The lighter soils can be used advantageously for the production of early truck crops. Strawberries do well on the Coxville soils and the Portsmouth sandy loam.

The surface features and generally mellow nature of the soils favor the use of labor-saving machinery. The soils usually are deficient in organic-matter content and fertilization is common, especially with cotton.



[PUBLIC RESOLUTION—No. 9.]

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

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

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

Approved, March 14, 1904.

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

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