

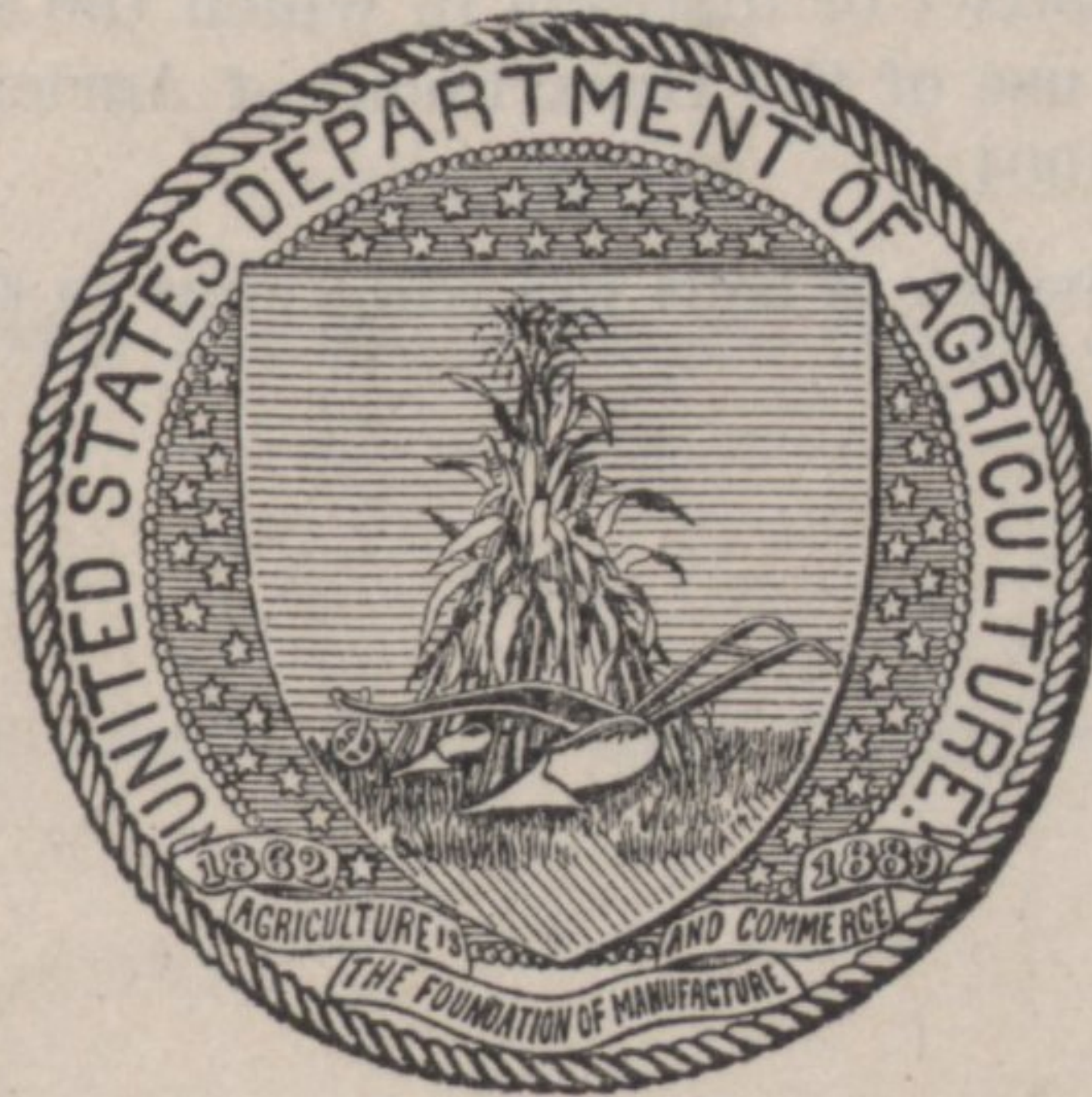
U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS—MILTON WHITNEY, Chief.

SOIL SURVEY OF DUPLIN COUNTY,
NORTH CAROLINA.

BY

ALDERT S. ROOT AND LEWIS A. HURST.

[Advance Sheets—Field Operations of the Bureau of Soils, 1905.]



WASHINGTON:
GOVERNMENT PRINTING OFFICE.

1905. COLLEGE

[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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MAP.

Soil map, Duplin County sheet, North Carolina.

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SOIL SURVEY OF DUPLIN COUNTY, NORTH CAROLINA.

By ALDERT S. ROOT and LEWIS A. HURST.

LOCATION AND BOUNDARIES OF THE AREA.

Duplin County, located in the eastern part of North Carolina, comprises an area of 527,488 acres, or about 824 square miles. It has for its immediate northern boundary Wayne County; Lenoir and Jones lie to the northeast; Onslow directly east; and Pender and Sampson on the south and west, respectively. The boundaries of the area are all imaginary lines, except where the Northeast River separates Duplin and Wayne for about 10 miles distance, and on the south, where Rockfish and Doctors creeks mark the line for a few miles. There are no large towns in the area, Warsaw, the



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

largest, having a population of 576 in 1900. Kenansville, the county seat, is located in the west-central part of the area and is 7 miles distant from Magnolia and 8 miles from Warsaw, the two nearest railroad stations. The population of the entire county is 22,405.

HISTORY OF SETTLEMENT AND AGRICULTURAL DEVELOPMENT.

Duplin County, N. C., was established from a part of New Hanover County during the legislative session of 1749-1750, and originally comprised what is now Duplin and Sampson counties, maintaining these boundaries until about 1784, when Sampson was established.

The first settlement of this section was made about 1737 upon a grant of about 70,000 acres of land, lying largely between the Black and Northeast rivers. From the beginning the settlements were very widely scattered, though chiefly along the streams, as there were no railroad facilities at that time. A very old settlement, which was one of the first in this territory, was at Sarecta, on the Northeast River, about 8 miles east of Kenansville. Another equally as old, if not older, settlement was at the present site of Kenansville, which is now near the center of Duplin County. This was the center of the early settlements of the county and is marked now by the old Routledge graveyard, which is about 1 mile east of Kenansville. At this place there was established by the legislature in 1785 the Grove Academy, which was one of the earliest institutions of learning in eastern North Carolina, and continued to be one of the leading schools until after the civil war. In the northwestern part of the county, on Goshen Swamp, near the present town of Faison, there was established another considerable settlement which began as early as 1740, and Presbyterian missionaries were there as early as 1742. Just west of the Wilmington and Weldon Railroad, near the present town of Warsaw, there was also a strong settlement, which became the county seat of Duplin County before Sampson was cut off from it. These and many other settlements were so scattered throughout the county that the different sections made about the same progress.

The original industries of the county were largely agriculture and stock raising, and the first settlers obtained their support chiefly from this source. The entire section was once covered with forest, largely longleaf pine, and later much attention was given to the manufacture of tar and turpentine, and for more than fifty years this industry was the chief source of income, continuing to be so until about 1890, when the resources of the longleaf pine forests became almost exhausted. In addition to the manufacture of naval stores, the business of cutting timber and floating it in rafts down the Northeast River to Wilmington, where it was marketed, was also extensively engaged in. This industry has likewise almost ceased, on account of the fact that the timber supply has either been exhausted or has been purchased by lumber companies.

Owing to the changed condition in the turpentine and timber interests, the entire attention of the people of Duplin, about 1890, began to be directed toward agriculture. Since that time there has been a most wonderful development along the Wilmington and Weldon Railroad, which was built between 1830 and 1836, where there has grown up a great trucking interest, which has caused this section to become widely known. The chief product is the strawberry, though Irish

potatoes, cantaloupes, watermelons, and various other products are grown in abundance.

Magnolia for fifteen years has had the largest tuberoses industry in the world. Hundreds of acres of tuberoses and other bulb plants are cultivated annually in various parts of the county, and the bulbs are shipped to the northern and foreign markets.

During the last ten years tobacco has been grown in all sections of the county, but most abundantly east of the Northeast River. This was the first section of the county to grow it to any extent, but it is seriously handicapped by the long distance to any railroad.

This section has also become an important cotton-growing section, and to-day there are thousands of acres cultivated in tobacco and cotton which only fifteen years ago were covered with pine forests, valued mainly for turpentine.

If during the next fifty years the development of the agricultural interests shall continue as it has during the last fifteen, Duplin County will be one of the most prosperous agricultural sections of the country, the people being almost exclusively occupied in some kind of agriculture.

CLIMATE.

The following table, compiled from records of the Weather Bureau, gives the normal monthly and annual temperature and precipitation, respectively, at Sloan, which is located in the southern part of Duplin County, and at Goldsboro, about 17 miles north of Faisons. These observations will suffice to represent fairly accurately the conditions for the whole area.

Normal monthly and annual temperature and precipitation.

Month.	Sloan.		Goldsboro.		Month.	Sloan.		Goldsboro.	
	Tem- pera- ture.	Precipi- tation.	Tem- pera- ture.	Precipi- tation.		Tem- pera- ture.	Precipi- tation.	Tem- pera- ture.	Precipi- tation.
	°F.	Inches.	°F.	Inches.		°F.	Inches.	°F.	Inches.
January	44.8	3.31	42.6	3.06	August	78.1	7.45	78.3	7.27
February	44.5	4.41	47.3	3.42	September	73.8	3.37	72.8	4.80
March	53.4	4.06	52.0	4.77	October	61.2	4.90	61.6	3.20
April	61.2	3.51	60.6	4.76	November	54.0	2.89	51.9	2.40
May	70.0	4.09	69.6	4.99	December	46.5	3.15	44.4	3.63
June	76.0	4.88	77.2	5.18	Year	61.7	52.17	61.5	53.56
July	77.1	6.15	79.8	6.08					

The highest mean temperature in the last year (1904) was 100°, on August 27, and the lowest was 14°, on November 28. The dates of the last killing frost in spring and the first in fall, covering a period of eight years, are shown in tabular form below:

Dates of first and last killing frosts.

Year.	Sloan.		Goldsboro.	
	Last in spring.	First in fall.	Last in spring.	First in fall.
1896	Apr. 5	Oct. 19		Oct. 19
1897	Apr. 21	Nov. 12		
1898	Apr. 8	Nov. 21		Nov. 20
1899	Apr. 6	Nov. 7		
1900	Apr. 5	Nov. 10	Apr. 6	Nov. 10
1901	Mar. 7	Nov. 7	Mar. 17	Nov. 7
1902	Apr. 2	Dec. 6	Apr. 2	Nov. 28
1903	Apr. 5	Oct. 27	Apr. 5	Oct. 27
Average	Apr. 4	Nov. 10	Mar. 31	Nov. 8

There is some variation in climate within the area. Strawberries are shipped about a day earlier for every 10 or 15 miles traveled southward. The prevailing winds are, generally speaking, from the southwest in summer and from the northwest in winter. Fogs are more prevalent in the fall of the year. Light snow falls nearly every winter, sometimes only a trace, but it rarely remains for more than a day or two. The area is one of high relative humidity.

PHYSIOGRAPHY AND GEOLOGY.

There is a gradual fall in the surface of Duplin County from north to south. The topography of the northern part is undulating and rolling, passing gradually with advance toward the south and east into a more level plain, with relatively poor drainage conditions. A more concise idea of the elevations of the county can be had by noting the height above sea level of the following points along the Atlantic Coast Line Railroad, which will show a section of the most elevated portion: Faison, 159 feet; Warsaw, 155 feet; Magnolia, 140 feet; and Wallace, 54 feet.

The relation of topography to the character of soils is evident even to the untrained eye; in fact, the surface conditions, particularly as affecting drainage, are the important factor in the separation of the types into the two distinct series of soils found within the area. The many high divides in the county and the rolling and well-drained uplands adjacent to stream valleys are occupied by the Norfolk series, and the broad expanse of low, wet lands, occurring most extensively on the almost level plain referred to, are made up of soils of the Portsmouth series and the numerous savannas, pocosons, and swamps which form an important part of this section.

The Northeast Cape Fear River, following a general north-and-south direction, affords drainage for the entire county, except where the high watershed between Warsaw and Kenansville directs Stewarts Creek and a few of its tributaries to the westward into Sampson County. Goshen Swamp, a stream of about the same magnitude, removes the surplus of water from the entire northeast corner of the county. This stream is flanked by a swamp covered with a dense growth of cypress and gum, and varying in width from one-fourth mile, where it enters the county, to a mile at its confluence with the Northeast River. A network of smaller streams interlaces the area. Almost always they have their sources in bodies of the Portsmouth soils or in the pocosons.

The largest of the streams have noticeable terraces, low and rather ill-defined, and the soils in many cases irregularly follow their contours. In the flood plains of many of these, especially east of the Northeast River, there occur valuable deposits of marl at a depth of 2 to 4 feet, the largest beds probably being found along Muddy Creek. This is extensively utilized as a soil improver upon the low, poorly drained lands.

The geological origin of all the soil types in the county is the same. The area, occurring in the Atlantic Coastal Plain, owes its formation to marine deposition of materials transported from the Piedmont Plateau and Appalachian Mountains. Since this deposition and the elevation of this region above sea level much of the soil has been modified by wet, swampy conditions.

SOILS.

Two general series of soils exist within the area—those which occupy the well-drained uplands, namely, the Norfolk fine sandy loam, Orangeburg fine sandy loam, and Norfolk fine sand, and those which are found in low, depressed areas, giving rise to the Portsmouth fine sandy loam, Portsmouth sand, Portsmouth loam, and Swamp. All of these types have been correlated with soils mapped in other areas and all are characteristic soils of the Atlantic seaboard.

The extent of these several soils is shown in the following table, the relative percentage of each to the total area of the county also being given.

Areas of different soils.

Soil type.	Acres.	Per cent.	Soil type.	Acres.	Per cent.
Norfolk fine sandy loam	180,032	34.2	Portsmouth loam	8,448	1.6
Norfolk fine sand	117,440	22.2	Orangeburg fine sandy loam	7,616	1.5
Swamp	109,824	20.8	Total	527,488	
Portsmouth fine sandy loam	66,112	12.5			
Portsmouth sand	38,016	7.2			

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NORFOLK FINE SANDY LOAM.

The Norfolk fine sandy loam covers a greater acreage than any other soil type in Duplin county, comprising 180,032 acres, or 34.2 per cent of the entire county. A large proportion of it is as yet undeveloped, though the earliest of the settlements were made upon it. Two distinct phases of the type are presented in this area, one differing from the other to such extent as to justify separate discussions.

The greater part of the type in Duplin county, however, consists of a loose gray fine loamy sand, grading into yellow sandy clay at any depth between 12 and 36 inches, usually at 20 inches. Where the soil occurs in slightly depressed and low, level, but well-drained areas it is more compact, has larger water capacity, more organic matter, and the soil grains appear more rounded; but in areas where the sand is deeper than 20 inches the soil, owing to its loose structure, suffers often from drought.

There are only a few parts of the county where the Norfolk fine sandy loam does not occur. The largest unbroken body is found north and east of Bowdens. The greater part of the type occupies undulating and gently rolling areas, and the natural drainage conditions are such that but a small proportion requires ditching, even to remove the surplus water. The soil is of sedimentary origin, the particles constituting it having been transported from other regions and deposited in shallow water.

The Norfolk fine sandy loam is adapted to a diversity of crops, but at present much of the type is devoted to corn, cotton, and tobacco. The production of cantaloupes and lettuce is becoming more important in the area, and these are grown almost altogether upon this soil. Tobacco is grown more extensively and with better results than upon any of the other soil types, the leaf obtained being of the desired color and texture and the average yield about 700 pounds per acre. Potatoes yield at the rate of 30 barrels per acre, cotton one-third to one-half bale, and corn 10 to 20 bushels. The cowpea should be more extensively cultivated on account of its qualities as a fertilizer and for the purpose of adding organic matter to the soil.

The other phase of the Norfolk fine sandy loam, of which some detailed description should be given, possesses characteristics easily distinguishable from the main part of the type in this area. The surface few inches of soil is a fine sandy loam, varying in color from almost black to yellowish brown proportionately as the organic matter is greater or less. Underlying this and at a depth of from 12 to 20 inches is a light-yellow fine sandy loam, becoming heavier with increase in silty material, beneath which rests a sticky, plastic yellow clay, extending to 3 feet or more. At greater depths beds of sand and clay occur in alternate strata.

This phase of the type occupies level or almost level areas, but with sufficient elevation for streams to carry off the surplus water and open ditches to complete the drainage. When properly ditched there is no fear of excessive moisture, and plowing can take place a few hours after a heavy rain. The most extensive occurrence of this phase of the Norfolk fine sandy loam is found just north of Goshen Swamp, around the town of Calypso; an irregular body of considerable size also occurs about Warsaw, where it frequently alternates with the Portsmouth fine sandy loam, and west of the town of Teachey's is a tract occupying a broad divide in the vicinity of Beulaville.

On account of its natural fertility, its relative great power of retaining fertilizers, its naturally moist condition, which guards against drought, and the great diversity of crops to which it is adapted, this phase of the Norfolk fine sandy loam is regarded as the most valuable soil in the area. Besides the crops heretofore enumerated, to which the Norfolk fine sandy loam is well adapted, this phase of the type has been found well suited to the cultivation of strawberries and has given the best results with this crop of any of the soils in the county. The strawberry plant, flourishing best in a moist habitat, finds an ideal condition for its growth and propagation upon this soil, and very satisfactory yields, both in quality and quantity, are obtained. When properly fertilized an average yield of 100 crates per acre is secured. Beans, cabbage, cucumbers, peppers, and other small truck crops would do well. The yields of Irish potatoes, corn, and cotton are much higher on this phase than on the main part of the type. The average per acre for potatoes is about 50 barrels; for corn, 20 to 25 bushels, and for cotton, three-fourths of a bale.

The most valuable timber growth in the county is seen upon the Norfolk fine sandy loam, and consists of shortleaf pine, scrub oak, and persimmon.

The following table gives the results of mechanical analyses of soil and subsoil of this type. The figures represent the average of separate determinations on four samples each of the soil and the subsoil.

Mechanical analyses of Norfolk fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.
12580, 12582, 12586, 12590.....	Soil.....	0.1	2.3	4.6	41.6	21.9	17.6	11.7
12581, 12591, 12583, 12587.....	Subsoil....	.1	3.7	5.8	31.8	16.6	15.4	26.3

D NORFOLK FINE SAND.

The Norfolk fine sand consists of 4 to 6 inches of a gray loose sand a little darker than the subsoil, which to a depth of 36 inches is a yellow or white sand. The slight proportion of organic matter accounts for the darker color in the first few inches of the surface soil. The sand in both soil and subsoil is of medium to fine grade and markedly lacks coherence. At 36 inches or deeper a yellow sandy clay is to be found, the same that occurs as the subsoil of the Norfolk fine sandy loam, the chief difference between these two types being in the depth of the superficial mantle of sand. A finer phase of this type is found in a few local spots, notably 3 miles northwest of Warsaw and a few acres along Rockfish and Muddy creeks, but occurring only as patches of limited extent they could not be shown on a map of the scale used in this survey.

The Norfolk fine sand comprises 117,440 acres, or 22.2 per cent of the entire area of the county, and is second in extent only to the Norfolk fine sandy loam. It is found in all parts of the county, in general following the trend of stream and river courses and widening out in certain sections to form high rolling divides with gentle slopes. The largest bodies are to be found west and northeast of Magnolia, west of Kenansville, and forming the major portion of the high watershed between the Northeast River and Goshen Swamp. Also large tracts are to be encountered in the extreme northeastern corner of the county. The topographic features of the area covered by it are distinctly marked. It occupies the undulating and gently rolling uplands, having a good fall, and this, combined with its loose, porous nature, guarantees perfect drainage, so that even after the heaviest rains cultivation can be undertaken within an hour or two.

Much of the Norfolk fine sand type is deforested of the longleaf pine which once flourished upon it, but on account of its low agricultural value only a small proportion is farmed. On account of the leaching which takes place as a result of the porosity of the soil, it is necessary to use large quantities of fertilizer to obtain good results. When properly handled the soil can be made to grow light truck crops, and is especially adapted to watermelons, which are cultivated in a limited way. Corn, cotton, and tobacco are the principal crops produced at present. Peanuts, for fattening hogs, are grown on many of the farms. The quality of the tobacco is very good, the leaf having the desired light color and fine texture. Tobacco yields an average of 650 to 700 pounds per acre, corn 10 bushels, and cotton one-third bale.

The most economical means of handling this soil is in the cultivation of cowpeas, which flourish particularly well upon it. By turn-

ing both roots and vines under and allowing them to decay, beneficial results will be obtained, both through the addition of needed organic matter and in giving more body to the soil. The application of lime will also tend to make the loose sand grains cohere and thus improve the texture.

Mechanical analyses of samples of the Norfolk fine sand are given in the following table, the figures representing the average of determinations for two samples each of the soil and the subsoil.

Mechanical analyses of Norfolk fine sand.

Number.	Description.	Fine gravel	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.
12592, 12596.....	Soil.....	0.6	9.6	11.2	62.0	9.8	2.9	3.8
12593, 12597.....	Subsoil.....	.5	10.4	12.2	60.8	9.2	2.7	4.2

D ORANGEBURG FINE SANDY LOAM.

The Orangeburg fine sandy loam, on account of its limited representation in the county, requires but a brief discussion. The surface soil is a medium to fine brown or gray sandy loam, grading at 12 to 20 inches into a sticky pasty red sandy clay. Its agricultural value is about the same as the Norfolk fine sandy loam, and, except for the properties of the subsoil, it does not materially differ and could not be differentiated from that type. The difference in the subsoils, which is mainly one of color, is believed to be due to a difference in the state of the iron contained in them, that in the Orangeburg fine sandy loam being in a more advanced stage of oxidization.

The type occurs in all cases adjacent to stream and river courses, the widest areas being found along Goshen Swamp for 8 or 10 miles after it enters the county. The drainage features are in all cases good, occupying as it does the rolling uplands along waterways.

The soil particles forming the Orangeburg sandy loam have been transported from the region to the northwest and deposited in water. In immediate proximity to stream beds gravelly areas frequently are to be seen, and irregular stratifications of these are in evidence in the subsoil in such cases.

Shortleaf pine and scrub oak constitute the chief timber growth. The largest part of this type, however, is cleared and under cultivation, and is in almost all cases used in the production of cotton and corn. Some tobacco is grown, but where the subsoil approaches the surface the leaf is darker in color, heavier in texture, and contains more woody fiber, and thus is inferior to the product on some other of the soils found here. Corn yields 12 to 25 bushels and cotton one-third to one-half bale per acre.

The average results of mechanical analyses of two samples each of the soil and subsoil of this type are shown in the following table:

Mechanical analyses of Orangeburg fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Me- dium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.
12598, 12600.....	Soil.....	0.8	7.9	7.9	43.6	19.1	12.0	8.2
12601, 12599.....	Subsoil....	.5	6.4	6.9	35.8	14.0	9.7	26.7

PORTSMOUTH FINE SANDY LOAM.

The surface soil of the Portsmouth fine sandy loam, to a depth of from 6 to 8 inches, consists of a black to gray fine sandy loam, in places having the properties of a loam on account of the large proportion of organic matter which it contains. Occupying a lower position than the adjacent soils, the finer grades of sand have been largely transported and deposited in this type, and as a result the sand content is chiefly of the finer grades. Underlying the soil and extending to a depth of 24 inches, a wet, sticky, sandy loam or sandy clay is encountered, gray in color, and somewhat coarser in the grade of sand. At 36 inches the soil is usually in a saturated condition.

Occasionally ferruginous crusts are found in local spots at a depth of 12 to 24 inches, and blue marl at a depth of 3½ to 4 feet.

The Portsmouth fine sandy loam is found generally distributed throughout the county in tracts varying from a few acres to several square miles in extent. In these larger bodies ridges of the Norfolk fine sandy loam and Norfolk fine sand frequently occur, so that a large irregular though connected body of the Portsmouth fine sandy loam is shaped. A dense growth of gall bushes, with scattering gums, bays, and shortleaf pine, constitutes the timber growth.

Since the subsoil of the Portsmouth fine sandy loam is quite impermeable, and the mean fall toward the ocean is not much more than a foot to the mile, and as the type occupies depressed areas, it would be natural to expect the prevailing poorly drained and water-logged conditions. This is the main feature distinguishing this and the other soils of the Portsmouth series from those of the Norfolk series, as both are essentially the same in their origin, having been laid down in water at a time when this section was experiencing a series of inundations. In the case of the former series, since their deposition the materials have been modified by standing water and swamp conditions, and the processes of aeration and oxidation, which are essential for the preparation of the soil for most crops, have been almost entirely wanting. Thorough drainage alone can remedy this, but

when it is supplied large tracts can be reclaimed from their present wet conditions and converted into soils of remarkable productiveness. The application of lime on such soils has also been recommended, both to correct acidity and to render the soil particles less cohesive, thus assisting the downward passage of water.

Certain varieties of strawberries thrive best upon this soil when drained, and, with the exception of the acreage devoted to these, but little of the Portsmouth fine sandy loam is now utilized for agricultural purposes. Tuberoses, dahlias, and cannas give good results. Strawberries yield an average of 100 crates per acre; tuberoses, 20,000 bulbs; dahlias, 8,000 (with 4,000 reserved for the next season's planting), and cannas, 20,000. These yields are secured only when fertilizers are used. The liability of the Portsmouth fine sandy loam to bake in dry seasons makes the Norfolk fine sandy loam the more desirable type for the production of strawberries. On the other hand, excellent results have attended the cultivation of cabbage, onions, spinach, etc., upon the Portsmouth fine sandy loam, when adequately drained, in other localities where the climatic conditions are practically the same as in Duplin County.

The average results of mechanical analyses of two samples each of the soil and subsoil of the Portsmouth fine sandy loam are shown in the following table:

Mechanical analyses of Portsmouth fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Me- dium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.
12606, 12608.....	Soil.....	0.2	3.9	5.7	55.4	11.3	10.9	12.2
12609, 12607.....	Subsoil....	.3	5.3	7.5	47.5	10.2	8.4	20.3

PORTSMOUTH SAND.

The Portsmouth sand has for its surface soil a black or brown sand 6 to 12 inches in depth and containing so much organic matter that in cases it has the properties of a sandy loam, or even loam. The sand is quite uniformly of medium texture. The character of the subsoil depends somewhat upon the position of the areas and the extent to which they have been subjected to wet conditions. In the lower depressions the proportion of organic matter in the soil is apt to be greater, and here the resultant acids have permeated the subsoil, imparting a dark-gray or drab color to the wet sand, while in cases the subsoil consists of a mottled white or light-gray sand. The sand of the subsoil varies from fine to coarse grades, or about the same as in the soil. At 24 to 36 inches the characterizing feature of the type occurs—a white sand, very impervious in character—and at this depth the maximum water content is generally reached.

The growth which always characterizes this type consists of gall bushes, and very frequently huckleberry bushes, bay, and longleaf pine, the latter occurring on the higher and drier areas of the type.

The most extensive bodies of Portsmouth sand are to be seen east of the Northeast River, where areas of several square miles occur in one continuous body. It is largely found around the sources of the many streams which constitute the drainage system of the county. Its occurrence is confined to depressed areas with deficient drainage. There is but little of this type that can not be ultimately reclaimed, should there be occasion for turning it into agricultural use, by ditching to the heads of the numerous streams which originate in it, and thus lowering the water table. At the present time, however, its reclamation would not warrant the outlay.

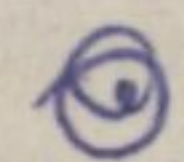
As in the case of the other soils of the area, the Portsmouth sand is sedimentary, having been deposited in water and subsequently elevated and modified by swamp conditions. It is unusually well adapted to the production of tuberose, dahlias, and cannas, and fairly well suited to strawberries where adequate drainage is assured and the soil possesses a large amount of nitrogenous matter.

With the application of fertilizers the average yield of the bulb plants are 20,000 tuberose bulbs, 20,000 cannas, and 8,000 dahlias. The area cultivated for other crops is restricted. A few acres of corn and cotton are cultivated upon it. The growing of onions, cabbage, and other late truck crops have been attended with success in other localities.

The results of mechanical analyses of the Portsmouth sand are shown in the following table, the figures representing the average of determinations for two samples each of the soil and the subsoil:

Mechanical analyses of Portsmouth sand.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>
12614, 12612	Soil	0.1	8.7	18.1	59.4	4.4	3.7	5.4
12615, 12613	Subsoil	.2	8.6	18.4	59.4	4.4	3.5	5.1

 PORTSMOUTH LOAM.

The Portsmouth loam has a very limited representation in Duplin County. In origin, in many of its properties, and in the position it occupies it bears a close relation to the Portsmouth fine sandy loam, but it differs from the latter in having a heavier texture, representing areas where the subsoil approaches nearer the surface than it does in the case of that soil. The surface soil consists of a heavy sandy

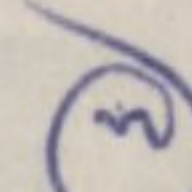
loam, fine sandy loam, or loam from 4 to 6 inches deep, which contains large stores of organic matter and grades into a gray sandy clay, plastic and wet, at 10 to 12 inches. This is sometimes underlain by the stratum of white impervious sand which often characterizes the soils of the Portsmouth series, this material usually being encountered at depths of 2 to 3 feet. The soil is generally saturated at about this depth also, though the conditions as to moisture vary somewhat with the seasons.

The Portsmouth loam occurs most largely in bodies of the Norfolk fine sandy loam, the bodies of largest extent in the county being found north of Calypso and between Rosehill and Teachays, where it occupies low, level, and poorly drained areas. Though deposited in water at the same time and in the same manner as the other soil types of the area, it, like the Portsmouth sand and Portsmouth fine sandy loam, has been subject to wet conditions for many years, so that a different nature and agricultural value has been imparted to it. It supports a growth of gallberry and huckleberry bushes, pine, and, where especially wet, gum and cypress. But a few acres are under cultivation, corn, cotton, and strawberries being the crops grown. When properly ditched it would prove an especially valuable soil for the production of corn, cabbage, and forage crops.

The average results of mechanical analyses of two samples each of the soil and the subsoil of the Portsmouth loam are given in the following table:

Mechanical analyses of Portsmouth loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>
12602, 12604	Soil	0.2	0.9	1.3	31.6	17.3	26.1	22.2
12605, 12603	Subsoil	.1	.7	1.1	28.5	17.3	23.8	28.2

 SWAMP.

All of those areas which are subject to overflow or are in such a wet condition that they are of no agricultural value until reclaimed have been classified as Swamp, whether they occur along the streams or as level undrained tracts upon the upland. The soil in different parts of the Swamp areas varies much in character, but since it is almost impossible to penetrate many of these a separation into the various types is impracticable.

The soil in the bottom lands along stream courses is composed of alluvial deposits of a heterogeneous nature, varying in texture from a loose unproductive sand to rich heavy black loam. Much of it along

the Northeast River is subject to overflow once only in every few years, and many areas are under cultivation, the heavier "mud lands" producing large yields of corn, frequently as much as 60 bushels per acre, and sometimes commanding a price of over \$100 per acre. Goshen Swamp, the largest affluent of the Northeast River in the county, has bordering it a perennially saturated strip of land one-fourth to 1 mile wide, possessing but little fall to the bed of the stream and covered by a dense and valuable growth of cypress and gum. The margins of the smaller stream courses are, as a rule, of much the same character as this, though adjacent to many are found very fertile and cultivable strips of a character similar to the "mud lands" of the river. Bays, juniper, gallberry bushes, and huckleberry bushes are characteristic growths, as well as cypress and gum.

The other phase of Swamp is represented by the various savannas and pocosons which occur frequently in certain parts of the county. In the southern part of the county, and lying directly in the large bend of the Northeast River as it changes its course toward the southeast, is the Angola Bay Pocoson, about 15 square miles of which are in Duplin County. With the exception of Gum Swamp, which lies within this pocoson and includes 3,000 or 4,000 acres, the soil consists largely of a wet, somewhat mucky loam or sandy loam filled with roots and fibers and underlain by a sticky sand or sandy loam. A rank, almost impenetrable growth of underbrush, together with a good growth of pine, characterizes this area.

The depth of the water table varies with the time of year. For weeks at a time this great basin is subject to standing water, but in dry seasons the soil is saturated at 2 to 3 feet. Gum Swamp, passing in a northwest and southeast direction through the pocoson, has a heavier soil in the form of the locally called "mud lands," described above. Work has been done toward reclaiming this section of the bay by private enterprises. Only a few acres have thus far been reclaimed, but they yield excellent crops of corn.

The description of the soils of the Angola Bay proper will apply to the other smaller ones in the county, except in certain sections of the Kenan Pocoson (the second most extensive of these bodies in the area), where the soil is similar to that found in Gum Swamp.

The elevation of the floor of the Angola Pocoson has been found to be something like 30 feet, and this relatively low position, together with the underlying impervious sand, gives rise to the deficient drainage features. Most of these pocosons can be ultimately reclaimed should there be created a demand for more land to cultivate.

The timber, especially the pine, upon many of the swamp areas is very valuable.

AGRICULTURAL METHODS.

In growing the general farm crops the methods employed are not different from those in use throughout the South, and it is not deemed necessary to discuss them in detail here. More interest attaches to the several special crops that have added greatly to the wealth and prosperity of Duplin County.

Of chief importance is the strawberry, the production of which has shown remarkable development in recent years. In growing this crop the Norfolk fine sandy loam, the Portsmouth fine sandy loam, and the Portsmouth sand are the preferred soils, the first mentioned being considered the best. The plants are usually set out in July and August in rows about 3 feet apart and at an interval in the row of 14 to 18 inches. Flat cultivation is the rule, but in wet areas, usually on the Portsmouth soils, the plants are sometimes set upon ridges. Fertilizers are very generally used, in amounts varying from 300 to 2,000 pounds per acre. Two applications are usually made—one in the fall, which is worked into the soil along the sides of the rows, and one about the middle of January, along the top of the row. No protection from the winter frosts is necessary, but in the early spring, when the buds are putting forth, a pine-straw mulch is raked over the vines whenever frost seems likely to occur. This straw is allowed to remain between the rows during the picking season to keep the berries clean. After the third season the vines are plowed up, and the land is allowed to remain idle or is used for other crops for a year or two before again rebedding it to strawberries.

A plan adopted by some growers is to plant strawberries in rows sufficiently wide apart to allow the cultivation of some intermediary truck crop—such, for instance, as beans or potatoes—but this system is looked upon with disfavor by the majority of berry growers, who say that the yield and quality of the berries are impaired by such practice.

The strawberry vines have recently been attacked by a pest, the strawberry beetle, and unless checked this may prove a serious drawback to the industry. The North Carolina experiment station has suggested a remedy, and the growers should lose no time in applying it.

For the last few years the production of early lettuce has been an important special interest, and the acreage is yearly increasing. The young plants are set in beds and during the winter are protected by cheese cloth.

Another special industry which has grown up within the last fifteen years and which has attracted attention both in this county and abroad is the production of tuberose, caladium, dahlia, and gladiolus bulbs. Wet, overflowed lands, or pocoson, is best adapted to their production, and it is a remarkable fact that even upon this rich,

naturally productive soil only two good crops can be grown, even though the fields be allowed to stand idle for several seasons and no matter what or how much commercial fertilizer or organic manures be applied to the soil. In the case of the two crops, the second is said never to be as good as the first. The bulbs are planted about March 15 and gathered in October and November. Thorough cultivation is absolutely necessary to obtain the best results, and during the period from May to August, when the growth of weeds is most rapid, the field should be cultivated at least once a week. Three applications of fertilizer are made at intervals during the winter. Generally this is home mixed, and composed of muriate of potash, cotton-seed meal, and acid phosphate. The quantities applied vary with the soil and the bulb grown, ranging from 500 to 1,000 pounds per acre for the tuberose, 400 to 500 pounds for the dahlia, from 200 to 2,000 for the caladium, and from 1,500 to 2,000 pounds for the canna.

In general there is little attention paid to the question of rotation of crops by the farmers of Duplin County. Those who do follow a definite system say that they derive as much benefit from this practice and subsoiling as from the fertilizers they use. The value of the leguminous crops, especially the cowpea, as a fertilizing agent is by no means generally recognized. These three matters, the rotation of crops, deeper plowing, and the use of the cowpea or other legume for manurial purposes, can not be too urgently called to the attention of the farmers of this county.

AGRICULTURAL CONDITIONS.

The agricultural conditions in the eastern and western parts of the county are very different. In the latter there has been a transformation in the system of farming with the advent and development of the strawberry and trucking industries, but owing to the lack of transportation facilities in the eastern two-thirds of the county there has been no opportunity for a like advance, and the resources are but poorly developed, except in certain settlements, where the cultivation of cotton, corn, and tobacco engages the energies of the farming class. In the trucking districts there are indications of prosperity on all sides. New settlements, factories for the manufacture of berry boxes, new banks, and dwellings have sprung up within a comparatively few years and there has been substantial progress. The small initial capital required to start in market gardening, the reasonable terms upon which land can be bought near the railroad, the climate, and the wide range of crops to which the soils are adapted offer to the thrifty farmer with restricted means a remarkably good opportunity for success.

A large percentage of the farms in the trucking area are operated by the owners, though the tenant system prevails to a certain extent. The tenants, however, are thrifty and realize a good margin of profit from the year's work. In other parts of the county a much greater proportion of the farms is tenanted, accompanied by the lien system, and where these conditions exist the welfare of the farming class is less marked. The share system of rental is most common, the landowner furnishing the team, implements, and one-half the fertilizers, and the tenant the other half and the labor, an equal division of the net proceeds being made. In the case of berry production, the cost of picking, freightage, and fertilizers is deducted from the total amount realized.

The large estates acquired by the original settlers have generally remained intact, and many farms comprise several thousand acres. On the other hand, especially in the trucking belt, the farms are much smaller, ranging from 10 to 150 acres, and the average for the county at large is about 118 acres. One grower will rarely attempt to handle more than 30 or 40 acres when the land is to be utilized for trucking purposes. Plans for subdividing many of these large tracts into smaller ones and for encouraging immigration are being considered, and much of this land which has heretofore been valued too high or has been offered for public sale in tracts too large to allow the average farmer to purchase will probably be offered on the market in such shape and at such prices as to be available to the small farmer and truck grower. The holding of these tracts is especially noticeable in the vicinity of the small towns along the Atlantic Coast Line Railroad, and has been a serious factor in retarding the development of the county.

Ordinary farm labor grows scarcer with the distance from the railroads, but even in the most populous communities it often is not available. The laborers when paid by the day receive 75 cents to \$1, and for longer periods from \$10 to \$15 a month. As the pay for much of the work of gathering the berry and truck crops is better than can be paid in general farming, the truckers have less difficulty in obtaining help. In the strawberry season the adjoining counties are drawn upon to meet the demand for pickers, and men, women, and children take up a temporary abode in the county. They usually have furnished them transportation to and from the area and are paid at the rate of 1 cent for every quart of berries picked. A good hand can readily fill from 100 to 150 quart baskets a day. As the strawberry season declines the huckleberries begin to ripen, and the hands then direct their attention toward gathering these, which they pick at random throughout the county and sell to buyers, receiving 5 to 10 cents per quart.

Berries and truck, bulbs, tobacco, corn, and cotton are the principal agricultural products of the county. The several varieties of strawberries grown have been originated in this section, and are thus adapted to the climatic and soil conditions. The earliest are shipped by express to northern commission merchants and bring fancy prices, sometimes \$8 to \$10 a crate, but the price rapidly declines with the advancing season. About May 1 shipments in carload lots in cold storage begin, buyers representing northern and western commission merchants purchasing from producers. The advantage to be gained in having an early crop and in getting it to the platform at the earliest possible date, the keen rivalry between the growers, and the sharp competition among the buyers, all tend to lend a fascination to the industry, and the various platforms at the small towns along the railroad present a scene of unusual activity when the season is in full swing. The average price obtained the season through is about \$2 to \$2.25 a crate, and the net profit is 50 to 75 cents a crate.

The small town of Magnolia, the center of the bulb industry, has to its credit the largest output of tuberose bulbs of any place in the world, and has maintained this position for the past fifteen years. Ninety per cent of the product finds its way to foreign markets—Holland, France, England, and Germany being the principal purchasers. Caladium, dahlia, canna, and gladiolus bulbs are shipped in large quantities, but few of these are exported. One firm shipped over 1,800,000 bulbs of all kinds during the year 1904.

The greater part of the tobacco crop grown in Duplin County is produced east of the Northeast River. It is of the bright yellow variety and brings an average price of 9 cents a pound. Most of this output is shipped to the factories at Durham, N. C., where it is manufactured into several grades of smoking tobacco.

Irish and sweet potatoes produce well upon most of the soils of the area, but are cultivated chiefly for domestic needs. A few carloads are sent out of the county each season.

Little attention is given to fruit growing aside from the strawberry. A few orchards are scattered here and there throughout the area. The chief difficulty attending the production of tree fruits is said to lie in the unusually heavy precipitation to which the county is subjected, and production would have to be confined to the light sandy soils. The native Scuppernong grape, however, grows prolifically upon most of the soil types, and brings from 75 to 80 cents a bushel at local markets and frequently as much as \$1 a bushel at Wilmington, N. C. When better devices for shipping in good condition shall have been found, it is believed a most profitable industry will be developed.

Cantaloupes are grown upon the Norfolk fine sandy loam and Norfolk fine sand and find ready sale in northern markets, bringing good

prices. Watermelons are produced to a more limited extent and altogether for local markets.

The timbered lands of the county have long been drawn upon, and at the present rate of cutting it will not be long before the entire area is largely deforested. Valuable tracts of loblolly pine are still to be found in the eastern and northeastern sections of the county, and the numerous swamps, fringing watercourses, and the pocosons support a thick growth of gum and cypress. The several crate factories established in the county depend upon these sources for their raw material.

Stock raising plays no part in the local agriculture except as concerns the individual needs of the farmers. Certain sections are fenced in, and within these the stock is allowed to roam at large.

Transportation by rail is furnished by the Wilmington and Weldon branch of the Atlantic Coast Line Railroad, which traverses the western part of the county in a northwest and southeast direction. Two short lumber roads exist in the county, one leading northwest from Bowdens, and the other terminating near the small village of Resaca. A large part of the produce of the east half of the area is transported down the Northeast River to Wilmington, whence it is conveyed by boat to other markets. Cotton and spirits of turpentine are loaded on flatboats and allowed to drift with the current to their destination. The empty flats are towed back by tugs. One steamer plies between Chinquapin and Wilmington, but, owing to the shallow water at certain seasons of the year, it can only be used a part of the time.

The greatest drawback to the development of a great part of the county is the lack of railroads. Several roads have been proposed and surveyed, but as yet their construction has not been undertaken. The wagon roads of the county are sandy and are kept in a fair state of repair, though they could be much improved by surfacing with the clay which is usually available near at hand.

The cities in the north and west afford markets for all perishable truck, while Norfolk and Wilmington take the cotton for shipment to other localities. The tobacco finds its way to markets within the State, where most, if not all, of it is manufactured. These three classes of products form the money crops of the area.

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