

SOIL SURVEY OF SUSSEX COUNTY, DELAWARE.

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DESCRIPTION OF THE AREA.

Sussex County is the southernmost county in Delaware. The boundary separating it from Kent County on the north is formed in part by the Mispillion River. Its eastern boundary is formed by Delaware Bay, and the Atlantic Ocean, and its southern and western by the State of Maryland. Sussex County is the largest of the three counties composing the State and has a land area of 945 square miles, or 604,800 acres.

All of Sussex County lies in the physiographic province known as the Atlantic Coastal Plain. The county can be divided roughly into three divisions: The marsh areas along the Atlantic Ocean, Delaware Bay, and some of the larger streams; a region of low, poorly drained country in the southeastern and northwestern parts of the county; and a region of higher, more undulating, and better drained country covering the rest of the county.

The salt marshes are rather extensive along Delaware Bay and the Atlantic Ocean. They are usually separated from the ocean and bay by a sand bar which extends practically all the way along the coast of Sussex County, but is not as pronounced along Delaware Bay as along the ocean. The salt marshes lie almost at sea level. Some of them are covered with water constantly, but parts are flooded only at high tide. Most of the marshes are cut by meandering sloughs, stream channels, bays, and ponds. A strip of marsh varying in width from about one-fourth mile to over 4 miles extends along all the eastern coast of the county, with extensions reaching considerable distances up the streams emptying into the bay and ocean.

The low, flat country of the southeastern and northwestern parts of the county is conspicuous because of its poor drainage. There are a number of streams running through this land, but unless their channels are kept open and they are supplemented with lateral drainage ditches they are inadequate to carry the run-off. There are also a



FIG. 45.—Sketch map showing location of the Sussex County area, Delaware.

number of poorly drained depressions in this region. A relatively small section similar to these low flats lies just north of Georgetown.

The third division, comprising the more undulating and slightly higher sections of the county, forms the greater part of the county. The streams through it generally have sufficient fall to effect good drainage. The elevation of these higher lands ranges from about 30 to 60 feet above sea level.

The drainage of Sussex County flows both east and west. The eastern half is drained by streams flowing into Delaware Bay and the Atlantic Ocean, while the western part is tributary to the Chesapeake Bay drainage. Practically all the streams are sluggish and, with the exception of the larger ones, meandering. The county would be more poorly drained than it is but for the excellent under drainage afforded through the porous material which underlies all the soils.

The topography of the county is flat to gently rolling. In the poorly drained region there is very little relief, but where the territory is fairly well drained the topography is slightly undulating to gently rolling. There is no abrupt break where the uplands fall off into the marshes. A few small ridges, which give the surface a rather billowy appearance, are scattered through the county. In the vicinity of Lewes a sand dune about 60 feet high stands out rather prominently. No land, except perhaps a few slopes along the banks of streams, is too steep for efficient use of any type of farm implement.

The first settlement in the county was made by the Dutch near Lewes in 1631, but this settlement was afterwards wiped out by the Indians. Permanent settlements were established some years later by the English, Swedes, and Dutch. The population of the county increased gradually from 25,936 in 1850 to 46,413 in 1910. In 1920 the population was 42,741, of which 96.6 per cent was classed as rural. The population is fairly evenly distributed. There are very few foreign born, except in one or two of the necks in the eastern part, where some small settlements have been made by foreigners. The majority of the population consists of native born whites of English descent.

The most important towns, with their populations, are Bridgeville, with 945 inhabitants; Seaford, 2,141; Laurel, 2,253; Delmar, 780; Milford, 2,703 (that part in Sussex County, 1,409); Georgetown, 1,710; Lewes, 2,074; Milton, 898; and Selbyville, 462. There are a number of smaller villages and towns throughout the county, some of them off the railroads and along waterways and public highways, having been located there when streams and highways were the only means of transportation.

Sussex County is well supplied with transportation facilities. The New York, Philadelphia & Norfolk Railroad (a subsidiary of the Pennsylvania Railroad System) crosses the western part of the county, passing through Greenwood, Bridgeville, Seaford, Laurel, and Delmar. The Delaware, Maryland & Virginia branch runs from Harrington (Kent County) to Franklin City, Va., through Milford, Georgetown, and Selbyville. These lines provide through service to New York and Philadelphia. The Cambridge branch extends west from Seaford to Cambridge, Md. Another branch extends from Georgetown to Lewes and Rehoboth Beach. The Maryland, Delaware & Virginia Railway crosses the northern part of the county through Greenwood, Ellendale, and Lewes. A steamboat line is operated on the Nanti-

coke River between Seaford and Baltimore by the Baltimore, Chesapeake & Atlantic Steamship Co. Freight is also brought up Broad Creek to Laurel on boats and barges.

Sussex County is gradually building a large mileage of excellent roads. At present the main concrete roads in the county are the DuPont Highway from Milford to Selbyville and the State highway from Greenwood to Delmar. Short stretches of concrete, macadam, sand-clay, and shell roads branch off from the main highways in different sections of the county. The main dirt roads are kept in pretty good condition, but a number of roads do not receive much attention, and during the winter months some of them are impassable. In the summer nearly all roads can be traveled with an automobile.

Practically every section of the county is served by rural mail routes. There are a number of telephones on farms, and this service is increasing. Schools and churches are located conveniently throughout the county.

Philadelphia, New York City, and Wilmington are the principal markets for the agricultural products of the area, although some of the truck crops are shipped to Boston, Pittsburgh, and Baltimore. Only a small proportion of the produce is consumed in the county.

CLIMATE.

The climate of Sussex County is marked by abundant rainfall, relatively high humidity, and moderate temperatures.

The mean annual rainfall at Milford is 43.69 inches, at Seaford 42.97. The rainfall is well distributed throughout the year, the heaviest rains occurring as a rule during the growing season. In the driest year (1895) on record at Milford the precipitation was 36.54 inches; at Seaford in the driest year (1904) it was 34.88 inches. At Milford in the wettest year (1903) the rainfall was 54.22 inches; at Seaford (1906), 62.92 inches. Occasionally the crop yields are decreased by dry spells or periods of excessive moisture, but these never result in complete crop failure. Crop losses from wind and hailstorms are comparatively light, and the damage is usually local. The snowfall is light, with an average of 24.1 inches at Milford and of 17.4 inches at Seaford.

During the summer the days are hot, but the periods of excessive heat are generally short. The nights as a rule are cool, owing to the prevailing breezes that cross the peninsula. The hottest month is July, with an average mean temperature of 76.7° F. at Milford and 76.2° F. at Seaford, and an absolute maximum of 104° F. at Milford and 102° F. at Seaford.

The humidity is high, and this has a tendency to make the heat oppressive. During the winter months there is considerable rain and the air is damp and penetrating. Periods of zero weather do not last long. During the winter and early spring there is considerable freezing and thawing, which is very often injurious to wheat planted on the poorly drained and heavy soil. February is the coldest month, with a mean temperature of 34.6° F. at Milford and 33.6° F. at Seaford.

At Milford the average growing season is 187 days, the average date for the last killing frost in the spring being April 20 and that of

the first killing frost in fall October 24. At Seaford the average growing season is not quite so long, being only 184 days. The latest killing frost in the spring and the earliest in the fall recorded at Milford occurred on May 4 and October 2 and at Seaford May 12 and October 9. It is very seldom that entire failure of fruit crops is caused by frost.

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

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

[Elevation, 40 feet.]

Month.	Temperature.			Precipitation.			
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year (1904).	Total amount for the wettest year (1906).	Snow, average depth.
	° F.	° F.	° F.	Inches.	Inches.	Inches.	Inches.
December.....	36.4	70	-4	3.38	6.07	3.45	3.9
January.....	35.1	73	-4	3.29	1.73	2.53	5.2
February.....	33.6	72	-11	3.44	2.32	4.61	5.7
Winter.....	35.0	73	-11	10.11	10.12	10.59	14.8
March.....	44.3	88	4	3.74	3.39	5.88	1.7
April.....	53.0	97	23	3.44	1.95	1.44	.2
May.....	63.4	98	32	3.86	1.52	4.86	.0
Spring.....	53.6	98	4	11.04	6.86	12.18	1.9
June.....	70.9	100	43	3.84	2.02	12.30	.0
July.....	76.2	102	51	4.83	7.74	11.56	.0
August.....	74.5	102	49	4.15	1.32	7.86	.0
Summer.....	73.9	102	43	12.82	11.08	31.72	.0
September.....	68.3	97	34	3.01	2.08	2.28	.0
October.....	56.8	89	26	3.55	2.73	4.70	.0
November.....	45.9	80	14	2.44	2.01	1.45	.7
Fall.....	57.0	97	14	9.00	6.82	8.43	.7
Year.....	54.9	102	-11	42.97	34.88	62.92	17.4

AGRICULTURE.

Sussex County has been agricultural in its pursuits from the earliest settlement and the inhabitants have had no difficulty in living very comfortably on the products of the land, supplemented by an abundant supply of game and fish. The principal crops grown by the early settlers were corn, oats, and tobacco.

Before the railroads came into the county all products that were marketed had to be shipped by boat, so that the crops grown were staple crops or fruits that could stand slow shipment. The peach industry was started in the early part of the nineteenth century and proved very profitable. The first trees planted were seedlings, but between 1830 and 1840 budded trees were introduced. During the latter part of the nineteenth century, however, a disease known as the yellows appeared and damaged a large number of the trees. Since that time the peach industry has gradually declined until it is now of relatively little importance.

After the Civil War the production of truck crops became important; the New York, Philadelphia & Norfolk Railroad was built, and the trucking industry expanded rapidly. This was followed by a substantial increase in the price of farm land. The raising of truck crops has come about naturally, being influenced by the demand in the cities and the improvement in transportation facilities and in marketing conditions.

The following table, compiled from the reports of the United States census, showing the number and the average size of farms and the acreage of improved land from 1880 to 1920, reflects to some extent the changes connected with the steady transition of the agriculture in Sussex County from an extensive to an intensive type:

Number and average size of farms and acreage of improved land in farms in Sussex County, as reported by the Federal census.

Year.	Number of farms.	Proportion of land in farms.	Average size of farm.	Improved land per farm.
		<i>Per cent.</i>	<i>Acres.</i>	<i>Acres.</i>
1880.....	4,215	88.4	123	72
1890.....	4,461	81.4	107	69.04
1900.....	4,785	82.7	101	65.3
1910.....	5,508	80.3	85.2	52.4
1920.....	5,404	70.8	76.5	49.3

It will be noted that there was a rapid increase in the number of farms, except in the last decade, with a rather close corresponding decrease in size. The decrease in size has been caused by numerous factors, such as more people working their own land, scarcity of labor, more intensive farming, and difficulty of obtaining good tenants.

There has been a rapid increase in the value of farms and farm property within comparatively recent years. In 1880 the value of farm property, including land, buildings, machinery, and domestic animals, was \$2,191 for a farm of 123 acres, while in 1920 the corresponding value was \$4,912 for a farm of 76.5 acres.

The following table shows the production of the most important crops, as reported by the United States census, and indicates the general trend of agriculture in the county during the last 40 years:

Leading crops in Sussex County in 1879, 1889, 1899, 1909, and 1919.

Year.	Corn.		Wheat.		Potatoes.		Sweet potatoes.	
	<i>Acres.</i>	<i>Bushels.</i>	<i>Acres.</i>	<i>Bushels.</i>	<i>Acres.</i>	<i>Bushels.</i>	<i>Acres.</i>	<i>Bushels.</i>
1879.....	105,442	1,424,031	16,428	153,596	.....	107,603	1,619	133,970
1889.....	91,277	929,951	14,080	176,285	1,388	107,271	1,275	123,040
1899.....	95,962	1,676,170	22,102	285,580	2,569	173,551	1,433	146,706
1909.....	100,644	2,181,732	22,260	231,208	6,049	558,661	3,351	490,564
1919.....	89,657	1,794,870	27,340	350,405	5,230	287,769	8,062	1,358,537

Year.	Peaches.		Apples.		Strawberries.		Hay and forage.	
	<i>Trees.</i>	<i>Bushels.</i>	<i>Trees.</i>	<i>Bushels.</i>	<i>Acres.</i>	<i>Quarts.</i>	<i>Acres.</i>	<i>Tons.</i>
1879.....	.....	.....	.....	.....	.....	.....	2,111	2,371
1889.....	1,597,764	226,251	140,998	43,558	.....	.....	15,904	20,147
1899.....	1,479,531	5,660	302,092	251,255	4,636	7,166,330	15,532	15,888
1909.....	523,155	1,900	192,938	38,180	6,404	11,154,730	21,053	31,143
1919.....	179,063	85,316	389,473	144,561	3,127	3,502,768	92,299	86,751

General farming is still the predominating type of farming carried on in Sussex County, although there are a number of farms devoted to trucking, producing principally potatoes, sweet potatoes, tomatoes, and strawberries. In the northern part of the county fruit growing is carried on rather extensively. Corn and wheat are the principal general farm crops. The production of forage crops, including the different legumes, is also important. In 1919 the farm crops were valued at \$11,253,725; of this amount about one-half is credited to general farm crops, and the remainder to vegetables, fruits, and nuts.

Corn is the principal crop; it is more generally grown than any other. In point of value, however, it does not rank so high as some of the truck crops. In 1919 it occupied 89,657 acres, with a production of 1,794,870 bushels. The crop is mostly used for feeding farm stock and especially for fattening hogs. A surplus is usually marketed. Corn fodder is valued very highly as forage.

Wheat, the next important farm crop, is grown mainly in the northern part of the county, where the soils are better adapted to it. In 1919, 27,340 acres were in wheat, and the production was 350,405 bushels. The wheat is either handled by local millers or shipped out. The straw is used for bedding stock.

The production of hay and forage crops is also carried on quite extensively. The growing of alfalfa is increasing; where the right soil is chosen and properly handled successful stands are obtained. Very little of the hay is shipped out; most of it is stacked and fed. Small areas of cowpeas and soy beans are sown. Sometimes they are turned under for green manure, but a large part of the crop is cut for hay. The following table, compiled from the 1920 census report, shows the acreage and production of the forage crops in 1919:

Hay and forage crops in 1919.

Crop.	Acres.	Yield in tons.	Crop.	Acres.	Yield in tons.
All tame grasses.....	14, 179	22, 565	Wild or salt grasses.....	406	627
Timothy alone.....	828	993	Small grains cut green.....	2, 150	2, 754
Clover alone.....	8, 563	13, 426	Annual legumes cut for hay.....	4, 167	5, 092
Timothy and clover mixed....	2, 273	3, 544	Corn cut for forage.....	70, 390	52, 881
Alfalfa.....	363	871	Silage crops.....	1, 051	2, 820
Other tame or cultivated grasses	2, 152	3, 731			

Buckwheat, rye, and oats are the minor farm crops. In 1919 the acreages in buckwheat, rye, and oats were 9,206, 3,877, and 1,902 acres, and the production 72,534, 37,917, and 24,740 bushels, respectively.

Potatoes and sweet potatoes are probably the most important vegetables grown. In 1919 potatoes were grown on 5,230 acres, with a production of 287,769 bushels. With the exception of the part used for home consumption, all the crop is sold to outside markets. Sweet potatoes are grown even more extensively than potatoes. The area planted in 1919 was 8,062 acres and the production 1,358,537 bushels. Practically all of the surplus, after supplying home needs, is marketed outside of the county. A few canners in the county take a part of the crop.

During 1919, 19,230 acres were planted to miscellaneous vegetables. The most important of these are tomatoes, peas, watermelons, and

muskmelons. The minor crops are cabbage, onions, turnips, beets, and beans. The tomatoes and peas are sold mostly to local canneries, some being shipped to the city markets or to canneries in near-by counties. The melons are nearly all shipped out of the county, enough being retained to supply the home demand.

Strawberries are an important crop in Sussex County. The southeastern part is the section in which the largest proportion of the crop is produced. In 1919 there were 3,127 acres planted to strawberries, with a production of 3,502,768 quarts. During the shipping season in the latter part of May and the first part of June special refrigerator express trains are run to New York and Philadelphia to facilitate handling the crop. Selbyville is said to be one of the largest shipping points for strawberries in the United States. Some of the other berries, especially blackberries, are grown to some extent.

Apples, peaches, and pears are the principal orchard fruit crops. The orchards are situated mainly in the northern part of the county on the better drained soils. The apple crop is either put into cold storage or marketed at picking time, depending on the demand. Peaches are generally shipped to northern markets, but some of the crop is consumed locally. Very few of the pears are shipped out of the county, most of the crop being absorbed by the local markets. Of 389,473 apple trees in the county in 1919, 284,477 were of bearing age and yielded 144,561 bushels of apples. The 139,595 peach trees of bearing age yielded 85,316 bushels of fruit. There were 47,011 pear trees, 35,581 in bearing, which yielded 20,963 bushels.

Poultry raising is developing into an important industry in the county. Some farmers have rather large incubators and make a business of shipping day-old chicks, which are marketed mostly in New Jersey, Pennsylvania, and Maryland. It is estimated that 100,000 day-old chicks are shipped out in a year. Some poultry is raised on practically every farm. Local merchants usually trade in poultry and eggs, shipping them to northern markets. The value of poultry and eggs produced in 1919, according to the census of 1920, was \$1,658,103.

The raising of livestock is not carried on very extensively, only one or two farms being run strictly as stock farms. Purebred stock is gradually gaining in favor. Enough hogs are raised on the farms for home use and to supply the local demand. A few farms carry flocks of sheep. Calves are all shipped to the northern markets. What beef cattle are raised are sold locally. A few horses and mules are raised in the county.

Dairying is not an important industry. Nearly every farm, however, has a sufficient number of cows to supply the home needs, and some dairy products are sold. The value of dairy products for 1919 was \$275,498.

The products of the forest are of considerable value. Sawmilling is an important industry in the county, and while no data are available as to the output, the value of the finished products is said to amount to more than \$1,000,000. The predominant tree is the loblolly pine, which makes a rapid, healthy growth. Almost every farm has its woodlot; in fact, a farm without a woodlot is not considered very desirable. A considerable output of mine props and piling is shipped to Pennsylvania and New York. The local mills saw lumber for build-

ing purposes and for strawberry crates, muskmelon crates, and hampers. In the manufacture of crates and hampers small timber can be used.

While the general farm crops are grown on almost all soils, the farmers recognize that the Sassafras loam and sandy loam are the best types for the production of corn, wheat, hay, and potatoes. The production of fruit on a large scale is confined almost entirely to the Sassafras sandy loam. Strawberries are grown most extensively on the Elkton and Portsmouth soils. Corn also is grown on these soils with good results. Tomatoes, sweet potatoes, and melons are grown on the sandier soils.

The farm buildings range from the large, substantial dwellings of the well-to-do farmers to the small tenant houses scattered throughout the county. Farm buildings, as a rule, are fairly well kept. Barns are usually of ample size for stock, hay, fodder, and machinery, and generally have grouped around them a number of small buildings such as corncribs, storage houses, machinery houses, garages, and shelters for stock. On many of the better farms gasoline engines and windmills are used for pumping water, and the use of modern lighting systems is increasing. Modern machinery is in common use throughout the county. The use of tractors has not become very general, although there are a number in use. The potato planter is used quite extensively, but the digger is not so popular. Grain is all harvested with the binder. The work stock consists of horses and mules in nearly equal numbers. Purebred cattle and hogs are becoming more popular.

The land for corn is generally plowed to a depth of 5 to 7 inches. The seed bed is usually prepared by harrowing and rolling. As a rule the seed is planted the latter part of April or first of May, depending on the locality and the condition of the soil. The crop is cultivated three or four times. The corn is sometimes topped and the blades removed from the stalk, but with a large part of the crop the stalk is cut and used for fodder. Considering the large acreage devoted to corn, very few corn harvesters are in use.

The corn land is quite frequently broken in the fall and planted to wheat. Where the corn has been topped, it requires considerable disking and harrowing to get the seed bed in the best shape for planting. Where the corn is all cut, it is shocked in rows a considerable distance apart and the wheat is planted between the shocks.

In preparing the land for potatoes, pine straw, or barnyard manure when available, is applied to the soil. The planting of potatoes begins as early as the weather and the condition of the soil permit. The greater part of the planting is done during April. The rows are usually 3 feet apart and are marked by a shallow furrow. The fertilizer is generally sown one row at a time, and this is followed with a cultivator to mix the fertilizer with the soil. The potatoes are usually quartered for planting, and a considerable part of the planting is done with potato planters. After planting, the middles are loosened up. Some farmers cultivate their potatoes so as to ridge them, while others prefer the more nearly level plan of cultivation. As a rule the crop is cultivated five to seven times.

The spraying of potatoes is not carried on in a systematic manner. Most all crops are sprayed or dusted at some time during the season, but some farmers spray only when it becomes evident that the crop

is going to be injured. The better farmers, however, spray two or three times. Arsenate of lead or Paris green are the materials used. Where blight is found, Bordeaux mixture is used. Northern-grown and some home-grown seed is used. The Irish Cobbler, Green Mountain, and McCormick are the principal varieties planted.

When the potatoes are planted for early market, they are dug as early as possible, and the prime potatoes are barreled in the field and hauled to the shipping point, but a large part of the potato crop of Sussex County is either shipped in bulk or in sacks. A considerable proportion of the late crop of potatoes is stored. The potato house is becoming popular, but many farmers continue to store the crop in mounds. This method is not as satisfactory as placing the crop in storage houses. Sweet potatoes kept in mounds must be given a somewhat heavier protection than white potatoes.

The young plants of sweet potatoes are grown in hotbeds. These beds are usually in protected places, preferably with southern exposure. Different types of hotbeds are used, some being supplied with artificial heat, while others are heated by fermenting stable manure and by the sun. The hotbed should be located where the sunlight will be unobstructed. It is often advisable to dip the seed in corrosive sublimate solution of 1 ounce to 8 gallons of water in order to disinfect it.

One of the first essentials for the growing of a good crop of sweet potatoes is manuring. As a rule the crop is manured rather heavily. Following a cover crop, however, manure is not applied, at least not heavily. The seed bed is very thoroughly worked up before the rows are marked. This done, the fertilizer is sown, and a bed is thrown up with one round of a plow, that is, two furrows. The strongest plants are selected for setting. They are transplanted by means of machines, tongs, or by hand. The rows are usually $2\frac{1}{2}$ feet apart and the potatoes are planted 18 to 20 inches apart in the rows. Ten to eleven thousand plants are required to plant an acre.

In cultivating sweet potatoes one or two hand hoeings are usually necessary, and the first of these is usually given 10 to 12 days after setting. For the early cultivations a vine-turning attachment is used on the cultivator. When the vines get large and interwoven, it is necessary for a man to precede the cultivator and turn the vines with a stick.

The sweet-potato crop in this county is usually harvested after the frost has killed the vines. The potatoes are generally taken out with a turning plow, put into baskets, and hauled to the potato houses. Part of the crop is marketed from the field and part of it is kept until in the winter and marketed in hampers. The principal varieties grown are the Big Stem Jersey, Yellow Jersey (*Up River*) and Southern Queen.

Strawberries generally are a two-year crop. The plants are propagated by means of runners, which are cut from year-old beds and set out as soon as growth of the old bed starts in the spring. The first year the beds are cultivated carefully and are kept very clean. The second year they do not receive any cultivation unless they are going to be used the third year, as is often done, in which case an effort is made to keep the grass out. The plants are usually set out on new land or on land that has been idle for a few years. In order to start the plants, they are usually treated with a 2-10-0 fertilizer

applied at the rate of about 300 to 400 pounds per acre. Sometimes a top dressing of fertilizer and barnyard manure is given the second year. The matted-row system is used. The berries are picked during the day and taken to market in the evening or morning.

The best shipping varieties grown are the Gandy, Missionary, and Chesapeake. The Climax and Superior are only fair shippers. The Beauty and Success varieties are grown for the canners and juice manufacturers.

Tomatoes are grown on a large number of farms as a cash crop. They are sold mostly to the local canneries. A part of the crop is grown under contract. The Greater Baltimore and Bonny Best are the leading varieties, while Marvel and Norton are the important wilt-resistant varieties. The wilt-resistant varieties have generally proved satisfactory.

The large commercial fruit orchards in the county are well taken care of. When the trees are young, they are intercropped, but when they start to bear the land is tilled and kept clean. The trees are pruned, and a definite system of spraying is followed. After picking, the fruit is taken to grading houses, where it is graded, put in hampers and either shipped or stored.

Practically all the farmers follow some system of crop rotation. This is not the same for the whole county, because of the variety of crops grown and the different soil conditions. The farmer endeavors to plan a rotation that will include a profitable legume crop. Cover crops are being used rather extensively. The use of commercial fertilizers is general throughout the county. In 1879 the expenditure for fertilizers was \$100,640. In 1909, 86.7 per cent of the farms reported an expenditure of \$403,762. The amount expended in 1919 was considerably less, amounting to \$293,019 on 90 per cent of the farms, or an average of \$60.23 per farm reporting.

Good results are obtained on potatoes from a fertilizer containing 5 to 7 per cent nitrogen, 6 to 8 per cent phosphoric acid, and 5 to 7 per cent potash. As high as 1,200 pounds per acre has been applied; 1,000 pounds is probably the average. Sweet potatoes are fertilized about the same as potatoes, the mixture mostly used being one containing 2 per cent nitrogen, 10 per cent phosphoric acid, and 5 to 6 per cent potash. When corn is fertilized, a 2-8-2, 2-10-2, or 3-10-4¹ mixture is ordinarily applied, the particular formula selected depending on the location, the soil, and the condition of the soil with respect to past treatment. Strawberries in recent years have received 300 to 400 pounds per acre of a 2-10-0 fertilizer, applied when the berries are set out. For a top dressing 400 to 500 pounds of a 4-6-0 fertilizer is often used. Tomatoes are usually given 400 to 600 pounds of a 2-10-0 mixture and peas about 400 pounds of the same grade. Barnyard manure is shipped in carload lots from the cities. Barnyard manure is used and pine straw is also used rather extensively. The use of lime is becoming common. Burnt or hydrated lime is applied at the rate of 600 to 1,000 pounds per acre, while ground limestone is used at the rate of 1,500 to 2,000 pounds per acre.

The expenditure for labor increased from \$235,050 in 1899 to \$528,324 in 1919, 43 per cent of the farms in the county reporting in

¹ Percentages respectively of nitrogen, phosphoric acid, and potash.

the latter year. During the last few years farm labor has been hard to obtain, but in normal times laborers are available in sufficient numbers at wages that are not exorbitant. Many of the farm laborers are negroes. During the strawberry season foreigners, mostly Italian families, are brought down from Philadelphia to help pick the crop. The price of farm labor varies, depending on the locality, the supply, and the demand. As a rule farm help is not hired by the month, but by the day or week. The handling of truck crops is paid for on a quantity basis, so much per quart, basket, or barrel gathered, depending on the crop that is being harvested.

In Sussex County there are 5,404 farms with an average size of 76.5 acres, of which 49.3 acres is improved land. There are some land holdings of several hundred acres, but these are usually divided up into a number of tenant farms. Where intensive farming is carried on, as it is in some sections of the county, small farms give the best results.

According to 1920 census, 65 per cent of the farms are operated by owners, 34 per cent by tenants, and 0.9 per cent by managers. Most of the tenant farms are rented under the share system. The prevailing practice is that the tenant furnishes the equipment, and the tenant and landowner each pays half of all expenses of operation and receives half of the crop. Very little land is rented for cash.

The 1920 census reports the average value of farm land in Sussex County as \$32.31 per acre. This value is based on assessed valuations, which are generally lower than the sale price. Land values in the county range from \$10 per acre to \$200 per acre. The important factors influencing the price of farms are the location of the land, condition of the land, drainage condition, whether the land contains any merchantable timber, and the condition of the buildings.

The Sussex County Farmers' Exchange, with headquarters at Georgetown, had a membership of 1,600 in 1920. This organization is divided into 12 local associations. These buy and sell on the cooperative plan. Some of them are successful and some are not. The Selbyville and Milford associations employ a manager to look after the buying and selling the year round; the other associations employ a manager during the rush season.

SOILS.²

Sussex County, situated in the central part of the Delaware-Maryland-Virginia peninsula, lies wholly within the Coastal Plain, which physiographic division extends along the Atlantic Ocean from Long Island to southern Florida and thence along the Gulf of Mexico to the mouth of the Rio Grande and beyond into Mexico.

According to the Maryland Geological Survey, the geology of this county is quite simple and uniform. The deposits belong to the

² The soils of Sussex County, Del., match very well with those of Kent County, Del., with the exception of some unimportant areas between Beaverdam Bridge and a point about 4 miles northeast of this, where the straight line of Sussex County intersects Tantrough Branch. Along this part of the county line rather more detail is shown on the Sussex County map than on the Kent County map, but the areas that do not join are of little importance. The soils along the south boundary of Sussex County join well with those of Wicomico County, Md. There is a discrepancy in the joining of Sussex County, Del., to Wicomico County, Md., for a distance of about 1 mile, 2 miles north of the southwestern corner of Sussex County. Here the soil mapped as Elkton sand in Sussex County joins with Keyport sandy loam in Wicomico County. Part of this discrepancy comes in connection with the Woodstown series, a recently established series, which in some respects resembles the Sassafras, but shows more gray mottling in the lower subsoil.

Columbia group of the Pleistocene age, and their elevation to the present altitude above sea level is comparatively recent in a geological sense. This county is covered by the Talbot and Wicomico plains, which are the younger and older series of beds of unindurated materials from which the soils of the area have been derived.

The Wicomico formation covers the greater part of the county, being particularly well developed in the northern half. In this formation the principal soil constituents are the sands, which make up a large percentage of the soil mass. In the south-central part of the county the Talbot formation appears to be better developed. In this formation, silt, fine sand, and clay are the principal soil constituents.

Usually, at a depth ranging from about 28 to 36 inches below the surface, the material is more sandy than the upper part, and generally the subsoil at this depth passes into a light sandy loam or into a sand which in places carries fine gravel. On account of the low, flat surface of much of this county such an open-natured substratum is advantageous in that it improves the underdrainage of the soils.

The material from which the soils of this area are derived was originally deposited as marine sediments, and the textural variations of the several types are due primarily to the sorting action of water prior to the final elevation above tide level. Apparently, erosion has played but little part in the modification of the material, but weathering, drainage, and organic life have been potent factors in altering the character of the material. The principal change in the materials since their deposition apparently has been an accumulation of organic matter in materials that were formerly sands like the present beach sands and in the removal of an excess of sodium chloride and other accumulated salts. There is no evidence that there ever was much lime carbonate in the soil material, at least there is, according to the acid test, no appreciable quantity of free lime carbonate in the newest formed soils of the beaches, marshes, and alluvial flood plains. Mineralogically the old sands, such as give the Sassafras soils, appear to be much like the beach sand, but there may be a little difference.

Some of the darker colored and black soils are highly charged with organic matter, which has accumulated through the growth and decay of vegetation in swampy or semiswampy situations. The mottled and variegated colors of the subsoils seem to have resulted from differences in degree of oxidation of the iron compounds in the soils under unequal conditions of drainage and aeration.

Bordering the streams are narrow strips of alluvial material so variable in texture, color, and structure that differentiation into types could not be satisfactorily carried out. Such areas are subject to overflow and in many places are either covered or saturated with water during the greater part of the year. A small area of Muck is found in the southeastern part of the county.

The soils of Sussex County are grouped into seven soil series, on the basis of the differences in color, mode of development, drainage, structure, and stage of weathering. Each series consists of soil types, which differ from each other in texture. Sixteen distinct soil types, three with phases, were mapped, in addition to which four miscellaneous materials are shown.

The Sassafras series includes the highest-lying and best-drained soils of the county. This series is distinguished by the brown color and mellow structure of the surface soils, the reddish-yellow to yellowish-brown color of the subsoils, and the presence of coarser material in the lower subsoil than in the upper subsoil. Four types are mapped, the Sassafras sand, loamy sand, sandy loam, with a deep phase, and the loam.

The Norfolk series is intermediate between the Sassafras series and the Keyport and Woodstown series. The types are characterized by the gray to grayish-yellow color of the surface soils and the pale-yellow or cottonseed-meal color of the subsoil. This series is not so well drained as the Sassafras and in places the lower subsoil contains some grayish mottlings. Three types of this series were mapped, the Norfolk sand, loamy sand, and the sandy loam, with a deep phase.

The types included in the Woodstown series are characterized by the light-brown or grayish-brown color of their surface soils, the pale-yellow color of the subsurface, and the mottled gray and yellow color and compact structure of the subsoil or lower subsoil. The surface soils resemble in color those of the Sassafras series, and the subsoil is similar to the subsoil of the Elkton. The surface soil has a tendency to become light grayish when dry. The subsoil is not so stiff as that of the Keyport. The drainage is about intermediate between that of the Sassafras and the Elkton. The areas mapped as Leonardtown in other parts of Delaware are similar to these and should be put in this newly established series. One type was mapped, the Woodstown sandy loam.

The types of the Keyport series are light brown in the surface layer, pale yellow in the subsurface and upper subsoil, and mottled yellow and light gray or bluish gray in the subsoil, which is a stiff, plastic clay or sandy clay. In this area mottled yellow and gray sand or yellowish sandy loam mottled with gray or rusty brown is frequently reached at about 30 inches. The Keyport soils characteristically resemble the Sassafras or Norfolk soils in the surface and upper subsoil; in the lower subsoil there is a close resemblance to the subsoil of the Elkton, except that typically the material is stiffer and heavier. Two types were encountered in this area, the Keyport fine sandy loam and silt loam.

The Elkton series is distinguished by light-gray surface soils and a mottled yellow and light-gray to bluish-gray, slightly plastic sandy clay to silty clay subsoil. The material is usually coarser in the lower subsoil, at depths of about 24 to 30 inches, than in the upper subsoil. The soils of this series occupy flat to level areas, where the natural surface drainage is generally poor, and in places they occur in depressions. The original soil material has undergone intermittent wet and dry stages, and this process apparently has developed the light and mottled colors. The series is represented in Sussex County by the sand, sandy loam, and loam types.

The types included in the St. Johns series are distinguished by their dark-gray to black surface color, and the presence at a depth of 6 to 18 inches of a compact layer of sand having a granular structure and brown color resembling that of coffee grounds. This layer can be bored through, except in places where the material has been consolidated and has the character of semihard rock. It is locally known

as "iron mine." Where this layer is near the surface, the underlying soil is pale yellow to orange, and where the layer lies deep below the surface the brown color persists throughout the 3-foot section. The sand is the only type of this series mapped in Sussex County.

The Portsmouth series includes types with dark-gray to black soils and mottled yellow or yellowish-brown and gray, light-gray, or bluish-gray subsoils. These soils have been developed in slightly depressed areas where natural surface drainage is poor and where water-loving vegetation has flourished. In this county the Portsmouth sandy loam and the Portsmouth loam are mapped, the latter with a mucky phase.

The miscellaneous types are Meadow, Swamp, Tidal marsh, and Coastal beach.

In Sussex County topography and drainage probably have had more influence than other factors in determining the character of the present soils. Where the drainage is best developed the most productive soils, the Sassafras and Norfolk, occur; where the surface drainage is good and the subsoil drainage poor the Keyport and Woodstown soils occur; and where the drainage of both the surface and subsoil is poor the Elkton, St. Johns, and Portsmouth soils occur.

In subsequent chapters the soils are described in detail and their relationship to agriculture is brought out. The accompanying map shows the distribution of the various soils in the county.

The following table gives the names and actual and relative extent of the soils mapped:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Sassafras sandy loam.....	78,400	19.6	Norfolk loamy sand.....	8,704	1.4
Deep phase.....	39,744		Elkton sand.....	7,488	1.2
Elkton sandy loam.....	91,712	15.2	Norfolk sandy loam.....	3,200	1.1
Sassafras loamy sand.....	63,232	10.4	Deep phase.....	3,648	
Norfolk sand.....	56,960	9.4	Coastal beach.....	4,224	.7
Portsmouth sandy loam.....	52,544	8.7	Meadow.....	3,392	.6
Sassafras sand.....	51,328	8.5	Elkton loam.....	2,496	.4
Woodstown sandy loam.....	42,688	7.0	Keyport silt loam.....	1,280	.2
Tidal marsh.....	35,136	5.8	Keyport fine sandy loam.....	1,216	.2
Swamp.....	26,432	4.4	St. Johns sand.....	960	.1
Portsmouth loam.....	17,280	3.0	Total.....	604,800	.....
Mucky phase.....	64				
Sassafras loam.....	12,672	2.1			

SASSAFRAS SAND.

The surface soil of the Sassafras sand consists of a brownish-gray, medium-textured, loose sand, ranging in depth from 2 to 10 inches. The subsoil consists of orange-colored to reddish-yellow loose sand. The color of the lower subsoil is almost always reddish yellow. Locally the material of the lower subsoil is somewhat coarser than the overlying material.

In some places the surface soil, to a depth of a few inches, is almost white. In places this type resembles the Norfolk in a degree that makes it difficult to draw sharp lines between the two soils, but the typical Sassafras always has a decided orange to reddish-yellow color, while the Norfolk typically is yellow or pale yellow. In the vicinity of Bethel the Sassafras sand and the Norfolk sand are so intermingled

that it was very difficult to map the areas in complete detail, and consequently some small areas of Norfolk sand are included with the Sassafras sand. Between Selbyville and Bunting small ridges of Sassafras sand occur through the flat areas of Elkton soils. These ridges cover a very small area, but they show such a contrast to the surrounding country that even very small areas were mapped. In many places quartz gravel and coarse sand occur through the soil and subsoil.

The largest and most important areas of Sassafras sand are in the southwestern part of the county in the vicinity of Woodland and Bethel and along the Nanticoke River and its tributaries. Numerous other small areas are mapped in different parts of the county.

The Sassafras sand includes the more rolling and undulating land of the county and usually occupies the slightly higher elevations, principally on ridges or knolls or along stream banks. The drainage is excessive; consequently the type is suited only to special crops in an average year, though in a wet season general crops can be grown satisfactorily.

The greater part of the Sassafras sand is under cultivation; the rest is still in forest, consisting of pine, oak, hickory, dogwood, sassafras, and huckleberry. The forest growth is sparse in comparison to that on the heavier Sassafras soils.

The principal crops grown on the Sassafras sand are sweet potatoes, watermelons, muskmelons, tomatoes, and corn. Sweet potatoes are the principal crop and yield 250 to 300 bushels per acre. Watermelons, muskmelons, cucumbers, berries, tomatoes, potatoes, and other truck crops do very well. When corn is grown, it gives good yields, but the wheat yield is only fair. Cowpeas, soy beans, and vetch are grown to some extent.

The soil is suited to the growing of early truck crops. It is warm, early, well aerated, easily penetrated by roots, very easily tilled, and responds quickly to the application of manure or turning under of green-manure crops. It requires heavier applications of fertilizers than the other Sassafras soils and is badly in need of organic matter. Commercial fertilizers of different formulas are applied, the brand and rate of application varying with the crop grown. Sweet potatoes are fertilized heavily, applications ranging from 1,000 to 1,200 pounds per acre.

SASSAFRAS LOAMY SAND.

The surface soil of the Sassafras loamy sand has a depth of about 8 to 10 inches and consists of a light-brown to grayish-brown loose sand or loamy sand, which on drying out takes on a grayish color at the immediate surface. The subsoil to a depth of about 30 inches typically consists of a reddish-yellow loamy sand, although there is a range to an orange in some areas. The subsoil is normally a trifle more coherent than the surface soil, and locally approaches a light sandy loam in texture. To a depth of 30 inches the texture is commonly uniform, but below this it becomes in places coarser, and considerable gravel may be present. This lower subsoil layer has a decided reddish tinge. In some places quartz gravel and coarse sand also appear in the surface soil.

A variation of the type in the vicinity of Ellendale shows a rather gray surface soil, underlain by a yellow loamy sand to about 20 inches,

which in turn is underlain by a reddish-yellow loamy sand. The yellow upper subsoil is like the subsoil of the Norfolk, but below this the material is of the Sassafras character. There are a few included areas of Sassafras sand and some of a deep phase of Sassafras sandy loam.

The most important areas of Sassafras loamy sand are in the north-eastern part of the county, but small irregular-shaped areas are mapped in almost all parts of the county. The largest areas of this type lie north and east of Ellendale. Other areas are at Cannon, about 3 miles east of Greenwood, and southeast of Milford.

The topography as a whole is gently undulating, but some areas are nearly level. (Pl. XXVII, fig. 1.) The drainage is prevailingly good, and in places it is excessive, crops suffering injury during ordinary droughts.

The Sassafras loamy sand is not very important in the agriculture of the county, only a trifle over half of it being under cultivation. Where it is forested the growth consists of loblolly pine, red oak, white oak, maple, hickory, some cedar, dogwood, and holly, and a dense undergrowth of myrtle, huckleberry, and smilax.

The same crops are produced on this type as on the Sassafras sand. The soil is warm and adapted to truck growing. Sweet potatoes, the most important crop, give good yields. Corn and wheat are grown with about the same results as on the Sassafras sand. Tomatoes and sweet corn are grown for canning, with fairly good returns. Berries and fruit do very well. Some cowpeas, soy beans and rye are grown for forage and green manuring.

This soil responds readily to fertilizers, but heavy applications are necessary. The amount applied is usually the same as on the Sassafras loam.

Land values on the type have a wide range, depending on location and improvements. Farms consisting largely of this soil are held at the present time (1920) for about \$25 to \$100 an acre.

In order to maintain the fertility of this soil, it is necessary to incorporate organic matter. This can be done by the liberal use of barnyard manure and by turning under such crops as cowpeas, crimson clover, or rye. The growing of legumes should be extended. Cowpeas are probably better adapted to this type than any other legume. Applications of lime should prove beneficial.

SASSAFRAS SANDY LOAM.

The surface soil of the Sassafras sandy loam is a light-brown to brown loamy sand or mellow sandy loam, with a depth of about 8 to 10 inches. This is underlain by a reddish-yellow or yellowish-brown heavy sandy loam to a sandy clay loam, which at 16 to 18 inches passes into reddish-yellow to yellowish-red friable sandy clay, which in turn passes at depths between 22 to 30 inches into dull-red or yellowish-red sandy loam, coarse sandy loam, or loamy coarse sand. Small flakes of mica are present locally in the soil and subsoil. The reddish color of the subsoil is more pronounced in the better drained areas.

Generally the surface is free from gravel, but a few small areas contain considerable quantities. These areas usually occur on slopes near stream courses. The upper subsoil is more compact than the surface soil, and the lower subsoil is looser than the upper subsoil. The unweathered material, which is encountered usually at about 30 inches, consists of clayey, sandy, or gravelly strata.

In various places this type includes areas of Elkton sandy loam occupying slight depressions that could not be mapped separately on account of their small size. These inclusions are most noticeable just west of Bridgeville. An area lying 1 mile south of Jacobs School contains some small patches of Keyport sandy loam. In an area northeast of Greenwood faint gray mottling was noted in the subsoil of that part of the type occupying slight swales. In the northeastern part of the county there are some small bodies of Sassafras loamy sand included with the Sassafras sandy loam.

The Sassafras sandy loam is one of the extensive soils of the county and is very important agriculturally. It occurs in rather large areas south and east of Milford, in the vicinity of Slaughter Neck School, Lincoln, Anderson Crossroads, Jefferson Crossroads, Belltown, and Midway in the northeastern part of the county. In the western part of the county a belt extends from the county line to Seaford along the Pennsylvania Railroad. This belt has been penetrated by streams and along these other soils have been formed, so that the strip is not entirely composed of Sassafras sandy loam. Other areas are scattered throughout the county.

The Sassafras sandy loam occupies flat to slightly undulating land at all elevations from near sea level to the highest elevations in the county. As a rule the surface is not so smooth as that of the Sassafras loam, but it is not sufficiently rolling to result in erosion. The drainage is good, owing in a large part to the porous substratum, but this does not result in droughtiness, as the friable heavy-textured subsoil holds sufficient moisture to carry the crops through dry spells. Because of the favorable texture and structure of the soil and subsoil the type is thoroughly aerated. The soil can be tilled under a wide range of moisture conditions, and in many places cultivation can be carried on a few hours after a heavy rain.

This type is recognized as one of the most important soils in the county and on it are located a large proportion of the better farms. It is considered one of the most reliable and productive soils, as well as one of the easiest to handle, in the county. Probably 80 to 85 per cent of it is under cultivation. The rest is in forest consisting of pine, oak, tulip poplar, and other deciduous species. The undergrowth, consisting of myrtle, sassafras, and some small maples and holly, is rather dense in places.

The principal farm crops are corn, wheat, buckwheat, clover, and hay. Tomatoes for canning are an important crop, and sweet corn and peas also are grown to some extent for canning. Many peach, pear, and apple orchards have been established on this type and do well. Watermelons, muskmelons, and berries succeed, but are not so extensively grown as on the lighter types of this series. When the soil is properly handled, potatoes and sweet potatoes produce good yields. (Pl. XXVII, fig. 2.) Cowpeas, soy beans, and alfalfa are successful crops.

Crop yields vary considerably, depending on weather conditions, kind and amount of fertilizer used, and the handling of the soil. Wheat averages 18 to 22 bushels per acre; corn, 35 to 40 bushels; buckwheat, 12 to 20 bushels; hay, 1 to 1½ tons; tomatoes, 5 to 8 tons; and potatoes, 75 to 100 barrels. Alfalfa can be cut three or four times during the season, giving three-fourths to one ton per cutting.

The Sassafras sandy loam is easily tilled and does not clod when wet nor bake when dry. It responds more readily to judicious manuring and fertilizer than most other soils in the area, and for this reason it probably receives relatively better treatment and the benefit of more soil-improving crops than most of the other types. This type requires a heavier application of fertilizers than the loam or silt loam, but a lighter application than the loamy sand or sand. About 350 to 400 pounds of fertilizer is used for wheat, while tomatoes, sweet potatoes, and potatoes receive heavier applications. Corn is very rarely fertilized. Barnyard manure is used when available. The value of lime is recognized, and on a number of farms it is applied regularly at the rate of 800 to 1,000 pounds per acre. Plowing under of green-manure crops has proved to be beneficial and is established on a number of farms. An improvement in the handling of this soil would be the adoption of a definite crop rotation, including a leguminous crop.

The selling value of this land varies with the location and improvements and ranges from about \$75 to \$120 an acre for ordinary farming lands and somewhat higher prices for land in orchards.

Sassafras sandy loam, deep phase.—The surface soil of the Sassafras sandy loam, deep phase, consists of light-brown to brownish-gray sand or loamy sand, with a depth of 6 to 8 inches. The subsoil is a yellow or reddish-yellow loamy sand passing at about 18 to 24 inches into reddish-yellow or yellowish-red loam, sandy clay, or sandy clay loam. At 30 to 32 inches it usually grades into light reddish yellow loamy sand or coarse loamy sand to sandy loam. In places the substratum is a plastic coarse sandy clay. Gravel is encountered locally within the 3-foot section.

There are a number of variations of minor importance, chiefly representing differences in the color of the soil and upper subsoil. Some of these variations are noted below specifically, in order to show just what is meant by variations of minor importance in this phase of the Sassafras sandy loam.

About three-fourths mile south of Laurel the soil consists of brownish-gray sand, underlain at 6 inches by yellow sand, which passes at about 20 inches into yellow sandy loam to sandy clay having a faint reddish shade, and this, in turn, into orange-colored sand within the 3-foot section. At a point $1\frac{1}{2}$ miles south of Laurel, the surface of the type is a light-brown sand having a slightly loamy feel, caused by the relatively high content of organic matter; this is underlain at about 8 inches by yellow sand, which extends to about 24 inches and passes into reddish-yellow or yellowish-red friable sandy clay, the texture becoming coarser in the lower part of the 3-foot section. Across the road from this boring, in forest, the soil is a light-brown or yellowish-brown sand passing at 1 to 3 inches into yellow sand, and this at about 15 inches into reddish-yellow sandy loam, which at about 24 inches is underlain by yellowish-red friable sandy clay containing more sand and less clay at a depth of 30 inches.

The deep phase of the Sassafras sandy loam differs from the typical Sassafras sandy loam not only in its greater depth to clay, but in having usually a slightly lighter average color at the surface, which apparently is due to a lower content of organic matter. It dries out to a light-gray color.

The topography is generally slightly undulating, although a few of the areas are flat. The drainage is good to excessive, but as a rule the soil is quite retentive of moisture.

The largest areas of Sassafras sandy loam, deep phase, are in the vicinity of Millsboro and of Milford, and some fairly good sized areas lie in the vicinity of Seaford and Laurel. Other irregular-shaped areas are scattered throughout the county. A few small areas of Sassafras sandy loam, with indefinite boundaries, were included with the phase.

The deep phase is not as productive as the typical Sassafras sandy loam, but it is a good agricultural soil. It is devoted to the same crops as the typical soil. It is an early soil and very easily tilled.

To increase the productiveness of this soil, the addition of organic matter in the form of stable manure or green-manure crops, the adoption of a proper crop rotation, including a legume, and the regular application of lime are necessary.

SASSAFRAS LOAM.

The surface soil of the Sassafras loam is a brown to grayish-yellow (in forest) mellow loam or light loam, about 10 to 12 inches deep. The subsoil is a reddish-yellow or yellow clay loam to sandy clay loam, grading into reddish-yellow or yellowish-red friable silty clay or sandy clay, which passes at about 24 to 36 inches into a more friable reddish-yellow to dull-red sandy loam, loamy sand, or coarse loamy sand, locally containing small quartz or flint gravel. In some places the coarser textured lower subsoil is not encountered at a depth of less than 36 inches, but as a general rule it is. In spots this lower stratum is more compact than the heavier upper subsoil, but when brought up with the soil auger it is friable.

The Sassafras loam and sandy loam are closely associated, and the boundary in many places is indefinite, so that some small areas of sandy loam have been mapped with this type. This is especially true of the area about one-third mile northwest of Midway.

The Sassafras loam is confined almost wholly to a broken belt extending from Rehoboth Bay north to the county line. The topography as a rule is undulating to slightly rolling; in a few places it is level or nearly level. The type occurs at a lower elevation than any of the other Sassafras soils in this county, but is well drained and well aerated. It is retentive of moisture and withstands dry spells better than the sandy types. Except in some of the flatter areas, it does not bake or clod and as a rule is easily tilled.

This is probably the best soil for general farming in the county. It is not quite so early as the sandy loam, nor will crops mature so early as on the more sandy types. It is a good fruit soil and is used rather extensively for the production of apples and pears. Berries, potatoes, and sweet potatoes do well. Corn, wheat, and hay are the principal field crops. Corn is probably the main crop and yields 25 to 35 bushels per acre. The yield of wheat varies considerably, some farms producing as high as 30 bushels per acre, but the average is 18 or 20 bushels per acre. Timothy and clover yield about 1½ tons of hay per acre. Alfalfa, buckwheat, cowpeas, and soy beans give good results. Tomatoes are grown rather extensively, and the yields are slightly higher than on the sandy types.

Land of the Sassafras loam used for general farming sells for \$75 to \$100 an acre, depending on location, improvements, and buildings, whether associated with well-drained or poorly drained soils, and the condition of the soil with respect to past treatment. Where the land is in fruit trees, the price varies with the kind of fruit and condition of the orchard, the price being considerably higher than in case of general farming lands.

This soil is more retentive of fertilizers than the sandy types and responds very readily to their application. It can be improved by the addition of organic matter, either in the form of stable manure or green-manuring crops. It is also benefited by liming. Good crop rotations, including some soil-improving crop, like alfalfa, clover, and cowpeas, should be adopted and systematically followed.

NORFOLK SAND.

The Norfolk sand consists of gray to grayish-brown loose sand, with a depth of 6 to 8 inches, underlain by yellow or pale-yellow loose sand extending to a depth of 3 feet or more. This typical description is applicable to a large part of the type, as mapped in Sussex County; but there are some variations that should be noted. The lower part of the 3-foot section, for example, may be yellowish gray in color, especially in lower situations, and on the other hand some of the better drained areas show a little reddish-yellow mottling in this part of the profile. About 1 mile east of Bacons the lower 3 or 4 inches of the subsoil is somewhat loamy. On the east bank of Gravelly Fork near Middleford the soil is typical Norfolk sand, but where the elevation is just a trifle higher than the surrounding country the subsoil is slightly reddish, though not enough so to give the Sassafras.

The Norfolk sand is best developed in the southern part of the county, the most important areas being east of Dagsboro, east of Seaford, and in the vicinity of Laurel. Many irregular-shaped areas are scattered through the county. Some small areas have been mapped within areas of the Sassafras sand southeast of Seaford. These usually occur in slight depressions.

The topography of the Norfolk sand is slightly undulating or billowy to gently rolling. The type usually has a somewhat higher elevation than the surrounding country and frequently lies adjacent to some of the larger streams. The drainage is excessive.

Probably half of this type is under cultivation, the rest being covered with forest, consisting chiefly of pine, oak, sassafras, dogwood, some holly, and cedar. The tree growth is not as hardy or vigorous as on some of the heavier soils.

This is a good soil for sweet potatoes, muskmelons, and watermelons, but it is not used very extensively for any of the general crops except corn. Sweet potatoes are probably the principal crop and produce good yields. Potatoes, tomatoes, berries, cucumbers, and corn do well. Cowpeas and soy beans are grown to some extent for soil improvement. The soil is loose and well aerated. It warms up early and matures crops quickly, these qualities favoring its use as a trucking soil. It responds very quickly to fertilizers, but because it is less retentive than the heavier soils heavier applications are necessary to obtain the best results.



FIG. 1.—TOPOGRAPHY OF THE SASSAFRAS LOAMY SAND.

The crop shown is rye.



FIG. 2.—HARVESTING POTATOES ON THE SASSAFRAS SANDY LOAM NORTH OF SEAFORD.

Land values on the Norfolk sand are relatively low, except near towns and on farms where the soil has been maintained in good condition by careful management, including the use of crop rotations and manure.

In order to bring the Norfolk sand up to maximum productiveness and to hold it there, it is necessary to increase and maintain the supply of organic matter by applying stable manure or by turning under green-manure crops, such as cowpeas, clover, or rye.

Owing to their small extent, a number of areas of Norfolk fine sand were included with the Norfolk sand. The former consists of about 6 inches of gray to grayish-yellow fine sand, underlain by pale-yellow fine sand to a depth of 36 inches or more. The surface soil when dry is usually rather gray.

The Norfolk fine sand is not very extensive in this county. Most of it occurs along the banks of streams and is excessively drained. The largest areas lie along Swan Creek north of Millsboro. The topography is undulating to rolling.

This soil, because of its small extent, is not very important agriculturally. The principal crops grown on it are corn, sweet potatoes, potatoes, and garden vegetables. The yields are somewhat lower than on the surrounding types.

NORFOLK LOAMY SAND.

The Norfolk loamy sand has a surface soil of gray to grayish-brown loamy sand, with a depth of about 6 to 8 inches. The subsoil is a yellow loamy sand extending to a depth of 3 feet or more.

The foregoing is typical of a large part of the Norfolk loamy sand in Sussex County, but there are a few areas that depart from this description somewhat. In slight depressions the surface soil is gray to a greater depth, and occasionally there are faint streaks of gray in the lower subsoil. In a few areas a layer of loam is encountered at a depth of 34 to 36 inches.

The Norfolk loamy sand is confined principally to the region north and east of Millsboro. It is closely associated with soils of the Sassafras and other Norfolk soils, and some small areas of Norfolk sand and sandy loam and Sassafras sand are included with the type as mapped.

The Norfolk loamy sand has a slightly undulating to gently rolling surface. It generally lies a little lower than the sand types of the Norfolk and Sassafras series and slightly higher than the heavier types of these series. The drainage is rather excessive.

This is a good soil for sweet potatoes, muskmelons, and watermelons. It is not used extensively for any of the general crops, except corn. Potatoes, tomatoes, berries, cucumbers, and corn do fairly well. Cowpeas and soy beans are grown to some extent as soil improvement crops. The soil is well aerated, loose, warm, and early, and where enough organic matter is added it is a good truck soil. It responds very quickly to fertilizers, but is not retentive, and the application should be relatively heavy to obtain the best results.

The value of the Norfolk loamy sand is not as high as that of the heavier types.

In order to keep the Norfolk loamy sand in a productive state, it is necessary to maintain in the soil a good supply of organic matter. This may be done by stable manure or by turning under occasional

crops of cowpeas, clover, or rye. Applications of commercial fertilizers are necessary. Crimson clover and rye make fairly good stands on this soil.

NORFOLK SANDY LOAM.

The surface soil of the Norfolk sandy loam is a light-brown to brownish-gray sand, loamy sand, or sandy loam, with a depth of 8 or 10 inches. The surface usually dries out to a grayish color. The subsoil is a pale-yellow sandy loam to about 20 inches, where pale-yellow sandy clay is reached.

A number of variations are found in this type. In places a pale-yellow friable sandy clay loam or sandy clay is encountered at a depth of about 15 inches, the material extending to 36 inches or more. Northwest of Mission the loamy sand extends to about 24 inches before the sandy loam is encountered. In a number of places the lower subsoil contains more sand than typical and is more friable than the upper subsoil. Some of the more poorly drained areas are mottled slightly with gray; these areas represent an approach toward the characteristics of the Woodstown soils.

The topography of the Norfolk sandy loam is flat to slightly undulating. The areas generally lie at a lower elevation than the Sassafras soils and higher than the Keyport and Elkton soils where the soils are associated. The type has excellent drainage. It does not have the excessive drainage existing in places on the Sassafras soil, and it rarely suffers from a surplus of moisture, as the Elkton soils do. During dry seasons moisture is generally present in the subsoil.

In this county the Norfolk sandy loam is of little importance agriculturally because of its small extent, the areas being small and scattered throughout the county. Practically all the type is under cultivation. The areas that are still forested support a good stand of oak, hickory, sweet gum, pine, some cedar, and beech, generally with a rather heavy undergrowth of sassafras, holly, myrtle, and smilax. The soil is not as productive as the Sassafras sandy loam, but responds very readily to the application of fertilizers. It is easily tilled and is a fairly early soil. Good yields of corn, wheat, buckwheat, hay, soy beans, cowpeas, potatoes, sweet potatoes, tomatoes, and berries are obtained. Tree fruits do fairly well on this type.

In maintaining the fertility of this soil liberal applications of fertilizer or barnyard manure are essential. The turning under of green-manure crops, such as cowpeas, crimson clover, or rye, is also very important. The application of lime and the systematic rotation of crops should be practiced.

Norfolk sandy loam, deep phase.—The surface soil of the deep phase of the Norfolk sandy loam consists of 8 inches of dark-gray sand or loamy sand. The subsoil is a pale-yellow sand to depths of 26 to 30 inches, where it passes into yellowish or brownish sandy loam extending to 36 inches or more.

In places this phase resembles the deep phase of the Sassafras sandy loam, but as a rule the subsoil is a decided yellow instead of the characteristic reddish brown typifying the Sassafras subsoil.

The topography is prevailing slightly undulating. The drainage is good, and the soil is normally retentive of moisture.

This phase differs essentially from the typical Norfolk sandy loam in that the heavier subsoil material is not so near the surface. Most

of this kind of land occurs in the southern part of the county in close association with the Elkton and other types of the Norfolk.

The phase is handled in the same manner as the typical Norfolk sandy loam. It is an early soil and is responsive to judicious treatment, but does not yield as high as the Norfolk sandy loam. Corn, tomatoes, muskmelons, and potatoes are the principal crops grown.

This soil can be made more productive by liberal applications of barnyard manure and by turning under an occasional crop of cowpeas, crimson clover, or rye. The use of lime with a systematic rotation of crops containing a legume is beneficial.

KEYPORT FINE SANDY LOAM.

The surface soil of the Keyport fine sandy loam is a grayish-brown fine sandy loam, with a depth of about 8 inches. The subsoil is a light-gray heavy sandy loam, somewhat mottled with yellow, to a depth of 20 inches, where it passes into brownish-yellow sandy clay, which grades into a stiff, plastic, heavy clay, mottled yellow and gray, or red, yellow, and gray, the gray predominating.

There are included areas of Keyport sandy loam about 2 miles southeast of Bacons, which consist of brownish-gray sandy loam, 6 to 8 inches deep, overlying gray, yellow, or mottled gray and yellow sandy clay, which passes into stiff plastic mottled gray and yellow clay. In places some red mottling is present in the middle subsoil. In some areas the texture of the soil ranges to a loam, and the subsoil is very stiff and mottled bluish gray and yellowish, and to some extent with red. An area $2\frac{1}{2}$ miles northeast of Delmar has a gray sandy loam to heavy sandy loam surface soil, 6 to 8 inches deep, and a mottled gray and yellow to gray stiff clay subsoil. A small area 2 miles north of Millsboro consists of a layer of brownish-gray to gray sand, 6 to 10 inches deep, overlying pale-yellow or yellowish-gray sand, which at about 24 inches is underlain by reddish-yellow sandy clay, passing quickly into stiff, plastic, heavy clay, mottled red and light gray.

This type is not very extensive. Most of it is in the southwestern part of the county, northeast of Delmar. One area lies about 2 miles north of Millsboro.

The topography is slightly undulating. The stiff plastic subsoil causes the underdrainage to be imperfect, and during heavy rains the crops on this type are sometimes damaged by too much water.

A large part of the Keyport fine sandy loam is under cultivation, being used mostly for the general farm crops. Where it is well drained, excellent results are obtained.

Where this type is not cultivated it supports a rather dense growth of loblolly pine, oak, sweet gum, and black gum, with an undergrowth including holly, huckleberry, myrtle, and smilax.

The Keyport fine sandy loam is generally sold with some more extensive type, which governs its price. When sold alone, the price at the time of the survey (1920) ranged from about \$35 to \$150 an acre, depending on location, improvements, drainage conditions, and condition of the soil with respect to past treatment.

The first step necessary for the improvement of this type is adequate drainage. The addition of organic matter by the use of coarse manure and the growing and occasionally plowing under of crops

like alsike clover, cowpeas, or rye is also essential. Addition of lime may be expected to prove helpful. Applications of 1,000 to 2,000 pounds of burnt lime per acre or twice as much ground limestone have been used on similar soil in the Chesapeake Bay region with good results. Moderately heavy additions of fertilizer or manure will probably be advisable.

The table below gives the results of mechanical analyses of samples of the soil, subsurface, and subsoil of the type:

Mechanical analyses of Keyport fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
190439....	Soil, 1 to 7 inches....	2.1	14.0	12.2	32.1	10.2	17.4	12.0
190440....	Subsurface, 7 to 20 inches.....	1.6	14.4	13.0	33.3	9.3	16.1	12.2
190441....	Subsoil, 20 to 36 inches.....	1.4	16.3	18.6	31.4	5.1	8.7	18.7

KEYPORT SILT LOAM.

The Keyport silt loam is grayish-brown silt loam, about 8 inches deep, underlain by grayish-yellow or mottled gray and yellow silty clay loam, which passes gradually into stiff, plastic clay loam, mottled gray, yellow, red, and brown. The surface dries out to a gray color resembling that of the Elkton, especially in the lower areas. The lower part of the Elkton 3-foot section, however, is often sandy, whereas there is very little sand anywhere in the subsoil of the Keyport silt loam.

A little more than 2 miles northeast of Delmar an area mapped as this type consists of gray silt loam, 8 to 12 inches deep, underlain by gray stiff clay mottled with pale yellow. The lower subsoil here is mottled bluish gray or light gray and yellow with some red in places. A small area of Keyport loam, $2\frac{1}{2}$ miles northeast of Delmar, has been included with the silt loam on account of its small extent.

The Keyport silt loam is not extensive in Sussex County. The largest areas are northeast of Delmar.

The topography is prevailingly flat, and the drainage is not so well established as on the Keyport fine sandy loam. In general it is better drained than the Elkton soils, but not so well drained as the Sassafras and Norfolk soils. The stiff plastic subsoil makes the subsurface drainage inadequate and crops suffer somewhat from excess moisture during rainy seasons.

About half of this type remains in forest and supports a rather dense growth of pine, oak, sweet gum, black gum, some hickory, holly, and an undergrowth of myrtle, huckleberry, and smilax. The cultivated areas are used for the general farm crops, and where drainage is well established fairly good yields are obtained.

This type is usually sold with more extensive types, which govern the sale price. When sold alone, it does not bring as much as the Keyport fine sandy loam. The price of the land depends on the location, drainage, and improvements.

In order to increase the productivity of the soil, the land should be drained, and the crops grown should include legumes, such as cow-

peas, crimson or alsike clover, for the purpose of maintaining the supply of organic matter and otherwise improving the soil. Addition of 1,000 to 2,000 pounds of burnt lime per acre or about twice as much ground limestone would correct the acid condition of the soil. Fertilizer or manure will be required in order to get the very best yields.

WOODSTOWN SANDY LOAM.

The surface soil of the Woodstown sandy loam is a brown to light-brown or grayish-brown sandy loam, with an average depth of 8 inches. The subsoil is a light brownish yellow to pale-yellow sandy loam or heavy sandy loam. Locally the material below 20 inches is a mottled grayish and yellowish sandy clay loam. In places the extreme lower subsoil consists of grayish loamy sand. The surface soil is generally friable and when dry is gray in color. As a rule the lower subsoil is more compact, though containing more sand, and is grayer than the upper part. The Woodstown sandy loam differs from the Norfolk sandy loam in that it is less well drained and has a mottled subsoil. It differs from the Elkton sandy loam in having considerably better drainage, a browner soil, and a more highly oxidized subsoil, resulting in a basic subsoil color of yellow, while that of the typical Elkton subsoil is gray.

Most of the areas of this type are uniform in their characteristics, but there are a few exceptions. About one-half mile north of Frankford, there is a poorly drained area which departs from the type in that the lower part of the subsoil is gray. The type is closely associated with the Elkton soils and as mapped includes some small flats in which the soil is the Elkton sandy loam.

As a rule the Woodstown sandy loam does not occupy large areas. It is an intermediate type between the Sassafras and Elkton soils and it occurs mainly in rather irregular-shaped areas scattered throughout the county. The surface as a rule is level. In places the type occupies slight saucerlike depressions in the Sassafras types; in other places it forms low ridges in the Elkton types; and it also includes flat lands around stream heads.

The surface drainage of the Woodstown sandy loam is only fair, though much better than that of the Elkton types. Most of the areas are situated so that they can be drained artificially very easily. Good results with crops are often obtained without artificial drainage. The soil would be much more poorly drained but for the sandy substratum, which favors the free internal movement of the soil water. The color and structure of the subsoil indicate that the type is much better aerated and therefore in a more favorable condition for plant development than are the Elkton soils.

More than half of the Woodstown sandy loam is under cultivation. The forested areas have a good stand of pine, oak, holly, cedar, and gum, and an undergrowth of myrtle and huckleberry and other shrubs. Maple, birch, wild cherry, persimmon, smilax, and grapevines also appear commonly in the vegetation of this type. The same crops are grown as on the Sassafras sandy loam, and the yields, except in wet seasons, are almost as large as on the latter soil. The soil is handled in the same way as the Sassafras sandy loam, but it is all in need of artificial drainage, whereas the Sassafras is not.

For the improvement of this type the suggestions for the Sassafras sandy loam may be followed. Best results are obtained where adequate drainage is provided. On this type of soil tile drains are more effective than open ditches, although both can be used. Where tile drainage has been installed it has proved very satisfactory. Alsike clover, cowpeas, red clover, and rye can be grown to advantage as soil improvers. Liming probably is necessary for best results. An application of about 2,000 pounds of burnt lime or twice the quantity of ground limestone would not be too much for an initial application. Probably there would be no need of a second application for six or seven years, or even longer. Applications of moderate to large quantities of fertilizer or large additions of manure will be needed in order to obtain the best yields.

ELKTON SAND.

The Elkton sand consists of a gray to slightly dark gray sand, underlain at about 10 inches by whitish sand to coarse sand or a brownish-yellow sand to a depth of 3 feet or more. In some places the subsoil is saturated with water.

The Elkton sand occurs in small to moderate-sized areas, commonly as slight ridges in the Portsmouth or in the other Elkton types and as depressed areas in the Norfolk or Woodstown soils. It is better drained than the heavier Elkton types, but artificial drainage is necessary to make it productive, and the application of lime is essential.

The Elkton sand is not an important type agriculturally. About half of it is cleared and cultivated. Where it is well drained, fairly good yields, considering the sandy texture of the type, are obtained. The important crops are corn, tomatoes, and strawberries. The part not cleared is covered with a mixed forest, including pine, oak, maple, beech, and gum.

The first essential in the improvement of this type is to provide adequate drainage by installing either tile or open drains. The addition of organic matter and the liberal application of lime would prove beneficial. Fertilizer in rather liberal quantities will be necessary for good yields, except where it is possible to make heavy applications of manure.

ELKTON SANDY LOAM.

The Elkton sandy loam consists of a gray, light-gray, or grayish-yellow sandy loam or heavy sandy loam, passing at 3 to 6 inches into gray sandy loam, which changes abruptly into a subsoil of white or light-gray sandy clay, mottled sparingly with yellow. The lower subsoil consists of white sandy clay to sandy loam, mottled with yellow, or a mottled bluish-gray and pale-yellow sandy clay, the sand content increasing with depth. Where the type is associated with the Portsmouth soils, and especially in forest areas, the surface soil for the first few inches is a trifle darker in color owing to a larger admixture of organic matter. When dry the soil is gray to almost white. The soil hardens in dry weather and forms clods when plowed.

In places the lower subsoil ranges from a white, compact, sticky sandy clay or sandy loam, frequently saturated with water, to a stiff, impervious, light-gray or bluish-gray silty clay mottled with rusty

brown or yellow. In places a layer of sand is encountered at about 30 inches, and in some of these the sand contains rounded quartz gravel.

The Elkton sandy loam is one of the extensive types in the county. It occupies rather large areas in the northwestern and southeastern parts of the county and small to medium-sized areas throughout the county. Some small areas of Portsmouth sandy loam and Keyport sandy loam, whose boundaries are very indefinite, are included with this type.

The surface of the Elkton sandy loam is flat. In places the type occupies saucerlike depressions in the uplands, surrounded by higher, better-drained soils. Many of the low areas about the heads of streams and the lands lying between natural drainage ways are of this type. The drainage is poor and the water table generally stands near the surface. Rather large areas of this type have to be drained before they can be successfully cultivated. This is ordinarily done by ditching.

A large part of this type is used for farming; the rest of it is in forest, which in many places is dense. The principal trees are white oak, black oak, willow oak, water oak, black gum, sweet gum, pine, beech, maple, and dogwood, with a thick undergrowth of myrtle, and of huckleberry and other shrubs.

Corn, hay, wheat, potatoes, tomatoes, and strawberries are the leading crops. As a rule the truck crops, with the exception of strawberries, do not do so well on this soil as on the better drained soils. Corn and strawberries yield well. The Elkton sandy loam does not warm up very early in the spring. It is not as easy to handle as the better drained soils, and requires much more care in cultivation. The cultural methods are practically the same as those employed on the better drained soils.

Owing to the generally poor drainage of the Elkton sandy loam, it is not entirely dependable. Crops sometimes drown out during periods of excessive rainfall, and are also affected by droughts. The average yields are somewhat lower than on the Sassafras and Norfolk sandy loams. Where good artificial drainage has been provided, fair to good yields are obtained in favorable seasons.

The value of land of this type, suitable for farming, ranges from about \$30 to \$70 an acre, the value depending on the drainage, location, and improvements. Where it is sold in connection with the better drained soils, higher prices than these are obtained.

The first step in improving the Elkton sandy loam should be the establishing of good drainage. Tile drains are used in some places, but because of the imperviousness of some of the subsoil, open main ditches with open laterals are probably as effective. A number of the natural drainage ways traversing areas of this type are sluggish and clogged by logs and other débris, which greatly impedes the flow. With cooperation among farmers these stream channels could be kept open and deepened, and this would help greatly in carrying away excess water. Until this excess of water is removed, other measures for building up the soil will be much less effective or fruitless. After good drainage is established, good results are obtained by plowing under coarse vegetation and stable manure and by the application of lime. Such treatment will help aerate the soil and neutralize the

acidity prevailing in most of the type. Rotations containing a leguminous crop should be practiced. With careful and judicious handling this soil can be made a reliable and productive type. Liberal use of commercial fertilizers or manures will be necessary in order to get best or even profitable yields.

ELKTON LOAM.

The surface soil of the Elkton loam is a gray to ashy-gray heavy to light loam, which becomes light gray or almost white when dry. The subsoil, beginning at a depth of about 8 or 10 inches, is a light-gray sandy clay or clay, mottled more or less with yellow and occasionally with reddish yellow and having in places a noticeable compactness. In the lower part of the 3-foot section the mottling is usually less intense and the material becomes more sandy, but it is usually plastic, ranging in texture from sandy clay to sticky sandy loam or sand. The subsoil is always moist and sometimes saturated.

The Elkton loam in Sussex County is of small extent. It is mapped east of Hitchens Crossroads and between Georgetown and Rehoboth and in a few small irregular-shaped areas in other parts of the county. It is closely associated with the Elkton sandy loam, and in places small areas of that type are included.

The surface is flat and in places depressed. The drainage is prevailingly poor. Open ditches have been cut in some places and have proved effective.

A large part of the type is in forest consisting chiefly of white oak, willow oak, black gum, sweet gum, maple, and other deciduous trees. Many farmers speak of this type, as well as the other Elkton types, as "white-oak land" and as "pipe-clay land."

The Elkton loam is adapted to the same general crops as the sandy loam and is handled in a similar manner, but on the whole is more difficult to cultivate. Corn in ordinary seasons yields about 15 bushels per acre, wheat 12 bushels, and hay $1\frac{1}{4}$ tons. Where it is not too wet, this type makes good pastures. Land prices range from about \$20 to \$35 an acre, depending on drainage, location, and improvements.

Adequate drainage is essential for the development of the type. Coarse manures and pine straw or hardwood leaves, when plowed under, aid in opening up the soil, and the liberal use of lime improves its physical condition and tends to correct its acidity. Fertilizer or manure are needed for best yields.

ST. JOHNS SAND.

The surface soil of the St. Johns sand is a dark-gray to black sand carrying sufficient organic matter to give it a loamy feel. This is underlain at depths varying from 6 to 18 inches by a compact layer of sand or fine sand having a brown color and granular structure. Where this "hardpan" layer lies near the surface, it is underlain within the 3-foot section by pale-yellow to orange-colored sand, but where it lies at a depth of about 18 inches the brown color extends throughout the 3-foot section. The surface soil when dry has a grayish color. The compact layer of brown material can be penetrated with a soil auger, except in places where the material has the character of semihard rock. This soil is locally known as "iron-mine land."

This type occurs mainly in the southeastern part of the county, although a few areas are in other sections of the county. Because of

the indefiniteness of the boundaries and the similarity of the soils, some small areas of the St. Johns sand were included with the Portsmouth sandy loam in the vicinity of Hickory Hill.

The type occupies low, wet, flat land, is very poorly drained, and is closely associated with the Portsmouth soils.

It is of little importance agriculturally. About one-half of it is under cultivation. The forest areas consist chiefly of pine, oak, gum, holly, with some maple, and an undergrowth of huckleberry and other shrubs.

Practically the same crops and the same cultural methods are used on this type as on the Portsmouth sandy loam, and the yields and land values are about the same.

The main steps to be taken in improving this type are to break up the hardpan and to promote drainage, the application of lime, and the use of fertilizers or manure.

PORTSMOUTH SANDY LOAM.

The Portsmouth sandy loam consists of a very dark gray to black loamy sand to sandy loam, underlain at about 8 to 14 inches by (1) a dark-gray loamy sand which passes at about 18 inches into whitish sand and at about 28 inches into white to bluish heavy sandy loam or sandy clay, or by (2) light-gray sandy loam, mottled in places with yellow or rusty brown, and passing in the lower subsoil into bluish sandy loam to sandy clay.

At a point $1\frac{1}{2}$ miles west of Whitesville the soil is a black sandy loam to loamy sand, underlain at depths varying from 8 to 14 inches by a dark-gray to light-gray sandy loam, which passes at depths of about 20 to 24 inches into white, saturated, compact sand having the nature of quicksand. This area occupies an old field covered with a dense growth of broom sedge, with scattered clumps of bay, myrtle, and blackberries. The substratum consists of a white, compact sticky sand.

The largest areas of Portsmouth sandy loam are in the southeastern part of the county, in the vicinity of Hickory Hill, Dagsboro, Frankford, and Selbyville. Several good-sized areas occur between Georgetown and Ellendale. The type is commonly associated with the Elkton and St. Johns soils and other types of the Portsmouth series.

In the vicinity of Lowes Crossroads some small narrow ridges of Elkton sand and southeast of Frankford some patches of Elkton sandy loam are mapped with the Portsmouth. Small areas of St. Johns sand, in which the hardpan layer appears but is not strongly developed, are included. These occur in the southern part of the county.

The Portsmouth sandy loam occupies flat, poorly drained depressions. Much of the type has been cleared, drained by means of ditches, and put into cultivation.

Corn is the principal crop, and where the land is well drained and cultivated good yields are obtained. Tomatoes, potatoes, and strawberries can also be grown satisfactorily on the better drained areas. Wheat is not so well suited to this type and very little is sown. The forested areas support a dense growth consisting mainly of loblolly pine, post oak, white oak, willow oak, water oak, sweet gum,

holly, beech, maple, and ash, with a heavy undergrowth of bay, button bush, highbush huckleberry, myrtle, laurel, and smilax. Areas that have been cleared but not cultivated support a dense growth of broom sedge.

The Portsmouth sandy loam has very little value for farming until it is drained. The drainage is effected by open ditches. Because of the compactness and imperviousness of the subsoil in places, there is some doubt whether tile drains would be satisfactory. This land is almost always acid, and rather heavy applications of lime are necessary to make it most productive. Fertilizer or manure will be needed after some years of cultivation in order to maintain the yields.

PORTSMOUTH LOAM.

The surface soil of the Portsmouth loam is a black to grayish-black mucky loam. This is underlain at about 6 to 15 inches by a black or gray loam to clay or sandy clay, which passes at about 20 to 30 inches into gray or whitish sand. The surface soil contains considerable organic matter, often giving the soil a mucky or chaffy feel, and locally the soil is sometimes called "chaffy land." The surface soil has an almost jet-black appearance when wet, but much of it dries out at the immediate surface to a grayish black or very dark brown. The subsoil in some places is mottled with yellow or rusty brown. In places the sand encountered at about 24 inches is sticky, in others it is a compact sand saturated with water. In parts of Cedar Swamp the soil consists of black peaty loam, passing at 5 or 6 inches into black mucky loam, and this at 10 inches into black loam, which is underlain at 18 to 20 inches by a pale-yellow to light-gray sandy clay grading downward into white sand.

The most important areas of Portsmouth loam are in Cedar Swamp and about 2 miles south of Frankford on the old Selbyville road. Smaller areas are found throughout the county. The surface is flat, and somewhat lower than the surrounding country. Much of the type is saturated or covered with water during several months of the year, and some pools of water persist throughout the year. There is practically no natural drainage, and in order to make the land of any value for farming it is necessary to dig deep ditches.

The Portsmouth loam that is under cultivation is in small scattered areas and strips bordering the larger areas. Thus the present use of the type is of no great importance in the agriculture of the county. The type supports a rather thick growth of pine, sweet gum, oak, maple, some cypress, and a thick undergrowth of briers, smilax, bay, huckleberry, and gallberry.

In time the type may be canalized and drained. Those parts that have been drained give good yields of corn, potatoes, and strawberries, the yields being in proportion to the thoroughness of the drainage. The liberal use of lime on this type likely would be of great benefit, and fertilizer or manure may be needed after some years of cultivation.

Some small areas of Portsmouth silt loam have been included with the type. The silt loam has a surface soil of about 8 to 12 inches of black mellow silt loam, containing sufficient organic matter to give it a mucky character. The subsoil is somewhat varied in character. It consists of gray sandy clay or silty clay loam, which passes into either a white, compact, sticky sandy loam to sandy clay, or a stiff

bluish-gray silty clay, and is usually saturated with water. Generally the subsoil contains some yellowish-brown mottlings.

The Portsmouth silt loam usually occurs in low saucerlike areas and has very poor natural drainage. The tree growth is vigorous and the undergrowth dense. During the fall, winter, and early spring the type resembles Swamp, for it is commonly covered with 3 inches or more of water. Very little of this soil is under cultivation. Where it is drained, it is as good as the other Portsmouth types.

Portsmouth loam, mucky phase.—The mucky phase of the Portsmouth loam forms a small, but very conspicuous area of muck about 2 miles north of Selbyville.

The soil is composed of black to brown muck grading at depths of about 6 to 12 inches into a muck having the color of coffee grounds. This is underlain at about 12 to 20 inches by a brown to brownish-yellow silty clay or sandy clay, passing in the lower subsoil into gray sand or sandy loam. Scattered through this area are numerous spots of mucky black sand. Clods of this material crumble on drying very much like the buckshot land of the Mississippi bottoms. The dry surface material will burn, so rich is it in organic matter. When dry, it is of very light weight and has a brown color resembling that of peat, but it probably has too much sand mixed with the decomposed vegetable matter to be classed as peat. It is locally known as "chaffy land" and as "sheep-liver land."

The topography is flat. This area is ditched, and when seen during the latter part of May it was very well drained. All of this soil is under cultivation. It is used principally for corn, which gives fairly good yields. It probably could be used successfully for lettuce, onions, and cabbage.

MEADOW.

Along practically every stream in the county there is a narrow strip of poorly drained alluvial soil that extends from the head of the stream to the mouth or to the Tidal marsh. These strips have been mapped as Meadow and Swamp, the areas having the better drainage being mapped as Meadow. The texture, structure, and color of the materials in these areas vary much within short distances. The surface soil is commonly dark gray or brown, contains considerable organic matter, and ranges in texture from sandy loam to silty clay loam. The subsoil is generally brown or light gray, and in places mottled with yellowish brown. The texture of the subsoil varies from sandy loam to silty clay loam. Occasional pockets, lenses, or thin layers of gray, loose sand and gravel appear.

Meadow is of small extent and little agricultural importance. It supports a good growth of trees and a dense growth of underbrush. The principal trees are willow oak, white oak, black oak, sweet gum, alder, maple, birch, and some loblolly pine. The underbrush includes smilax, catbrier or greenbrier, wild grape, and poison ivy. If naturally well drained or if reclaimed by artificial means, Meadow makes good pasture lands. It also produces good crops. Corn and potatoes give the best results. A good part of this land could be brought under cultivation with moderate expenditures for drainage. During the winter months and during wet seasons water now covers most of the areas.

SWAMP.

Swamp comprises low bottom land along the fresh-water streams. It is composed of variable soil materials and is subject to standing water or swampy conditions throughout the year. It occurs in strips along the larger streams of the county, notable areas being those along the branches of the Nanticoke River and Cedar Creek.

The surface of much of the swamp consists of 6 to 8 inches of black muck. In other places it consists of a dark-brown to black sandy loam, loam, or silt loam. This is underlain at varying depths by brownish-gray to light-gray silt loam, clay loam, or sand. Along Pepper Creek northwest of Frankford the soil consists of a dark-brown to black loam, and the subsoil, beginning at 18 to 24 inches, of gray to whitish sand. The subsoil is usually so saturated with water that it is often impossible to bring it up with a soil auger. In a few places a very narrow strip of swamp lies between the Tidal marsh and adjacent higher lying soil types. In most cases these strips are narrow and unimportant, and many of them are not mapped. These strips differ from the Tidal marsh not only in soil material but in being covered with forest growth.

None of the Swamp is in cultivation. Where it is not too boggy, it is used for pasture. Pine, gum, birch, maple, alder, button bush, cedar, and a dense undergrowth of vines and shrubs constitute the vegetation on the Swamp.

TIDAL MARSH.

Tidal marsh consists of marshy land lying near sea level and subject to tidal inundation. The soil material of these areas varies considerably. The surface layer may consist of a dark-brown to bluish-gray oozy silty clay loam or silty clay, in the upper part of which appears a matted mass of roots of coarse grasses and considerable decomposing organic matter. The subsoil is commonly a dark-gray or bluish-gray silty clay slightly heavier than the surface soil. The whole remains saturated the year round.

The largest area of Tidal marsh lies along Delaware Bay in the northeastern part of the county. It also occurs on the lower courses of all the large streams. The surface is uniformly flat and only 2 to 4 feet above low tide. The areas support a dense growth of sword grass, calamus, cat-tails, and various marsh-loving and salt-water plants.

There are a few areas adjacent to or within the typical Tidal marsh that are a trifle higher than the marsh proper and hence not inundated regularly. These have been included with Tidal marsh rather than with Coastal beach. Some of these areas consist of light-colored sand. The grass on these sandy areas is much shorter and sparser than on the typical marsh. In these sandy areas there are many shallow depressions that hold water most of the time.

Agriculturally Tidal marsh has very little value. It can be reclaimed only by diking, which is expensive. In places cattle are pastured on the areas part of the time, and in other places a coarse hay is cut.

Under present economic conditions it is doubtful whether it would be advisable to undertake the comprehensive drainage operations needed for the reclamation of such land. There would appear to be too much available unused farming land elsewhere in the county

to warrant spending very much money on these lands. They have been drained, however, in various places in the Delaware Bay region and successfully used for the production of potatoes, strawberries, corn, and hay. The silty or heavy variation makes better land when reclaimed than the more sandy areas.

COASTAL BEACH.

Coastal beach represents a shore-line strip of sand which is still being added to and reworked by waves, tides, and wind. The soil to a depth of 36 inches or more is a light-gray to almost white, loose, fine sand or medium sand. In some places along the ocean front shell fragments are present through the material.

Coastal beach occupies a narrow strip along the coast and acts as a barrier between the Tidal marsh and Delaware Bay and between the bays and the Atlantic Ocean in the southern part of the county. Along the coast the topography is usually flat or gently sloping. The inland boundary along the marshes and bays is usually rather abrupt and ragged. The elevation is usually from 0 to 10 feet.

In the vicinity of Cape Henlopen an area of Dunesand has been included with the Coastal beach. In color and texture it is practically identical with the beach sand. The difference is in topography, which has been formed by the action of the wind throwing the sand up into ridges and dunes, some of which rise 50 feet above the surrounding country.

Coastal beach is nonagricultural and supports only a thin and scattered growth of stunted pines, shrubs, and some grass.

SUMMARY.

Sussex County is the southernmost county in Delaware. On the east it faces Delaware Bay and the Atlantic Ocean. The land area is 945 square miles.

Three physiographic divisions are developed, the uplands in the northern and west-central parts of the county, the low, poorly drained land in the southeastern and northeastern parts of the county, and the marshes along the bay and ocean.

The county was permanently settled during the latter part of the seventeenth century. An earlier settlement, made in 1631 by the Dutch near Lewes, was not permanent. In 1920 the county had a population of 42,741. The population is fairly evenly distributed.

Railroad transportation facilities are excellent. Concrete roads are being built in all sections of the county and most of the earth roads are kept in fair condition.

The climate is favorable for the production of many general farm and truck crops. The average growing season is 184 days. The rainfall, which averages about 43 inches per year, is well distributed.

General farming is still the main type of farming in the county, although the farmers are giving more attention each year to trucking. The principal crops are corn, wheat, buckwheat, hay, tomatoes, potatoes, sweet potatoes, strawberries, apples, and peaches. The growing of soil-improvement crops is becoming more general. The raising of poultry is an important industry, and hogs are kept on every farm.

A rather intensive system of cultivation is used. The farm machinery is of improved patterns. Crop rotation and the use of commercial fertilizers are general.

The farms are rather small, averaging 76.5 acres, of which about 64 per cent is improved land. In 1920 there were 5,404 farms in the county, and 65 per cent of them were operated by the owners. Land values vary considerably. The lower land adjoining the marshes can be had very cheap, while the land that is highly cultivated, near a shipping point, and with modern improvements, brings a relatively high price.

The farmers are fairly well organized in a buying and selling association.

Forest products are closely linked with agriculture and form an important source of income.

Sussex County lies within the Coastal Plain province, and the soil materials were originally accumulated as marine deposits. The area contains soils of the Sassafras, Norfolk, Keyport, Woodstown, Elkton, St. Johns, and Portsmouth series. The better drained and more retentive types are well suited for the production of truck crops. Most of the soils are easily handled, hold improvement well, and respond readily to judicious treatment.

The Sassafras sand occurs in rather extensive areas. A large proportion of it is under cultivation. It is a warm, rather early soil. Where properly fertilized, sweet potatoes, tomatoes, watermelons, and muskmelons do well. Some corn is grown.

The Sassafras loamy sand is a light loamy sand well suited to the growing of truck crops. About one-half of it is in cultivation. It is not as productive or as valuable as the Sassafras sandy loam.

The Sassafras sandy loam is one of the best soils in the county. Probably 85 per cent of it is under cultivation. It is a good trucking and general farming soil and produces high yields of all crops.

The Sassafras sandy loam, deep phase, is similar to Sassafras sandy loam, except that the depth to the loam subsoil is considerably greater. It is not quite as productive as the sandy loam.

The Sassafras loam is used mainly for general farming and gives good yields of corn, wheat, buckwheat, and hay. It is a little later soil than the lighter types, but is valued very highly for general farm crops.

The Norfolk sand is most extensive east of Dagsboro. About one-half of it is in cultivation. The principal crops grown are sweet potatoes, watermelons, and muskmelons. In order to maintain its productiveness the application of considerable organic matter is necessary. The Norfolk loamy sand occurs north and east of Millsboro. It is better adapted to truck crops than to the general farm crops, although corn is grown rather extensively. It is an early soil and responds readily to good treatment.

The Norfolk sandy loam is not very important because of its small extent. It is well adapted to the production of truck and general farm crops.

The Norfolk sandy loam, deep phase, is mapped in the southern part of the county. It is a type of moderate extent. Properly handled it is good for the production of early truck crops.

The Keyport fine sandy loam and the Keyport silt loam are not very extensive. They are considered fairly good soils for general crops when adequately drained.

The Woodstown sandy loam occurs in all sections of the county. It is in need of drainage, but it is regarded as a productive soil and in dry years returns rather high yields.

The Elkton sand occurs in rather small areas scattered throughout the county. Truck crops appear to do well. It is in need of drainage.

The Elkton sandy loam is one of the most extensive soils in the county, occurring principally within the southeastern part. It is poorly drained. A large part of this type is in cultivation, and where good drainage has been established it makes a good soil for truck crops and general farm crops. Strawberries are grown extensively on this type.

The Elkton loam is found in small areas and is generally farmed like the Elkton sandy loam.

The St. Johns sand is characterized by the presence of a dark-brown layer of the nature of hardpan. About half of the type is under cultivation. This soil is handled and cropped the same as the Elkton and Portsmouth soils.

The Portsmouth sandy loam is a flat, poorly drained soil. Corn is the principal crop, but tomatoes, potatoes, and strawberries, are grown rather extensively on the reclaimed areas.

The Portsmouth loam is low and poorly drained, and most of it is in a semiswampy condition. Very little farming is done on this type. Corn does well where the land is sufficiently well drained to allow cultivation. A small area of a mucky phase of the type, lying $3\frac{1}{2}$ miles southeast of Frankford, has been drained. This is used principally in the production of corn.

Meadow and Swamp are alluvial soils along the streams. These lands are not farmed extensively but have considerable value for pasture.

Tidal marsh includes the extensive salt marshes along the coast and bordering the estuaries which penetrate the inland. It is used for pasture and produces some marsh-grass hay.

Coastal beach comprises the narrow strip of sand along the ocean. It has no agricultural value.

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