

SOIL SURVEY OF THE EASTON AREA, MARYLAND.

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DESCRIPTION OF THE AREA.

The Easton area, including the counties of Caroline, Queen Anne, and Talbot, is situated in the central part of the Eastern Shore of Maryland, between the Chesapeake Bay and the Delaware line, and is included within the meridians $75^{\circ} 40'$ and $76^{\circ} 25'$ west longitude, and parallels $38^{\circ} 30'$ and $39^{\circ} 15'$ north latitude. It is bounded on the north by Kent County and on the south by Dorchester and Wicomico

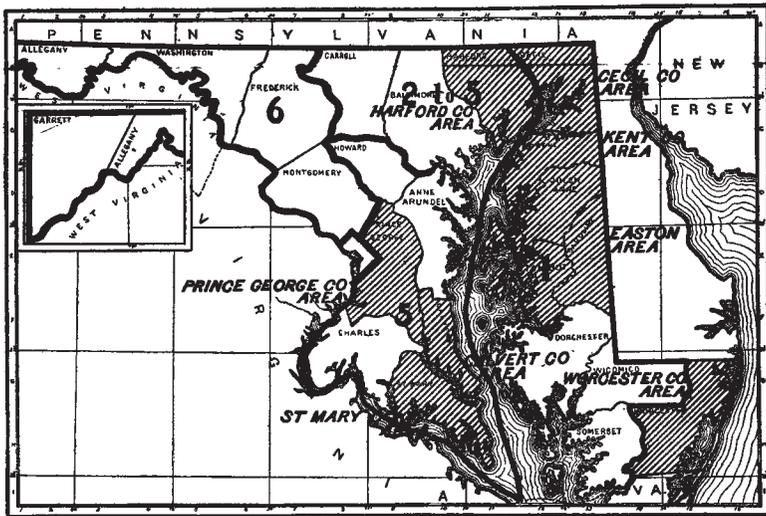


Fig. 3.—Sketch map showing location of the Easton area, Maryland.

counties. Its extreme length from north to south is about 47 miles and greatest width about 34 miles. The total land area is 618,560 acres, or about 967 square miles.

The area lies wholly within the physiographic division known as the Atlantic Coastal Plain. The land surface varies in its topographic features from the nearly flat foreland country bordering the Chesapeake Bay and its estuaries, to the gently and moderately rolling upland plain, including most of the country east of a line drawn from

Chestertown through Queenstown and Easton to Cambridge. Generally there is not an abrupt break between these topographic divisions; the change is more of a gradual rise of the lower division toward the upper plain, the two blending in gentle slopes. However, there is in some places an escarpment of sufficient slope to give rise to considerable erosion. The true lower division lies largely below the 20-foot elevation line and entirely below the 30-foot line. While its surface is for the most part flat, some of it is undulating. This foreland country has been indented by the streams and bays branching off from Chesapeake Bay, which have divided the country into long, narrow peninsulas and islands, making travel by land circuitous. Along the shore of the Chesapeake and its larger estuaries the waves are gradually cutting back the shore line—in some places as much as 20 feet a year—especially where the shore line is precipitous. The eroded material is carried to more protected places and deposited, eventually forming Marsh.

From the very irregular shore line it might be inferred that the foreland country is excessively marshy and unfit for cultivation. Such is far from true, the extent of Marsh being confined to inconsiderable marginal fringes, amounting to 2.5 per cent of the land area. There are in protected places like bays and coves a few exceptionally large bodies of Marsh containing several acres. Bordering the upper sources of the larger streams, like the Chester and Choptank rivers and Tuckahoe Creek, there are marginal strips subject to tidal overflow varying from a few rods to three-quarters of a mile in width. Very few drainage ways reach up into the interior of the foreland plain, thus leaving the flat lands without sufficient outlets for good surface drainage.

The upland plain division for the most part is gently or moderately rolling, and lies well for the use of modern farm machinery. In the northern part of the area elevations of 80 feet above sea level are attained at a few points. Inequalities in the surface configuration become less bold toward the south, changing gradually from the moderately rolling topography in the northern part to the flat and gently rolling country in the southern part, where the highest elevations are about 60 feet. There is a tendency for this upland country to assume more level and unbroken topography toward the interior, where is found a plain more nearly as it existed just subsequent to the emergence of the area. A larger proportion of this interior would be much more poorly drained but for the excellent underdrainage afforded through the porosity of the underlying material. There is considerable country in northern Caroline and eastern Queen Anne counties where the nearly flat surface is interrupted only by low ridges, mounds, and basinlike depressions. Streams have not worked

out good channels in this section, which fact accounts largely for the poor drainage conditions existing in the intervening flat lands.

The channels of main upland streams increase gradually from mere shallow drainage ways near the interior to comparatively deep valleys toward the marginal portion of the upland plain. The sides of some of these are sufficiently steep to have developed, through excessive erosion, a relatively broken surface. Numerous tributaries reach out from the main streams, affording a good drainage system to most of the upland country. The fall of many of the creeks is sufficient to develop considerable power. There are a number of water-power flour mills scattered throughout the uplands. The smaller streams are nearly all bordered by narrow strips of low, wet ground extending from mouth to source in the uplands, where considerable areas of flat, poorly drained land, sometimes semiswampy in character, are found. The larger streams flow very sluggishly in a general northeast-southwest direction.

The Chester and Choptank rivers are navigable to points near the Delaware line. The Tred Avon, Miles, Wye, Back Wye, and Corsica rivers are wide and navigable nearly to the head of tidewater, where they suddenly narrow to small streams which reach comparatively short distances into the uplands.

Talbot County was organized under the provincial government about 1664 and included the present domain of Queen Anne, considerable portions of Caroline and Kent counties, and nearly all its present territory. Later the county was divided, and from it Talbot, Queen Anne, Kent, and Caroline counties were formed.

Active settlement began about the middle of the seventeenth century. The settlers were mainly English, from whom the present population is largely descended. The "toleration act" of 1649 attracted quite a number of religious refugees, among them a considerable number of Quakers from Virginia and New England. Most of these colonists settled within sight of navigable water. Transportation and travel were mainly by water.

The farmhouses and outhouses are quite substantial, and the fields are effectively fenced with wire or osage-orange hedges. Churches and schools are conveniently located. The highways are excellent in summer and good in winter over most of the area surveyed.

The largest towns, Easton, Centerville, and Denton, are the respective county seats of Talbot, Queen Anne, and Caroline counties. There are many other important towns and shipping points throughout the area. The Easton area is exceptionally situated with respect to large markets. From Easton, in the southern part, Baltimore is distant only forty-odd miles by water, while Philadelphia and New York, respectively, are 108 and 198 miles distant by rail, over the

Pennsylvania Railroad. This railroad furnishes the transportation facilities by land for the entire area. Various steamboat lines are accessible from almost any part of the survey, and many freight-carrying sailing vessels ply between the various landings and Baltimore.

Throughout the area there are numerous canning factories, well situated near railroad stations and boat landings. It is estimated that Caroline County alone furnishes 10 per cent of the total tomato pack of the United States. These factories vary in their output from a few hundred cases of tomatoes to about 100,000 cases a season, besides the heavy packs of garden peas, corn, and pears.

CLIMATE.

The appended tables giving the records of weather observations at Easton, near the southern boundary, show a mean annual precipitation of 40 inches for that section. Records of the State weather service indicate variations in the precipitation of the upland country from 39 to 41 inches, and a somewhat higher average for the low foreland division. Rainfall is fairly well distributed throughout the year, although there is slightly more during the summer months of June, July, and August, the average for these months being about 12 or 13 inches. For other seasons the average is approximately 10 inches. The spring of 1907 was unusually wet, and corn planting was delayed about a month. Dry periods in the late summer and fall sometimes bring about a hardened condition in the soil which interferes with the preparation of the land for wheat.

There is very little variation in temperature between the northern and southern sections. There is some moderation in temperature along the water front, where early vegetables are sometimes grown. The mean annual temperature at Easton is about 55° F., while that at Chestertown, just outside the area to the north, is approximately 54° F. The temperature for January and February averages 33° F. and 32.5° F., respectively, and for July the mean is 76° F. In the winter months brief cold spells occur when the zero mark is reached, while in summer the temperature is occasionally 100° F., although rarely going higher than 95° F. The maximum range of temperature at Easton is about 115° F.

The last killing frost in spring occurs usually between the 1st and 20th of April, and the first in fall about the last of October. Early strawberry blossoms and fruit-tree buds, particularly the peach, are likely to be damaged from late spring frost, and sometimes the late tomato crop suffers.

The ground rarely freezes to a depth of more than 6 to 8 inches. Winter crops on the mellow Portsmouth soils, particularly wheat,

are liable to injury on account of the heaving of the surface soil during alternate freezes and thaws. The heavier soils, in particular the Elkton silt loam, frequently are crumbled by alternate freezes and thaws and after rains form a hard, compact, smooth surface. Beyond these tendencies such favorable conditions prevail in the soils during the winter that remarkably little damage is done crops.

During the winter the prevailing winds are from the northwest and north, while in summer the winds blow more often from the south and southwest.

Normal monthly and annual temperature and precipitation.

Month.	Easton.		Chestertown.		Month.	Easton.		Chestertown.	
	Temperature.	Precipitation.	Temperature.	Precipitation.		Temperature.	Precipitation.	Temperature.	Precipitation.
	° F.	In.	° F.	In.		° F.	In.	° F.	In.
January.....	33.3	2.92	32.0	3.14	August.....	74.9	3.60	73.9	4.99
February....	32.9	3.93	31.4	3.14	September...	69.0	3.00	67.9	3.63
March.....	43.6	3.53	42.5	3.73	October.....	57.2	3.22	55.9	3.00
April.....	53.2	3.05	51.3	3.63	November...	45.6	2.49	45.2	2.75
May.....	63.9	3.34	63.0	2.89	December....	36.4	2.99	35.3	.....
June.....	71.5	3.87	71.2	4.01	Year....	54.8	40.44	53.8	.....
July.....	76.5	4.50	76.0	4.34					

Dates of first and last killing frosts.

Year.	Easton.		Chestertown.		Year.	Easton.		Chestertown.	
	Last in spring.	First in fall.	Last in spring.	First in fall.		Last in spring.	First in fall.	Last in spring.	First in fall.
1898.....	Apr. 28	Oct. 28	Apr. 28	Oct. 28	1902.....	.....	Oct. 22	Apr. 4	Oct. 21
1899.....	Apr. 6	Nov. 13	Apr. 11	Oct. 22	1903.....	Feb. 27	Oct. 28	May 1	Nov. 7
1900.....	Apr. 11	Nov. 15	.....	Nov. 14	1906.....	Apr. 3	Oct. 13	May 11	Oct. 12
1901.....	.....	.....	.....	Nov. 21	Average.	Apr. 3	Oct. 3	Apr. 23	Oct. 31

AGRICULTURE.

Since its earliest settlement the Easton area has been preeminently agricultural in its pursuits. In the early days little more corn and wheat were produced than sufficed to supply the wants of the colonists, and in unfavorable seasons there were periods of distress from short crops.

At first tobacco was grown almost to the exclusion of other crops, and was long the medium of exchange. There were six tobacco warehouses in Talbot County in 1775, but with the beginning of the nineteenth century the tobacco acreage had enormously decreased, and warehouses were little used. The larger planters shipped their tobacco to England, but the smaller planters traded with the local

representatives of English houses. Warehouse receipts representing the quantity of tobacco stored, like tobacco, passed as money.

The Revolutionary war hastened a change in agriculture by cutting off the export trade with the mother country and creating a demand for cereals to feed the Provincial army. Prior to this, however, farmers had begun to realize that their lands were being impoverished by cultivation to one crop and were increasing the acreage of wheat. Clover and timothy were coming into favor and were rotated with cereals. It was about this time that the present three-field system of cropping appeared. Flax was grown for the fiber until some time before the civil war. Sweet potatoes have been produced on a small scale since the earlier days. Peaches began to be a crop of considerable importance about sixty-odd years ago. Cultivation of tomatoes for canning purposes began about 1872, when one of the first canning establishments was put up at Greensboro. Rye has never been an important crop, though a few thousand bushels were grown annually for a time in Caroline County.

From 1859 the production of oats decreased until 1879, since when the crop has not had an important place in general agriculture. This crop too often has suffered from unfavorable weather conditions in June and July, filling out poorly.

The production of wheat has increased steadily and on a fairly profitable basis in spite of western competition. The total yield for Caroline, Queen Anne, and Talbot counties in 1849 was 498,845 bushels, while in 1879 Talbot County alone produced nearly as much as this and in 1899 the total for the three counties was 2,150,460 bushels, Talbot County leading with over 800,000 bushels. Owing to more thorough preparation of the seed bed and to the freer use of manures there has been a marked increase in the average yields of wheat within the last twenty-five years.

Corn also has shown a steady increase. The production in 1849 for the three counties was 1,656,659 bushels. By 1879 it had increased to 2,139,680 bushels and in 1899 to 2,610,940 bushels. Of this total Queen Anne County produced nearly one-half.

The value of live stock increased from \$900,312 in 1849 to \$1,744,589 in 1879. In 1899 the value of live stock was \$579,514, \$1,049,553, and \$759,581 for Caroline, Queen Anne, and Talbot counties, respectively.

Fertilizer expenditures varied from \$87,548, \$158,977, and \$110,001, respectively, for Caroline, Queen Anne, and Talbot counties in 1889, to \$93,290, \$130,330, and \$89,040, respectively, for the same counties in 1899. The decreased expenditures, as shown for Queen Anne and Talbot counties, mean rather a decrease in the quality and price of material than any decrease in quantity. It appears that the quantity used has steadily increased since the introduction of this class

of fertilizers following the civil war, and the indications are that in quantity, at least, there will be no marked decrease in the near future.

There were very few large plows in the area prior to the early seventies. Up to that time ridging for corn had been the practice. Since the introduction of the large chilled plows the practice has largely disappeared and the soils have been prepared deeper and more thoroughly. The three-field system, corn, wheat, and grass, had been the prevailing rotation up to the time of the introduction of this plow. The farmers are slowly growing less corn and wheat and practicing more diversification. More stock is being raised, more grass and forage crops grown, and more corn cut for shredding. The heavier, better drained soils are so well adapted to wheat that the crop continues to hold an important place. Farms are gradually being reduced in size, a fact which in itself points toward more intensive methods of farming.

At present the dominant system of agriculture practiced over a very large proportion of the area is general farming in connection with more or less trucking. On most farms situated within 4 or 5 miles of a cannery or boat landing, tomatoes are grown as an important crop, and often sugar corn, garden peas, and pears are grown for canning, while peaches, pears, asparagus, strawberries, and dewberries are grown for market. In the vicinity of Ridgely trucking is equally as important, or even more so, than general farming.

There are no farms devoted exclusively to dairying, although a number of farmers sell milk at the local markets or at the few creameries. A small number of the farmers are using separators, selling the cream to the creameries or shipping it and feeding the skimmed milk to hogs.

Hogs are raised to supply the home and local market demands. Poultry and sheep are considered important additions to general farming, especially in certain localities like Kent Island. Most of the draft animals are raised on the farm.

Of the total acreage of land cultivated to crops in Queen Anne County, about 55 per cent is seeded to wheat and 35 per cent to corn, with grass and miscellaneous vegetables next in importance, in the order named; in Talbot County about 60 per cent of the cultivated area is seeded to wheat, about 25 per cent to corn, and the remainder to grass and miscellaneous vegetables, principally tomatoes; and in Caroline County about 40 per cent to corn, 35 per cent to wheat, and the remainder about equally divided between miscellaneous vegetables and grasses. About 65 per cent of the total acreage cultivated to miscellaneous vegetables is used for tomatoes. The bulk of this crop is sold to local canneries, although a considerable quantity is

shipped by boat to outside canneries. Most of this season's crop (1907) is contracted for by the local canneries at about \$9 per ton. The variety most generally grown is the Stone—a medium large, uniformly ripening, prolific variety, possessing the red color and fleshiness desired for canning purposes.

Considerable quantities of garden peas, sugar corn, and Kieffer pears are handled at the canneries. The Kieffer, the most successful pear grown, and a wonderful producer, is better suited to canning than marketing. Strawberries, raspberries, and dewberries of excellent quality do well on the lighter soils. Strawberries grown in the vicinity of Ridgely have a good reputation in northern markets. The crop proves immensely profitable in years of short crops of strawberries elsewhere, and on the average a good margin of profit is realized. The Lucretia dewberry proves very successful, especially on the lighter soils of Caroline County. Wild huckleberries thrive on the light soils and considerable quantities are gathered for market. Good sweet and Irish potatoes are obtained on the light types. A dry, mealy sweet potato of good keeping quality is grown in Caroline County on a small scale for marketing.

For many years the peach crop was very profitable throughout the area, but owing to ravages of disease, particularly the "yellows," the industry has declined. The trees, unless diseased, make a rapid growth and produce abundantly in favorable years. Some orchards have not been injured—those near the water front seem especially resistant to disease. The crop is yet of considerable importance and orchards are still being set out, perhaps more generally in Caroline County than elsewhere. The Elberta appears to be the favorite variety at present, although numerous varieties are grown. Farmers should watch their orchards closely and burn, root and branch, every tree as soon as the first indications of the "yellows" are noticed. Some good varieties of summer apples are grown for home use. Of the late varieties the Winesap, Ben Davis, and York Imperial have proved well suited to the soils and climate. It is believed that the Stayman Winesap, which is being successfully grown on similar soils in Delaware, would prove a profitable variety on the Sassafras loam and sandy loam. Scarlet clover is grown as a soil renovator and occasionally for seed. More cowpeas should be grown for seed, especially on the lighter Sassafras soils.

Notwithstanding that the better crop adaptations of soils are pretty clearly understood, there is too little specialization to accord with soil variation. Farmers everywhere recognize that the Elkton silt loam is a poor corn and tomato soil, though a fair soil for wheat and grass, yet all these crops are indiscriminately grown on it. Although average yields of corn on this type are poor, in favorable seasons the crop does well, and it is with the expectation of such a season

that farmers put in a considerable acreage every year instead of increasing the acreage of wheat and grass and keeping more stock.

The Sassafras loam and silt loam are admirably suited to wheat, corn, and grass, while the Sassafras sandy loam averages excellent yields of these crops. An inferior quality of wheat—small kernels—is expected on some of the poorer drained phases of these types. It is claimed, however, that the quality of that grown on the Elkton and Portsmouth soils is generally very good. Tomatoes do best on the Sassafras sandy loam, although the Sassafras loam makes good average yields, while the Sassafras silt loam makes a fairly good late crop. In growing tomatoes for canning there is no particular purpose in getting an early crop, except to head off frost. The canneries begin in August and run until the crop is canned. Strawberries and dewberries do best on the Sassafras sandy loam, Portsmouth sandy loam, and Portsmouth loam, and these types when available are generally selected for these crops. The Sassafras sand and loamy sand are particularly suited to garden peas, asparagus, turnips, early tomatoes, and Irish and sweet potatoes. Cultivated chestnuts do well on these soils.

The clovers do best on the better drained heavy soils. Red clover frequently dies out and is being replaced by crimson or scarlet clover and alsike. Timothy does well on the heavier soils, but should be grown in rotation with other crops. The well-drained, heavier Sassafras soils produce good crops of alfalfa. The subject of crop adaptation is taken up more in detail under the heads of the different soil types.

While most farmers practice some system of rotation, there are others who grow corn or wheat on the same land several years in succession. Under this treatment some of the fields have decreased in yield, but only a small proportion of the area has been subjected to such injudicious treatment.

The prevailing schemes of crop succession—the old three and five field systems—are very well suited to the Sassafras loam, sandy loam, and silt loam, which types constitute about 70 per cent of the cultivated acreage. These systems include the following rotations: Corn, wheat, and grass for the three-field system, and corn, wheat, grass, wheat, and grass for the five-field system. The grass consists of timothy and red clover or timothy alone, and is usually cut once and then left for grazing. Tomatoes fit in well after corn and are followed by exceptionally good yields of wheat on account of the excellent physical and moisture conditions induced in the soil by the shading of the vines and the good manurial properties of the vines and refuse fruit. It is estimated that wheat following tomatoes or a timothy-clover sod will yield an average of one-third more than if it follows corn. Tomatoes do not do so well after tomatoes. Rotations on all the types

except, perhaps, the Portsmouth soils, should include crops of cowpeas or clover to be turned down green in conjunction with applications of 25 to 50 bushels of lime per acre once every three to six years, according to the condition of the soil and its power to retain organic matter. On account of the more thorough aeration of the lighter types, like Sassafras sand and loamy sand, the organic matter is likely to be depleted rapidly owing to rapid oxidation, and it is therefore necessary to grow frequent crops of cowpeas, but not so much lime is required as on the heavier soils. Good results are secured by liming grass in the fall preceding breaking for corn or wheat. Direct applications of lime to grass should be light (20 bushels to the acre), for the reason that too rapid decomposition of the turned-under vegetation results from large applications. In case large amounts of lime are used, the applications should be made to the broken soil so as to keep the lime from direct contact with the vegetable matter. A good many farmers are beginning to sow cowpeas or crimson clover in corn or crimson clover in tomatoes at the last cultivation, turning these under before planting wheat. The practice of turning under green crops obtains more generally throughout Caroline County than anywhere else in the area. Here the practice has proved invaluable in building up the soils, both in connection with general farming and trucking.

Much trouble in getting good crops by employing the old method of seeding red clover on wheat in late winter is experienced. The young, tender plants, suddenly exposed to hot sunshine by cutting off the wheat close to the ground, seem to be unable to withstand the change and gradually die out. In seasons with plenty of moisture and no protracted hot spells succeeding harvesting, good crops are secured. Contrasting the clover yields obtained in the earlier days by sowing with wheat, and the good crops now obtained on the newly cleared peach orchards, with the crops obtained on other soils, it appears that the latter may have come into an unhealthy condition with respect to this crop. However, with an increased yield of wheat and consequent heavier growth and denser shading, the young plants are crowded nearer together and probably are less strong upon removal of the grain than formerly was the case. Some attribute the failures to toxic effects coming from continued use of acid-phosphate fertilizers. On the other hand there are many instances where good crops have been secured by seeding alone in the fall on thoroughly prepared limed ground. Many farmers claim they have no trouble in getting good crops by liming after breaking sod land, sowing wheat, topdressing with good barnyard manure, and then sowing the clover on the wheat in late winter or early spring. Scarlet clover can be grown with ease on most of the types, but the hay is not considered as good as red clover hay. Cowpeas can be grown on all soils, even

those too light for crimson clover, and always improve the land, whether cut, grazed off, plowed under, or left as a winter cover crop. Alsike clover, which is rapidly coming into favor, will prove a valuable crop for this region. By growing cowpeas land too light for clover can be brought up to good condition for that crop.

Large quantities of commercial fertilizers are used. Fertilizers used for tomatoes, potatoes, asparagus, and corn average about \$17 a ton in price and vary considerably in analysis, running generally from a "10-5" phosphate potash to about a "8-2-4" brand:

As a general rule, readily soluble, "quick-acting" fertilizers which produce an early growth and early ripening of the crop are most desirable. If nitrogen is needed, nitrate of soda is perhaps the best form in which it can be applied. It acts quickly but not through a long period, and for that reason is very desirable where short-season crops are concerned. In many cases it is found an advantage to apply the nitrate at two periods rather than all at once. It is well to make one application when the plants are set in the field and a second about the time the fruits begin to color. Fertilizers containing nitrogen in a slowly available form, such as cotton-seed meal or coarse, undecomposed stable manure, which do not stimulate an active growth until late in the season, are not desirable for this crop. Such fertilizers are too slow for a short-season crop like the tomato, which needs something to stimulate it at the very time it is transplanted to the field. Such fertilizers also tend to stimulate late growth of vine at the expense of the maturity of the fruit. Potash and phosphoric acid are more conducive to the development of fruits than is nitrogen, except in the form of nitrate of soda.

Heavy dressings of stable manure tend to produce too much vine, and are seldom or never employed. If stable manure is used it is at a moderate rate, usually not more than one or two shovelfuls to a plant. This, if well decomposed and thoroughly incorporated with the soil, is very stimulating to the young plant and consequently very beneficial.

Any fertilizer used should be applied, in part at least, at the time the plants are transplanted to the field.^a

Fertilizers for wheat and grass vary in cost from \$12 to about \$18, averaging in composition about "9-1-2." Very little sodium nitrate is used. Kainit is used frequently on the Elkton soils to prevent "frenching." About twenty years ago considerable "black residuum" was used to prevent "frenching," and it is claimed with good results. This material, composed of charred leather, undecomposed scrap iron, and traces of muriate of potash, the residuum left in the manufacture of potassium prussiate, probably improved the structure of the soil and acted as an absorbent. It is said that phosphates help ripen crops and even force out a large number of "underlings" or stool stalks.

Fertilizers are applied at the average rate of about 300 pounds an acre for wheat, 200 pounds for corn, and 400 pounds for tomatoes. Heavier applications are made for crops like asparagus, garden peas, etc. Although commercial fertilizers are not as generally used for corn as for wheat, the bulk of barnyard manure is used for corn.

^a Farmers' Bulletin No. 220, p. 12.

Experience of the most successful farmers shows that fertilizers are more lasting and beneficial when applied in conjunction with vegetable manure. Nitrogen, the most expensive ingredient of fertilizers, should be secured by growing cowpeas and clover, which crops gather atmospheric nitrogen through the action of bacteria living in the root nodules of these legumes. Alfalfa also stores up nitrogen in the soil. Too little home mixing of the fertilizer ingredients is done. Farmers generally buy from agents for future delivery.

Barnyard manure is the best fertilizer for general use on the soils of this section. Moderate amounts are made by using wheat straw as bedding material, though generally not enough to cover the land intended for corn. Considering the excellent quality of this form of manure and the ease with which heavy yields of forage crops can be produced, it seems strange that stock raising has not been carried on on a more important scale. A large extension of the stock industry undoubtedly would prove profitable. It should be the object to feed the bulk of corn and increased quantities of hay and forage crops to stock, carefully preserving the manure and returning it to the land. By establishing more cooperative creameries at convenient points throughout the area, butter making could be introduced on a profitable and permanent basis.

Farmers frequently claim that the soils are not well enough adapted to grass for profitable dairying. The yields of hay from the heavier types—from 1 to 2½ tons per acre—compare favorably with those of some of the most prosperous butter-making sections, and further, there could not be found anywhere soils better adapted to forage crops. It is not necessary to have a large acreage of pasture land where such yields of these can be secured. Silos, a comparatively small acreage of mixed grasses for pasturage, and a large acreage in cowpeas, clover, sorghum, timothy, etc., would solve the problem of feeding.

For wheat, breaking begins on stubble and sod land in late July and in August, and "corn land" is broken as soon as the crop can be removed. After breaking to a depth of 4 to 6 inches with a walking moldboard plow drawn by two or three horses, according to soil conditions, the ground is rolled with heavy iron rollers, then run over several times in opposite directions with spike-tooth and spring-tooth harrows and occasionally with a smoothing, an acme, or a disk harrow, then rolled again and seeded. It is a good idea to get the soil sufficiently pulverized for a hoe-drill to do good work, although it is not necessary to use this kind of a drill. Sometimes farmers get behind to such an extent that there is not sufficient time for giving corn land thorough preparation. Fairly good results are obtained by simply disking and seeding. Such land, however, is more inclined to run together and harden the following spring.

Most of the wheat crop is put in during the first half of October, although seeding sometimes begins as early as the middle of September and continues up to about the 1st of November.

Land for corn is plowed to an average depth of about 5 inches, rolled and prepared about as for wheat, then planted in checks, generally between April 20 and the middle of May. The heavier soils could be put in better condition by breaking in the fall, so as to expose the soil to the action of freezes and thaws. Especially is this beneficial for sod that has been packed by grazing or is in an unfavorable structural condition through depletion of its organic matter. However, such fall preparation for corn sometimes conflicts with the seeding of wheat and care of the late crops of tomatoes. Corn is cultivated comparatively deep the first two or three times with a "buggy cultivator" or walking cultivator, then shallower with a walking cultivator. This frequent flat cultivation is sufficient for all needs of the crop. There is a custom of cultivating every other middle in going over a field after surface roots begin to form. The object is to avoid retarding growth by leaving one-half the surface roots uninterfered with until those in the cultivated middle have time to recuperate. Corn is either cut and shocked in the field or stripped of the lower blades and topped, leaving the ears to be pulled. The wide corn-shock rows are sometimes seeded to oats in late winter or early spring. Very little wheat is stacked, thrashing being done from the shock.

Tomato land is prepared and the crop cultivated about the same way as corn. The general plan is to set the plants close enough to allow them to mat and completely shade the land, thus protecting the soil and fruit from the hot sun. Fall plowing would be the better plan, except on the Sassafras sand and loamy sand. Strawberries are cultivated in matted rows. The middles are cultivated shallow in July or August, while weeds and grass are removed by hoeing and by hand.

Whenever possible fall plowing should be practiced for all crops on all soils, except the Sassafras sand and sandy loam, which would not be particularly benefited except by turning under vegetable matter. The depth of plowing should vary and should be generally increased to 7 to 10 inches, care being taken not to increase the depth more than an inch or two in one season. When more than this amount of the under soil is turned to the surface injury is sometimes done succeeding crops, owing to the fact that the lower soil or subsoil does not have time to weather out and get in good condition during winter. This is especially true with the Elkton soils and the poorer drained phases of the heavy Sassafras types. There are instances where suddenly turning up a large quantity of the subsoil has injured land for years. The depth of plowing should not be increased materially

in the spring with the intention of growing a crop that season. Applications of lime immediately following deep plowing hasten improvement in the exposed subsoil material.

Farm hands hired by the month are given \$15 and board. It is believed the tomato industry would be considerably extended were day laborers more numerous. A good many Bohemians and Poles from Baltimore work in canneries. Labor-saving machinery is helping to solve the labor problem, as the land is well suited to such modern machinery as wheat and corn harvesters, sulky and gang plows, manure distributors, wide harrows, etc. An extension of stock raising and a reduction of the acreage of those crops that require the most labor would make the problem still simpler.

About 55 per cent of the farms of Caroline County, 50 per cent of those of Talbot County, and 40 per cent of those of Queen Anne County are operated by owners, the remainder being cultivated largely by share tenants. The share tenant pays one-half the fertilizer and seed bill and receives one-half of the crops. Land is rented for one year. Landlords generally have a voice as to the acreage that shall be planted to different crops. Wheat and corn are by agreement more exclusively planted. Too often the grass area is restricted and the number of stock kept too limited for the production of a reasonable quantity of manure. A considerable number of rented farms could be managed more providently with respect to soil improvement. This is sometimes neglected, owing to the lack of interest on the part of the tenant or because the landlord is too interested in immediate returns in wheat or corn. The average size of farms in 1899 was about 100 acres for Caroline County, 137 acres for Talbot, and 153 acres for Queen Anne. The price of land has increased considerably in the last fifteen years. Acreage valuation varies widely—from \$30 to \$60 for average farming land—according to the character of the soil, state of improvements, and locality. Land can be bought at lower figures on some of the poorer drained or deep sandy soils not within easy reach of shipping points, while, on the other hand, some of the water-front and suburban farms can not be bought at \$100 an acre. The price of land has often been influenced by the price of wheat and corn.

SOILS.

The superficial geology of the region is comparatively simple. The two main topographic divisions previously described as the lower foreland and the upland country comprise, respectively, the Talbot and the Wicomico plains, geologic terms applied to the younger and older series of beds of unindurated materials from which all the soils of the area have been derived. These divisions belong to the Columbia group of Pleistocene deposits, and their ele-

vation to the present altitude above sea level is comparatively recent in a geological sense.

The chief soil-forming materials of both the Wicomico and Talbot formations are sand and silt, the latter being made up of soil grains ranging in sizes between very fine sand and clay. The former is the dominant constituent of all the Caroline County soils and those of the contiguous northeastern part of Queen Anne County. Silt is the most prominent constituent in the soils of the "necks" and foreland country and of many areas, especially the flat stretches, in the uplands west of the Choptank River.

The underlying or substratum materials usually consist of sand or sand and gravel much coarser than the constituents of the overlying mass. Below a depth of about 3 or 4 feet such beds of coarse material frequently alternate or are interstratified with beds of silty clay, fine sand, coarse gravel, etc. In some sectional exposures there are exhibited alternating strata of various thicknesses—from thin seams to 2 or more feet—presenting great variety in texture and color. At Downes Landing, in Tuckahoe Neck, in a vertical exposure of about 15 feet, there can be seen some twenty distinct strata, which separately include silty clay, clay loam, silt loam, coarse, medium, and fine gravel, coarse, medium, and fine sands, sandy loams, fine sandy loams, and gravel and sand mixtures, covering nearly the whole range of soil classes. Cross bedding and interstratification is common in those substrata where sand is the chief constituent, as is shown in a section near the Baltimore, Chesapeake and Atlantic depot at Hillsboro. The character of these lower materials does not, as a rule, affect the character of the soil, except as regards drainage conditions.

The source of most of the superficial material undoubtedly is the glaciated region and the region of crystalline rocks to the north. The sand does not have the appearance of being an old sand; it has not suffered an extreme degree of weathering. The quartz grains are subangular or much less rounded, generally, than the worn grains of some of the older Norfolk sand of the Coastal Plain region to the south, and minute mica flakes, grains of feldspar, magnetite, and fragments of dark-colored rocks are fairly abundant. Erratic boulders occur here and there in northern Queen Anne County, decreasing in number toward the south.

The silt deposits have a marked resemblance to some of the loess of the Mississippi Valley, particularly in structure, texture, and color. This material is of common occurrence at all elevations, but east of the Choptank River it loses its identity as a stratigraphic unit, being simply a component of the more abundant coarser soil material. There is very little silt in the deep sand deposits that occur along the east banks of the river and larger creeks, but as the distance from the streams increases the silt content of the soils increases.

Erosion, weathering, and drainage have been the most potent factors in the modification of the original material. The rate of erosion has been restricted in a large degree by the general slope of the surface and the original heavy forest growth. Except in case of stream alluvium and the hummocky soils in the region of northern Caroline County, where there are evidences of soil movement through the agency of wind, erosion has been limited to a comparatively slow movement or gentle shifting of the superficial materials in the direction of the surface slope. The finer materials are moved faster than the coarser ones, and therefore a tolerably definite relationship exists between the soils and the topography. The lighter soils are found on the slopes, while the heavier soils occur in the more nearly level areas; but the transition from one type to another is always a gradual one. On broad areas of comparatively level land, where little or no surface wash has taken place, the texture has been determined by the character of the originally deposited material.

The various types are quite regular in profile, uniformity of texture, and structure, irrespective of topography or geological relationship. Generally, the surface foot carries more coarse material and is not as compact as the portion between 12 and 30 inches, and the section below 30 inches is much coarser and more open than the overlying mass. The brown color of the soil and the reddish-brown or reddish-yellow colors of the subsoil tend to give way to grayish in the soil and more nearly yellow in the subsoil toward the south.

Wherever topography and texture have combined to insure good natural surface and underdrainage, the iron content has reached a higher degree of oxidation and the soil grains have been stained brown, reddish yellow, or reddish brown. These colors in the soil and subsoil invariably indicate that condition of mineral and organic constituents which may be considered the normal state of a good, productive soil in this region. Such thoroughly aerated and oxidized soils have very few if any undesirable chemical or physical properties and are well suited to general farming. All the soils of this character have been grouped in the *Sassafras* series. They are the most productive and easiest managed soils of the area.

Where more or less swampy conditions have prevailed, decaying vegetable matter has accumulated, usually in sufficient quantity to form an appreciable part of the soil mass. As is common in such wet, boggy places, the accumulated vegetable matter is very black and occurs in varying stages of decomposition, from slightly changed to well decayed, mingled with earthy material, so as to make a sponge-like mass. Under natural wet conditions such soils are unsuited to most cultivated crops, but owing to the fact that the organic-matter content is otherwise in good condition, drainage only is required to bring these into good crop-producing soils. Owing to the saturation of the subsoil, air has been excluded and naturally this lower mate-

rial is in an unoxidized condition not very unlike that obtaining in the deeper portion of the Elkton soils. These black soils have been assigned to the Portsmouth series.

In those wet and depressed areas where the surface drainage, and generally the underdrainage, has been imperfect, the original material, subjected to intermittent wet and dry stages, has undergone unfavorable structural and chemical changes; the organic matter, though considerable in amount, is in an unfavorable condition, and the soils have turned almost white in color. Through lack of aeration the finer particles have combined rather than granulated, forming a compact, clammy mass. The absence of brown and red colors shows the iron to be in a low state of oxidation. These abnormal processes of weathering have combined to veil the properties of the original material and to bring about changes unfavorable to the development of a good agricultural soil, giving rise to the distinct series of Elkton soils. These Elkton soils stand between the Sassafras and Portsmouth soils as a transitional series that has been derived from the same material but subjected to different processes, or rather abnormal processes, of weathering.

In this series grouping of the soils according to their most prominent characteristics of color, drainage condition, organic-matter content, productiveness, structure, etc., no account has been taken of the textural differences due to the various sizes or grades of the constituent soil grains. However, to assist in a more specific and clearer treatment, the several series have been divided into classes—sands, sandy loams, fine sandy loams, loams, silt loams, etc., according to their respective textures or relative content of coarse, medium, and fine sand, silt, and clay, as shown by mechanical separation and weighing of the various constituents of representative samples.

The following classification shows the soils of the area grouped according to processes of weathering or alteration in the original marine sediments:

	{	Sassafras gravelly loam.
		Sassafras sand.
Soils formed under good drainage conditions.....		Sassafras loamy sand.
		Sassafras sandy loam.
		Sassafras fine sandy loam.
		Sassafras loam.
		Sassafras silt loam.
Soils formed under intermittent wet and dry drainage conditions.....		Elkton sandy loam.
		Elkton loam.
		Elkton silt loam.
Soils formed under swampy drainage conditions.....		Portsmouth sandy loam.
		Portsmouth loam.
Unclassified alluvium and semiswampy upland.....		Meadow.
Alluvium subjected to tidal overflow.....		Tidal marsh.

The local names of soils have been brought out in their proper relationship to the several types in so far as these names are sufficiently definite to admit proper correlation in this detailed soil classification.

The Sassafras soils are confined largely to the upland plain, although several members of the series occur in small areas in the lower foreland. The Portsmouth soils are confined almost entirely to the uplands, and principally in northern Caroline County and the bordering portion of Queen Anne County. The Elkton soils are found throughout both the low forelands and the upland country. The extent and location of the various types are shown on the accompanying map made on a scale of 1 inch to the mile. The general lay of the land is also shown on the map by contour lines drawn through points of equal elevation above sea level, and thus, besides showing the character, extent, and location of the several soils, the topographic relief of the entire country, the direction of natural drainage, and the proper location for artificial drainage ways are indicated.

The names of the several types, together with their actual and relative extent, are given in the following table:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Sassafras sandy loam.....	160,576	25.9	Sassafras fine sandy loam....	18,496	3.0
Sassafras silt loam.....	130,944	21.2	Tidal marsh.....	15,616	2.5
Sassafras loam.....	101,760	16.4	Elkton sandy loam.....	9,280	1.5
Sassafras loamy sand.....	52,992	8.6	Portsmouth loam.....	2,944	.5
Elkton silt loam.....	42,432	6.9	Sassafras gravelly loam.....	2,880	.5
Sassafras sand.....	29,696	4.8	Elkton loam.....	2,624	.4
Portsmouth sandy loam.....	27,840	4.5			
Meadow.....	20,480	3.3	Total.....	618,560	

SASSAFRAS SAND.

The surface soil of the Sassafras sand to a depth of 5 to 10 inches is a dull-brown sand, with a predominance of the coarse and medium grades. The subsoil is a reddish-yellow, sometimes an orange-yellow, sand which generally becomes slightly loamy and coarser toward the lower portion, frequently being underlain at about 32 inches by a reddish-yellow or reddish-brown sandy loam or sticky coarse sand. The underlying substratum is quite variable in its texture and profile features. Generally it consists of a succession of strata and seams of silty clay, coarse, medium, and fine, loose, or very compact sands or gravelly sands, and fine, medium, and coarse gravel, which vary in thickness from an inch to about 3 feet and in color from light and bluish gray to a deep reddish brown. Although in its mineralogical composition the soil material is mainly quartz, close examination reveals the presence of other minerals. Generally

the finer particles cling to the larger grains in a way that tends to impart more coherence between the constituents than in case of the loose, incoherent Norfolk sand which covers extensive areas in other parts of the Coastal Plain. The Sassafras sand has not been so thoroughly reworked and washed as the latter soil and, therefore, is not so clean a sand. However, the grains have suffered considerable abrasion and are more or less rounded.

In small areas quartz gravel is interspersed throughout the soil mass, but not in sufficient quantity to change the character of the soil materially.

The Sassafras sand occurs largely in comparatively narrow belts along the east side of the Choptank River and Tuckahoe and Marsh Hope creeks in Caroline County and the south side of the Chester River, approximately from the Chestertown bridge to the Delaware line. Isolated areas occur here and there in the uplands. There is a considerable area in northern Caroline County. Along the streams it varies from flat forelands nearly on a level with tidewater to a gently rolling topography on the slopes. The upland areas occur as ridges and knolls. In upper Caroline County the type is closely associated with the Sassafras loamy sand. Here the knolls and ridges rise gradually from the level of the flat Portsmouth soils to a height of about 15 feet. The water table lies quite near the surface. There are numerous pot holes or small, rounded depressions in which poor drainage has favored the development of small areas of Portsmouth soils, which owing to their inconsiderable size were included with Sassafras sand.

Wind action may have aided in the formation of these ridges and knolls by assorting and blowing the sand from surrounding areas which supported less vegetation probably during dry periods long before the present wet conditions had appeared. The original material of the type was transported by water from the region of crystalline rocks north of Maryland.

The forested areas support a growth of shortleaf pine with a sprinkling of oak near the boundaries of the heavier soils.

The Sassafras sand is a well-drained, warm, early soil, well adapted to vegetables, especially early market-garden varieties. Excellent tomatoes, asparagus, Irish and sweet potatoes, garden peas, turnips, melons, and cucumbers can be easily grown. The yields depend largely upon the organic-matter content. There are very few soils that respond more quickly to applications of barnyard manure and the turning under of green crops, particularly legumes, such as cowpeas and crimson clover. Incorporations of such vegetable manures should be made at frequent intervals and in considerable quantities, as the soil is so thoroughly aerated and well drained that the decomposition of organic matter takes place at a comparatively rapid rate.

Excellent crops of rye can be made after turning under cowpeas or crimson clover as green manures and applying moderate quantities of phosphate potash fertilizer. An application of about 35 bushels of air-slaked lime in conjunction with the turning under of heavy crops of vegetation, such as cowpeas or crimson clover, would materially assist in improving the structure of this soil by binding together the soil particles, so as to make it less open and porous. Although the type in its average condition of fertility gives rather moderate yields of the general farm crops, in years of normal rainfall very fair wheat and good corn returns can be obtained. Where the humus content has been kept up, as high as 20 bushels of wheat and 40 bushels of corn per acre have been made under conditions of fair soil treatment. Although the grasses do not do well, heavy crops of cowpeas, crimson clover, and sorghum can be made. This is a good soil for growing cowpeas for seed. Dewberries do well and strawberries fairly well. Cultivated chestnuts seem to find an especially favorable environment on this soil.

The soil is very easily tilled and can be kept in fair condition by applying barnyard manure and turning under green legumes once every two or three years. Crops are inclined to suffer from drought in dry seasons. This type of soil can be bought for less than the heavier soils, from \$20 to \$30 being a fair price.

The following table gives the average results of mechanical analyses of samples of the Sassafras sand:

Mechanical analyses of Sassafras sand.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
17908, 17923, 17925.	Soil.....	2.5	35.9	30.5	22.8	1.0	3.9	3.3
17909, 17924, 17926.	Subsoil.....	2.2	35.8	30.7	23.3	.6	3.8	3.7

ELKTON SILT LOAM.

The soil of the Elkton silt loam is a very light-gray to almost white silt loam. In a field in good tilth it is loose and floury, the light color and fine texture being its most marked characteristics. It contains very little medium and practically no coarse sand. The percentage of fine sand is usually low, and there is only a moderate quantity of clay. The chief constituent is silt, which forms from 60 to 80 per cent of the soil body. When wet it is yielding under foot, in some instances quite miry, but not particularly adhesive. On drying it coheres in a firm mass which may have minute cavities interspersed through it.

The organic matter content appears to be low. In the virgin soil of the woodland there is usually 2 or 3 inches of darker colored soil slightly stained by humus, but immediately below this the material is white and powdery.

In most places there is no well-defined line of contact between the soil and subsoil. The latter has about the same texture to a depth of 12 or 15 inches, below which there is an increase in the clay content. This difference in composition is most apparent between the depths of 18 and 30 inches. It is usually observable in an exposed section and is very apparent on digging or boring into the subsoil. The subsoil forms a compact stratum, very hard when dry, and, when wet, somewhat more sticky or plastic than the soil.

The subsoil at a depth of about 3 or 4 feet frequently changes to a grayish sand, medium to coarse in texture and usually saturated. This stratum varies from 1 to 2 feet in thickness and is usually underlain by a heavy bed of clay. Frequently the sandy stratum has a thin layer of soft, white, unctuous clay in it. This stratum seems to be nearly or quite impervious and is probably the cause of the saturated condition of the overlying sand.

The subsoil proper is of a grayish color somewhat darker than that of the soil. It is generally mottled with yellow and brown iron stains, especially if pockets or seams of sandy material are present. The heaviest part of the subsoil is usually a bluish-gray color with very little mottling.

This soil attains its typical development in the western part of Talbot County. The largest areas are found in the peninsulas lying between the estuaries. The central portions of most of these necks are nearly level, and the sluggish surface drainage, together with the character of the material, accounts for the formation of this type. Smaller areas are found in the uplands wherever similar conditions prevail.

The type is associated with the Sassafras silt loam and is derived from the same kind of material. The differentiation is due entirely to drainage conditions. While the two soils are very distinct in color, organic matter content, and general agricultural value, the change from one to the other is frequently so gradual that it is difficult to draw an exact boundary.

The original vegetation consisted chiefly of white oak, and the land is now locally termed "white oak land." A mixed forest now occupies uncleared fields, and loblolly pine, which came in when the original white oaks were removed, is a common species and attains good size. Other kinds of oak trees, with gum, soft maple, beech, and dogwood, are very commonly found on this type.

Much of this soil is under cultivation. It is somewhat difficult to manage, especially in wet seasons. After a rain the soil tends to run together, and on drying forms a smooth, hard surface. When slightly moist it yields very readily to tillage.

The Elkton silt loam is well adapted to timothy and excellent crops are grown. The acreage planted to this crop is rather limited, and could be increased with profit. Red clover does not grow on this soil well, probably on account of a somewhat acid condition. In fields which have reasonably good surface drainage scarlet clover is successfully grown. A large proportion of the tillable area of this type is annually sown to wheat. The same cultural methods are generally practiced as on the Sassafras silt loam. In seasons which are not excessively wet the average yields compare well with those of the Sassafras soil. In some seasons a good crop of corn is secured, but this land is too cold, wet, and deficient in humus to be well adapted to this cereal.

The improvement of many of the small areas in the highland country requires ditches of sufficient capacity to remove promptly the excess water. Ditches should be located near the upper margin, so that the water will be intercepted and not saturate the lower lying soil, as is the case where the main ditch is placed near the center of the area. It is highly essential that the ditches be deep enough to lower the water table to $2\frac{1}{2}$ or 3 feet below the surface, so that the subsoil may be aerated.

The permanent improvement of the larger areas, particularly those on the "necks," is a more difficult problem. They are larger and so flat that it is sometimes expensive to construct ditches with an adequate outlet.

The nature of the strata underlying the subsoil has already been briefly described. It seems probable that the structure of the deeper subsoil is the same for much of the Elkton soil of the "necks" and for the Sassafras silt loam adjoining these areas. The roadside cuts on the slopes leading down from the upland often show a light-colored clay with sandy material between the subsoil and the deeper subsoil. Any excess of water in the soil of the higher ground tends to follow the sandy stratum to the lower levels. Where no natural drainage line intervenes between the higher ground and that somewhat lower a positive upward pressure of the ground water may exist in the latter. This is probably why the subsoil of the Elkton silt loam remains saturated long after surface conditions would indicate a normal moisture content.

The present artificial drainage consists of surface ditches. They are usually shallow—only a foot or two in depth. These serve to remove the excess of rainfall, but fail effectually to drain or prevent

a waterlogged condition of the subsoil. It is highly desirable that the lower soil be so drained as to have comparatively free access of air.

It can not be positively stated, however, that even thorough drainage alone will result in an immediate improvement of this soil. It has been so long subject to intermittent saturation that its constituents have undergone important changes. The soil has quite lost the property of granulation as is evidenced in its lifeless, puttylike feel when moist and its firm cementation when dry.

The frequent unsatisfactory crop yields from well-drained land which has been given good culture indicates a poor structural condition or the presence of injurious substances. There are very few iron concretions. The ferruginous material is seldom further concentrated than in small, soft grains and thin streaks of limonite, or other compounds of iron, and these are not abundant in the heaviest phases of this soil where aeration is least active. It is probable that the decaying organic matter under the moisture condition which usually prevails renders soluble much of the iron forming ferrous carbonate, a substance injurious to cultivated plants. Under similar conditions the phosphoric acid of the soil combines with the iron in an insoluble form, thereby becoming unavailable for crops.

Experience has shown that a heavy application of coarse manure often gives surprisingly good results. There should be an abundance of organic matter incorporated with the soil, which can be most cheaply done by plowing under some green crop. This should be done in early fall or precede by some months the time of planting the next crop, so that partial decay may take place. Otherwise more harm than good may be done the first crop. Complaint is made sometimes that saturating rains following deep fall plowing cause the soil to run together in such a way as to give rise to the formation of an almost glasslike smooth surface, which bakes and hardens with subsequent sunshiny weather. This trouble would be lessened by the incorporation of coarse manures, the application of lime, and general improvement of the drainage condition.

Lime should be liberally applied (30 to 40 bushels an acre), not only for the favorable chemical effect it has on this soil, but that flocculation of the clay may be favored. Turning under green vegetation should be done always in conjunction with an application of from 25 to 50 bushels of lime per acre.

After the physical condition of the soil has been improved in the manner thus outlined, its further fertilizer requirements depend upon the crop to be grown or the method of farming practiced. It will probably be found that little or only moderate amounts of commercial fertilizer are needed. In case fertilizer is found to be necessary, one containing a high percentage of phosphoric acid would be of benefit, especially to wheat.

Where it is impracticable to drain land of this kind it seems that such crops as timothy and redtop offer the best means of utilization.

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

Mechanical analyses of Elkton silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
16990, 17900.....	Soil.....	0.2	2.3	2.5	4.8	2.6	77.5	10.0
16991, 17901.....	Subsoil.....	.2	3.2	3.2	5.1	2.9	63.7	23.0

A determination of the organic matter gave the following percentages: No. 16990, 3.55 per cent; No. 17900, 1.42 per cent.

SASSAFRAS SILT LOAM.

The Sassafras silt loam to a depth of 8 or 10 inches is a friable silt loam. A dry sample rubbed between the fingers breaks into a soft, pulverulent mass in which little or no medium sand can be detected. A perceptible quantity of fine sand is present, consisting in part of minute mica flakes. When wet such a sample is somewhat plastic, mulches easily, and shows little tendency to adhere. On drying it becomes crumbly, the fragments being weak and porous.

The soil yields readily to tillage, and the cultivated land has a soft, loamy surface. A considerable portion of the first 2 or 3 inches will be almost pulverulent if the field has been harrowed or rolled when in a slightly moist condition. If clods form at all, they are generally small, porous, and break under a light pressure.

The color of the moist soil is usually a yellow brown. It becomes lighter as the moisture content decreases and not infrequently approaches a buff or very light yellowish brown. An exposed section in a roadside cut generally shows, beneath an inch or two of grayish surface loam, a light-yellowish soil grading downward to a reddish yellow or dull reddish brown, which is usually the color of the subsoil.

The subsoil contains more clay than the soil and is usually rather compact. Between the depth of 15 and 30 inches it is somewhat granular. On drying it breaks into roughly angular fragments. The granulation is not strongly developed and is easily destroyed by manipulation when the material is moist.

This soil is found in the southeastern and southern parts of Queen Anne County and is of common occurrence throughout Talbot County. A few small areas occur in Caroline County. It ranges in altitude from 10 to 70 feet above sea level and attains its typical development on the gently undulating interstream divides. On the "necks" this type is confined to those portions which have rela-

tively good drainage. Where the surface has little or no relief the Sassafras silt loam gradually passes into the Elkton silt loam. Wherever the surface is more rolling some of the lighter soils are generally found.

The drainage is usually good. The sandy substratum gives excellent underdrainage and prevents any undue accumulation of water where the surface is slightly depressed.

The color of the subsoil is a reliable indication of the average moisture conditions. Where the color is brown or approaches a reddish yellow the drainage is effective and the soil mass has good aeration. Where the drainage is not as thorough as it should be or is somewhat sluggish the soil usually is of a pale-yellow shade.

In some of the depressions which occur in this type the soils have a texture, structure, and color so different from that of the Sassafras series that they belong to the Elkton series. The areas are usually too small or ill defined to be shown on a map of the scale used.

All of this type was originally forested. It seems to be a congenial soil for numerous species of trees and shrubs. Most of it is now under cultivation, but in the forested portions almost every variety of tree common to this section of country may be found, excepting those confined to marshy soils.

The Sassafras silt loam is well adapted to grass, forage crops, and wheat. The average yields of grain are quite as high as upon any other type in the area. Its texture admits of the preparation of an ideal seed bed, and the average moisture content is favorable for winter wheat. Its structure admits of only a minimum loss through leaching of the fertilizer applied. Twenty-five to 30 bushels of wheat per acre is not an uncommon yield in favorable seasons, but the average is nearer 18 or 20 bushels.

Clover and timothy do well. It is sometimes difficult to secure a good stand of clover, but this trouble is due to cultural practices or seasonal extremes rather than any condition peculiar to the type.

The yields of corn in favorable seasons average from 50 to 60 bushels per acre. The yield could be improved by liberal applications of organic matter. The usual supply of barnyard manure and the frequent changes to grass fail to give the needed quantity of humus. The fact is frequently overlooked that a high organic matter content, besides assisting in the maintenance of moisture, also improves the physical condition of the soil. In this instance it would tend to prevent the "running together" of the surface soil after each heavy rain.

This is the heaviest well-drained soil in the area. It should be restricted to those crops which require a long growing season and for which a continuous moisture supply is of first importance.

The following table gives the average results of mechanical analyses of typical samples of the soil and subsoil of this type:

Mechanical analyses of Sassafras silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
16988, 17011, 17939.	Soil.....	0.6	2.8	2.7	4.3	8.9	71.9	8.6
16989, 17012, 17940.	Subsoil.....	Tr.	1.1	1.5	2.9	9.7	65.1	19.4
17013.....	Lower sub-soil.	3.6	18.3	12.4	8.3	0.5	45.8	11.6

A determination of the organic matter gave the following percentages: No. 16988, 1.02 per cent; No. 17011, 1.07 per cent; No. 17939, 0.92 per cent.

SASSAFRAS LOAMY SAND.

The Sassafras loamy sand represents a transition between the sand and sandy loam of the Sassafras series. In agricultural value it is much inferior to the normal sandy loam of the series, but is much more productive than the sand. It presents variations which are apparent even upon casual examination, and which are of considerable importance from an agricultural standpoint. These are determined for the most part by the distribution, or location, in the soil profile of the silt and clay.

In the greater proportion of this soil the fine material is found largely between the depths of 15 and 30 inches. The most extensive development of this phase occurs on the east side of the Choptank River, extending as a fairly continuous belt between the sand which borders the river and the heavier soils of the uplands. There are also considerable areas in the southeastern part of Caroline County which have a similar relation to the streams of that section.

The soil to a depth of 6 to 8 inches is a dull-brown loamy sand. All grades of sand are found, but medium to coarse grains usually form a considerable part of the whole and give a coarse, gritty character to the material. There is some small quartz gravel, which with the larger sand grains is quite conspicuous on the surface after a rain. The proportion of fine material is usually sufficient to cause the sand to cohere feebly if a moist sample is pressed in the hand. When dry it is quite loose, but not so incoherent as the Sassafras sand.

The upper part of the subsoil has about the same texture and structure as the soil. It is much lighter in color, usually a pale yellow. At a depth of 15 inches there is a perceptible increase in the percentage of fine material. This lower part of the subsoil is a moderately heavy sandy loam. If moist it is somewhat sticky; when dry the fine material binds the sand grains in a rather friable mass. Unless excep-

tionally coarse it possesses good capillarity. This part of the soil section is essentially the moisture reservoir of the soil.

The surface of most of this phase is gently undulating. Some areas of considerable size are nearly level or have a low but very uniform slope toward the nearest stream. Slight inequalities of the surface frequently indicate differences in the agricultural value of the land, the high ground usually having the heavier subsoil. Not infrequently small elevations are much lighter in texture, but in general this type passes into the Sassafras sandy loam along the higher contour lines.

In some places the surface assumes a grayish tint when dry, while the subsoil approaches pale yellow in color. This indicates poor drainage. This condition is not always due to topographic position, for some of this phase is underlain by a thin clay stratum similar to that found under the Elkton silt loam. It frequently occurs at a depth of 40 or 50 inches, but seems to be local in its development. Some of the light land east of the Choptank River between the towns of Fowling Creek and Bethlehem has such a structure of the deep subsoil and crops frequently suffer during prolonged wet periods.

Where drainage is necessary the proper location of ditches is somewhat difficult to determine. The depth to the clay substratum and the direction of its slope should be taken into consideration. In most instances the ditch should be dug along the upper side of the tract to be drained instead of being located in the middle or lower part.

The native timber growth comprises most of the oaks common to this area and sweet gum, dogwood, and pine, with a few birch, beech, and hickory. Alder and huckleberry are abundant undergrowths. Crabgrass commonly takes possession of neglected fields, followed later by loblolly pine.

In another phase of this type the silt, clay, and various grades of sand are evenly distributed throughout the upper 30 inches of the soil section, there being very little difference between the soil and the subsoil. This variation is found in the northern part of Caroline County. The topography of most of it may be described as "hummocky." The surface consists of low mounds and very irregular ridges, seldom rising more than 10 or 15 feet above the intervening depressions. The latter vary from spots a few rods across to ill-defined, semimarshy areas containing many acres.

The Sassafras loamy sand occurs on the higher ground, while the Portsmouth sandy loam is found on the low land. The subsoil of many of the narrow or moundlike ridges is very light, but usually has enough silt and clay to cause a slight crust to form after a rain. In most fields small, friable clods form if the land is plowed when wet. The organic matter content is low.

Between the depths of 15 and 25 inches the subsoil is frequently very compact when dry. It seems to be due to a filling of the interstices with fine material rather than cementation or coherency of the clay content. The deep subsoil consists of loose, coarse sand. It does not generally afford good capillarity between the water table below and the subsoil, although the former stands within 10 or 15 feet of the surface.

The oak trees on this phase of the Sassafras loamy sand do not generally attain a large size. A variety of pine having a short bristly leaf is common, and in places forms much of the timber growth.

Some of the Sassafras loamy sand in the neighborhood of Preston and Federalsburg is a light soil of good quality to a depth of 12 or 15 inches, resembling the sandy loam. The subsoil is a medium to coarse sand, or occasionally a very light sandy loam. This phase is of limited extent and often occurs near larger areas of the Sassafras sandy loam.

This soil is easily cultivated and responds well to fertilization. Since all of it is very deficient in humus, the organic matter content should be increased. It would also be of benefit to have some cover crop during the winter. This prevents to some extent the excessive leaching to which these light soils are subject. An acreage application of about 30 bushels of lime in conjunction with a green crop, preferably cowpeas or clover, would improve the structure; that is, bind the soil particles into such an arrangement as would make the soil less open and droughty.

Much of this soil is now used for general farm crops. The yields of corn and wheat are low and often severely affected by dry weather. It is better adapted to truck crops and an increasing acreage is being planted. Melons, cantaloupes, tomatoes, and sweet potatoes are successfully grown. Buckwheat, crimson or scarlet clover, and cowpeas do well and many small fields of the crops are grown. Peach orchards might well be located on the well-drained portions of the soil.

The market value of all the areas of this soil is steadily advancing. The price per acre ranges from \$5 or \$10 to \$25. Small tracts well located with regard to shipping points or near a cannery command a much higher price than those not so favorably situated. More of the Sassafras loamy sand can be utilized profitably in the production of early vegetables and tomatoes.

The following table gives the average results of mechanical analyses of the Sassafras loamy sand:

Mechanical analyses of Sassafras loamy sand.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
17048, 17902.....	Soil.....	1.6	20.5	22.4	28.2	1.7	18.3	5.9
17049, 17903.....	Subsoil.....	1.5	22.3	21.8	30.2	2.6	15.3	5.7

SASSAFRAS SANDY LOAM.

The Sassafras sandy loam in its typical development to a depth from 9 to 13 inches is a grayish-brown or brown moderately heavy sandy loam, consisting of a fairly even distribution of the coarse, medium, and fine grades of sand with a relatively high proportion of silt which coheres to the sand grains so as to impart a distinctly loamy character to the soil, especially when dry. The soil always has a more pronounced sandy feel when wet, owing to a weakening of the binding power of the finer material which is given freer movement by the excess of moisture. There are some areas very much lighter than the general average as described above. The absence of very fine sand is everywhere noticeable. The subsoil consists of a reddish-yellow or reddish-brown sandy loam or heavy sandy loam which at 26 to 30 inches generally passes into a reddish-brown coarse light sandy loam to sticky coarse sand, with small quartz gravel sometimes quite compact. The tendency is toward a slightly lighter and coarser textured subsoil, more compact and more nearly red with increasing depth. Sometimes the upper portion of the subsoil is pale yellow and siltier than the average, while in the more nearly level and poorer drained areas the pale yellow may extend as far downward as the change in the substratum. As a rule the subsoil is only slightly heavier than the surface soil, and like it carries considerable silt and little very fine sand. Generally the well-drained soil becomes lighter in color as the organic-matter content diminishes, but fields often are spotted with gray in slight depressions, where the soil approaches the Elkton sandy loam, and may contain considerably more organic matter than the surrounding better drained and more productive soil. The better drained brown phase of the northern part of the area tends to give way to a lighter colored and somewhat less productive phase accompanying a moderation in the surface relief toward the south. Occasionally small areas are quite gravelly, especially on stream slopes. A more nearly red subsoil is found in the better drained areas. The type is locally styled "red clay bottom" or "medium light loam."

On account of the coarser substratum excellent underdrainage obtains throughout the larger proportion of the type, which feature, coupled with the good texture of the overlying material, makes the type a thoroughly aerated soil, capable of maintaining a supply of moisture favorable to healthy plant development.

Under fair treatment the soil is tilled easily under widely different moisture conditions, yielding most readily to treatment of all the extensive general purpose soils. However, continuous cultivation without restoring vegetable matter, especially where closely grazed through all sorts of weather, is apt to induce a compact structure resistant to plowing and favorable to excessive loss of moisture in dry spells by surface evaporation.

The Sassafras sandy loam occurs throughout the survey and is largely confined to the uplands. It is conspicuously absent from the lower forelands. It sometimes follows the slopes of the inland stream valleys nearly to tide level, thus occupying all variations in land surface from broken stream slopes to moderately rolling and nearly flat upland country. In some sections the surface configuration is interrupted by small poorly drained depressions, some of which contain bodies of Portsmouth or Elkton soils too small to be outlined on the map.

The type has been derived from sediments of marine deposition brought down from the region of crystalline rocks to the north of Maryland and Delaware. The sand particles are generally less round than those of the Sassafras sand, showing that the material has been subjected in a less degree to reworking by water and wind. Since the elevation of the sedimentary material above the sea considerable weathering has taken place to a depth of 3 feet or more. This weathering mainly consists in the oxidation and consequent change in color of the material and the accumulation of organic matter in the surface. There has been considerably less washing out of the fine materials and leaching than in the Norfolk sandy loam, a much less productive soil occurring extensively in other parts of the Coastal Plain.

The Sassafras sandy loam is adapted to a wider range of crops than any other type of the area. The principal crops are corn, wheat, tomatoes, and grass. Under favorable conditions of weather and soil management, and accordingly as the crop is grown on the lighter or the heavier phase, wheat yields from 15 to 30 bushels, corn from 35 to 65 bushels, hay from 1 to 2 tons, and tomatoes from 4 to 12 tons per acre.

This is the best tomato and strawberry soil of the area. Excellent returns were secured from a large acreage of tomatoes put out in 1907, averaging 5 tons per acre, and a considerable acreage of strawberries was also very profitable in the neighborhood of Ridgely.

Irish potatoes, sweet potatoes, cantaloupes, watermelons, cucumbers, and asparagus do well, as do all kinds of forage crops suited to this climate. Pears, peaches, chestnuts, dewberries, raspberries, and blackberries find the soil well suited to their needs. In view of the ease with which good crops of cowpeas and crimson clover can be secured, and the readiness with which the soil responds to applications of barnyard manure, these legumes should be more generally grown in connection with an extension of the live-stock industry. Some claim that the soil is not well enough adapted to grass to yield satisfactory returns in stock raising, but by growing forage crops, excellent yields of which can be obtained, any such deficiency can be offset. A ton or two per acre of hay, however, is not considered poor even in the most prosperous stock raising sections.

Turning under green crops of cowpeas or clover grown in rotation with wheat, corn, tomatoes, or grass, or any other rotation, in conjunction with applications of 25 to 40 bushels of lime per acre every four or five years, is the most economical method of improving and maintaining the productivity of the type. Two excellent rotations are corn with cowpeas or crimson clover, wheat, grass, wheat, cowpeas, or clover to be turned under and limed, then corn; and corn, with cowpeas or crimson clover, tomatoes, wheat, grass and clover, corn. The same fertilizers are used upon this soil as upon the other soils of the area.

The type sells for \$25 to \$60 an acre according to location and improvements.

The following table gives the average results of mechanical analyses of the soil and subsoil and the results of a single determination of the lower subsoil of the Sassafras sandy loam:

Mechanical analyses of Sassafras sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
17014, 17917...	Soil.....	2.9	20.9	15.4	17.7	2.7	35.2	5.1
17015, 17918...	Subsoil.....	2.9	18.5	11.9	14.1	3.0	35.7	13.9
17919.....	Lower subsoil..	1.3	19.2	19.3	26.1	3.9	17.5	12.2

A determination of the organic matter gave the following percentage: No. 17917, 1.05 per cent.

SASSAFRAS FINE SANDY LOAM.

The surface soil of the Sassafras fine sandy loam is a grayish-brown to yellowish-brown quite silty fine sandy loam which grades into a pale-yellow material of the same texture a few inches beneath the surface. At about 20 inches the soil portion is underlain by a reddish-yellow, compact, rather clammy light silty loam, which in turn is underlain at 28 to 36 inches by an orange-yellow, reddish-yellow or

reddish-brown, light, fine to medium sandy loam. Wherever the relief is sufficient to insure good drainage the subsoil is quite friable, admitting of good aeration and circulation of moisture. On the other hand, the subsoil of the flat bodies lying in swales or near the water level is inclined to be mottled in color, clammy, and insufficiently aerated on account of poor drainage. The productiveness of the Sassafras fine sandy loam depends largely upon the drainage.

The type is confined largely to the necks and water fronts lying below the 25-foot contour line. The most important areas are those on Piney Neck, on Kent Island, in the Stevensville neighborhood, the extensive area including the greater part of the neck south of Claiborne, and the upland strip occurring along the 50-foot contour line or rim of the highland bordering the Choptank River valley from a point just south of Trappe to the neighborhood of Manadier. The topography of this higher area is moderately rolling. Its drainage is very good. The lower foreland is about equally divided between that having an undulating to slightly ridgy surface with good natural drainage and that having a nearly flat surface with poor underdrainage.

The type is fairly easy to cultivate, especially where the drainage is good, although in dry weather the soil is inclined to bake and harden in a way that makes fall breaking quite difficult, requiring considerable harrowing and rolling to bring it into a good tilth.

About 50 per cent of the Sassafras fine sandy loam is under cultivation, the remainder being forested mainly with pine, white oak, chestnut, sweet gum, black gum, and dogwood. It is devoted to general farming, including the production of wheat, corn, grass, and tomatoes. The yields of corn and wheat are about the same as on the Sassafras sandy loam, but the yields of timothy are thought to be better. Although the type does not have the texture of a typical truck soil, very fair yields of tomatoes of good quality are grown. Alfalfa seeded in the fall would do well on the better drained phase. Like the Sassafras loam, it requires regular applications of vegetable manure, barnyard manure, or legumes turned under in order to maintain favorable structural conditions.

The poorer drained areas are so situated that very effective drainage systems could be installed with inconsiderable outlay. Good results could be had with deep open ditches through the lower depressions; but much more satisfactory results would be obtained by installing lateral tile drains to discharge into main open ditches.

The Sassafras fine sandy loam can be bought for about \$25 to \$50 an acre.

The following table gives the results of mechanical analyses of samples of the soil, subsoil, and lower subsoil of this type:

Mechanical analyses of Sassafras fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
17927.....	Soil.....	0.1	2.0	14.3	29.2	10.1	35.6	8.7
17928.....	Subsoil.....	.2	1.6	12.8	28.0	8.0	25.9	13.8
17929.....	Lower subsoil..	.0	1.4	20.0	41.6	10.0	15.2	12.1

SASSAFRAS LOAM.

The surface soil of the Sassafras loam consists of a brown or yellowish-brown moderately heavy loam from 8 to 16 inches deep. The typical subsoil is a reddish-yellow heavy loam carrying about the same amount of silt but a little more clay than the soil. It becomes reddish brown in the lower portion, passing at 26 to 32 inches into a reddish-brown coarse sandy loam to sticky coarse sand with fine quartz gravel. Often the subsoil is pale yellow or yellow in the upper part of the profile, but always tends toward a reddish color with increase in depth. As a general thing the better the drainage the more nearly reddish brown becomes the subsoil. The type is locally called "red clay" or "medium stiff loam."

Not infrequently small quartz gravel is distributed throughout the soil mass, but never in sufficient quantity to influence materially the moisture-holding capacity. Minute flakes of mica can be seen distinctly in the subsoil in some places, though not so generally as to be a distinguishing feature.

Although the texture of the Sassafras loam is quite uniform, it requires close observation to determine the exact boundary between its lightest phase and the heavier Sassafras sandy loam, while on the other hand the gradation into the lighter phase of the Sassafras silt loam is very insensible.

Both soil and subsoil have an ideally well-balanced texture; that is, the constituent particles of sand, silt, and clay are so proportioned and arranged as to constitute a soil capable of maintaining moisture in the most favorable quantity for the healthy growth of plants. However, where the organic content has been allowed to run down through continuous cropping without replenishment of vegetable matter, and where the land has stood long without cultivation—especially if cattle have been permitted to graze it closely and pack it during all kinds of weather—the soil assumes a hardened, compact structure unfavorable to cultivation, especially in dry falls. Such fields break up in clods and repeated rolling and harrowing are required to restore a good

tilth. If the supply of humus is kept up and due attention is paid to moisture conditions in their relation to plowing and grazing, the soil can be kept in the best condition of tilth.

The Sassafras loam is confined largely to the uplands of Queen Anne, Talbot, and eastern Caroline counties, and is rarely found east of the Choptank River. A small percentage occurs in the lower foreland country, and it is even found along the steeper slopes. Its topography is quite like that of the Sassafras sandy loam, though generally somewhat less rolling. Where the relief has favored erosion the surface soil has been removed from small spots, revealing the yellowish-red subsoil in such a way as to give fields a spotted appearance. These spots, owing to the higher content of clay, are a little more difficult to cultivate than the true surface soil. They are sometimes called "clay hills."

While the texture affords good natural drainage, an occasional flat or depressed area will need main outlet ditches and tiling.

The Sassafras loam owes its origin to the weathering of marine deposits under good drainage conditions. It has since its uplift undergone about the same degree of weathering as the Sassafras sandy loam.

This is the best general farming soil of the area, being ideally adapted to wheat, corn, grass, clover, and forage crops and quite well suited to certain truck crops like tomatoes, beans, and cabbage. Wheat yields from 18 to 35 bushels, corn 40 to 75 bushels, and grass 1 ton to 2½ tons per acre. Where the soil is kept up to a good state of productiveness, as under a five-year rotation of corn, wheat, grass, wheat, grass, applying barnyard manure and 40 bushels of lime to the broken grass sod preceding corn and about 300 pounds of good commercial fertilizer to wheat, average yields of 60 bushels of corn, 20 bushels of wheat after corn and 28 bushels after grass, and 1½ tons of hay per acre are readily secured. If occasional crops of cowpeas or clover, to be turned under in conjunction with 40 bushels of lime per acre, should be introduced into the above general scheme of rotation, the most worn fields of the type could be brought quickly up to a point of equal productiveness or even better. Alfalfa does well when seeded properly; that is, in the fall, on a thoroughly prepared seed bed.

A large acreage of tomatoes is grown on this type, the average yield being about 4 tons per acre. Strawberries, cantaloupes, asparagus, beans, and buckwheat do well. Peaches, pears, and raspberries grow rapidly and bear well. In view of the good yields of hay and forage crops stock raising should be extended. Dairying and sheep raising could also be made quite profitable. There is no excuse for other than good average yields on the Sassafras loam, as it is easily

improved and kept in good condition. Its valuation varies greatly with location. Generally outside the influence of towns it can be bought anywhere from about \$40 to \$65 an acre, though in some of the poorer drained localities it can be had for less.

The following table gives the average results of mechanical analyses of samples of the Sassafras loam:

Mechanical analyses of Sassafras loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
17003, 17933..	Soil.....	2.3	13.7	9.9	12.7	3.2	50.1	8.4
17004, 17934..	Subsoil.....	1.3	10.0	9.5	13.9	4.3	46.1	14.3
17005, 17935..	Lower subsoil..	5.2	25.2	17.4	21.8	3.1	14.1	12.5

SASSAFRAS GRAVELLY LOAM.

The Sassafras gravelly loam consists of a loamy soil resembling the Sassafras loam, through which from 10 to 25 per cent of small and medium rounded quartz gravel is distributed.

The type occurs as narrow strips along stream slopes or as small patches on upland slopes. It owes its origin largely to a partial removal of the soil mass by wash, so as to expose the more gravelly material beneath.

There are throughout the area surveyed quite a number of these gravelly spots of limited extent and irregular occurrence. Only the larger areas are shown. The type is most frequently seen in the northwestern part of Queen Anne County. It is suited to the same crops as the Sassafras loam and where not too sloping for easy cultivation it makes profitable yields.

ELKTON SANDY LOAM.

The surface soil of the Elkton sandy loam consists of 6 to 10 inches of dark-gray, clammy, rather silty sandy loam which becomes light gray in the lower portion. The subsoil is a clammy, medium heavy sandy loam to loam carrying considerable silt. The upper portion is a light-gray to drab, frequently slightly mottled with reddish-yellow streaks, while the lower portion is generally intensely mottled with grayish, reddish-yellow, and reddish-brown colors. Strata of clayey material are quite common in the lower portion, and at a depth of about 30 inches occurs a substratum of compact, light-gray or mottled, sticky, medium to coarse sand which is always saturated with water.

The type occurs as small bodies in depressions and as low, flat land around the heads of small streams. The drainage is very poor, the

water table generally standing very near the surface. The surface configuration of those areas found near the heads of streams is usually interrupted by small saucerlike depressions holding dark-colored material high in organic matter and generally in a semimarshy condition. The greater part of the type occurs as widely separated areas throughout the uplands of Caroline County, closely associated with the light Sassafras soils. There are small bodies throughout the uplands of the area, many of which are so small as to necessitate their being included with other types.

The Elkton sandy loam is derived from the same material that gives rise to the Sassafras sandy loam. The original material, subjected to intermittent wet and dry stages, has undergone unfavorable structural and probably chemical changes and has accumulated a small amount of organic matter in an apparently stagnant, unhealthy condition.

Most of the Elkton sandy loam is forested with sweet gum, white oak, maple, black gum, dogwood, scattered pine, and a thick undergrowth of shrubbery. Under present conditions of drainage it is hard to manage and comparatively unproductive. Buckwheat, strawberries, and dewberries do fairly well where the drainage is best. By deepening, strengthening, and extending the natural drainageways and by putting in close lateral tiles or even open ditches, most of the type could be brought into pretty good condition without a prohibitive outlay of money. Many of the small depressions can be drained simply by a deep outlet ditch. Wheat, strawberries, dewberries, and grass would do quite well. Coarse barnyard manure plowed under improves the aeration considerably, under fair conditions of drainage. The type is not as desirable a soil as the Portsmouth sandy loam.

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

Mechanical analyses of Elkton sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
17892, 17894.....	Soil.....	1.7	14.9	14.2	26.1	5.0	31.8	6.3
17893, 17895.....	Subsoil.....	1.4	12.8	12.8	29.2	5.3	25.2	13.1

A determination of the organic matter gave the following percentage: No. 17892, 1.56 per cent.

ELKTON LOAM.

In color and profile the Elkton loam is very similar to the Elkton sandy loam. The surface soil from 6 to 10 inches consists of a dark-gray, silty, medium loam which becomes light gray in the lower por-

tion. The subsoil to a depth of about 30 inches is a light-gray to drab, clammy, silty, heavy loam with a slight mottling of reddish yellow in the upper portion and intense mottling in the lower portion. Thin strata of clayey material occur in the lower profile. Below 30 inches there is usually found a substratum of light-gray, compact, medium to coarse sand always saturated with water.

The Elkton loam, like the Elkton sandy loam, occurs as poorly drained depressions and flat land around the heads of small streams. Narrow strips of Elkton silt loam are frequently found near the stream, while toward the outer edges, where the surrounding soil is light, may be found a narrow belt of Elkton sandy loam. Again, there may be small depressions holding darker colored soggy soils. These nonconformities, however, are not of sufficient extent to warrant their separation. The type is confined largely to Caroline County, occurring as widely separated bodies, the largest being those in the southeastern part of the county.

There is a phase of the type occurring in small, nearly flat bodies on the neck of land to the south of Claiborne, and in such places the soil to an average depth of 10 inches is a light-gray to ashy-gray, quite silty, very fine sandy loam.

About 75 per cent of the type is timbered mainly with white oak, maple, and gum. In its crop adaptation it is quite like the Elkton sandy loam, producing, however, better grass and wheat, but not as good corn, strawberries, and dewberries. It is probable that red-top, clover, herd's-grass and millet would do well on this soil. The type under present conditions of drainage is too soggy and cold to constitute even a fair agricultural soil. By draining the soil proper could be deepened and the subsoil opened, increasing the circulation of air and extending the zone for root development. Turning under partially rotted, coarse manure in conjunction with about 50 bushels of lime to the acre would go far toward rectifying the condition of the soil, though little permanent benefit can be expected until the soil is thoroughly drained. For this purpose deep open ditches and tiling are recommended.

The following table gives the results of mechanical analyses of a sample of the soil and of the subsoil of the Elkton loam:

Mechanical analyses of Elkton loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
17896.....	Soil.....	2.0	12.7	11.0	16.5	3.0	48.9	6.4
17897.....	Subsoil.....	.9	10.4	10.0	15.1	3.1	49.7	10.0

PORTSMOUTH SANDY LOAM.

The Portsmouth sandy loam is a very dark-gray to black medium sandy loam of high organic-matter content, varying in depth from 8 to 12 inches. The subsoil to about 28 inches is a gray sandy loam with a slightly higher silt and clay content and much lower organic-matter content than the soil. The subsoil frequently is mottled with reddish yellow and in the lower portion may carry strata and pockets of sandy clay. It usually passes into a light-gray or nearly white, compact, coarse sand to sticky sand, which also may contain pockets and thin strata of sandy clay. This sandy substratum is always saturated, except where thoroughly drained. It is sometimes washed out into open ditches, filling the bottoms and causing the banks to cave. In some places the soil may consist largely of organic matter mixed with just enough earthy material to give it the characteristics of muck. Again, small areas may consist, from a few inches to a foot or more, of bog iron ore, occurring on top or at any position in the profile.

Uncleared areas support a growth of sweet gum, black gum, beech, maple, and scattering pine, with a dense undergrowth of whortleberry, gallberry, and other bushes.

The Portsmouth sandy loam is confined to northern Caroline County and the near-by contiguous portion of Queen Anne. It occupies level areas and small, basinlike depressions. The extensive flat areas are interrupted by ridges and knolls of the lighter Sassafras soils. In these lighter types occur numerous small depressed bodies, many of which were of too limited extent to indicate on the map.

The soil is almost entirely lacking in natural drainage. All of it, however, can be reclaimed. While some substantial, effective ditches were put in years ago and some are still being dug in a few places, thus reclaiming considerable areas, the work has not been pushed persistently, and at present the type on the whole is too poorly drained to admit of profitable cultivation. Ditches too frequently have been allowed to fill. Some of the farmers, by keeping the main ditches cleaned out and extending laterals, have reclaimed limited tracts. Individual effort can not cope successfully with the problem in the larger bodies. There must be substantial main ditches, the construction of which is feasible only through the concerted action of landowners, assisted possibly by the county or the State, and by drainage laws opening the way for outlets.

The type is derived from the same material that gives rise to the Sassafras and Elkton sandy loams. The topography has induced wet, swampy conditions which have favored accumulation and preservation of a large quantity of spongy vegetable matter in the soil, at the same time retarding subsoil weathering.

When thoroughly drained the Portsmouth sandy loam proves a very productive soil. Excellent yields of strawberries, corn, and

dewberries are made. Owing to a tendency of the soil upon freezing to heave, the type is not especially suited to fall-sown crops. Wheat and grass are particularly likely to suffer in this way. It is claimed, however, that wheat grown on this soil is of the good hard quality preferred by millers. Buckwheat and oats would do well, as would onions and celery also. Tomatoes do only fairly well. Rather heavy applications of lime—from 40 to 60 bushels per acre—at frequent intervals are required to bring the soil up to its maximum producing capacity. Deep plowing is said to be quite beneficial. The improved land can be bought at about \$15 to \$30 an acre.

The following table gives the results of mechanical analyses of samples of the soil, subsoil, and lower subsoil of the Portsmouth sandy loam:

Mechanical analyses of Portsmouth sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
17910.....	Soil.....	1.2	24.2	26.0	26.5	1.9	12.5	7.3
17911.....	Subsoil.....	1.1	16.4	20.8	35.5	5.1	12.7	7.7
17912.....	Lower subsoil..	2.0	17.0	20.7	45.6	5.0	7.0	2.7

A determination of the organic matter gave the following percentage: No. 17910, 3.48 per cent.

PORTSMOUTH LOAM.

The Portsmouth loam consists of a rather spongy black loam so high in organic matter as very frequently to approach quite nearly the characteristics of a muck soil. Small areas of Muck do occur here and there. At 12 to 24 inches the soil passes into a dark-gray sandy loam carrying strata and pockets of clayey material, and this in turn at 30 to 36 inches generally passes into a grayish, compact, sticky coarse sand or sandy loam. The type is not extensive and occurs closely associated with the Portsmouth sandy loam having the same topography as well as being the result of the same processes. The most important area is that along Long Marsh Branch—the boundary line between upper Caroline and Queen Anne counties. This area has been effectively drained and is producing good crops of corn. The other bodies are largely in a semiswampy condition. The type when drained is well suited to strawberries, corn, dewberries, and buckwheat.

The following table gives the results of mechanical analyses of the soil and subsoil of the Portsmouth loam:

Mechanical analyses of Portsmouth loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
17915.....	Soil.....	4.0	9.5	10.7	27.4	5.3	28.4	15.1
17914.....	Subsoil.....	3.6	26.4	22.3	23.0	1.1	16.3	7.6

MEADOW.

Wet alluvial bottom land having no uniformly definite texture and those areas near the heads of streams subjected throughout the year to standing water and swampy conditions have been classed as Meadow. A considerable proportion of the alluvial phase is susceptible to easy reclamation, and some of it is under cultivation. The upland bodies can be reclaimed by clearing, straightening, and extending the natural drainage ways. A few small areas are found along the water front just above tidal overflow. Generally every stream and drainage way has a narrow strip of Meadow from its mouth to its source. When thoroughly drained Meadow produces excellent corn and, where the organic-matter content is not too high, good grass and wheat.

TIDAL MARSH.

The areas of marshy land lying near water level and subject to tidal overflow are classed as Tidal marsh.

This land is a black or brown slimy loam, clay loam, or ooze, which is generally underlain at about 2 feet by a sandy or clayey material. The mass is pretty thoroughly interspersed with the roots of coarse grasses and cattails and decomposing vegetable matter. The whole remains saturated the year around. Considerable hydrogen sulphide is developed in the lower portion by decomposing vegetable matter. The odor can be very distinctly detected in the freshly exposed material, particularly in those areas touching salt water.

Tidal marsh occurs as narrow fringes along the larger bodies of water. The most extensive areas are found along the arm of Chesapeake Bay between Kent Island and the mainland and along the upper Choptank River.

The material is sedimentary in origin, having been deposited by rivers or built up by tides and waves. It can be reclaimed only by diking to keep out the tides. It supports a rank growth of coarse grasses and cattails. The grass is sometimes cut for hay.

SUMMARY.

The Easton area is situated in the central part of Eastern-Shore Maryland, between the Chesapeake Bay and the Delaware line. The total area is 618,560 acres. The topography varies from the low, flat, foreland country to the moderately rolling upland plain, which attains in some points altitudes of 80 feet. The lower division is much indented by rivers and bays. The upland country in general has very good drainage.

The climate is good. The mean annual temperature is 55° F., and there is a well-distributed rainfall of about 41 inches. The waters

abound in fish, oysters, and crabs, and the fishing industry is important.

The transportation facilities, both water and rail, are good. Public roads are good in summer and are kept, for the most part, in pretty fair condition throughout the winter.

The soils of the Easton area are among the most productive of the Atlantic Coastal Plain. Most of the soils are easily managed, hold improvement well, and respond readily to judicious treatment. For wheat the heavier Sassafras soils equal and frequently exceed the production of the fertile "black lands" of the northwestern wheat States. From 1 to 2½ tons of good hay can be produced on the heavier soils, while large yields of forage crops can be secured from all the types. There are no better tomato and trucking soils in the country than the lighter Sassafras soils, as is strongly emphasized in Caroline County, where about one-tenth of the total tomato pack of the United States is put up.

Attractive inducements are offered persons seeking soils adapted to special lines of farming, general farming, or the two in conjunction with stock raising. Butter-making should become permanent and profitable.

Named in the order of importance, wheat, corn, tomatoes, and hay comprise the general farm crops. A number of specialties like sugar corn and garden peas for canning, and strawberries, asparagus, cantaloupes, peaches, dewberries, and peas are grown for market. Cowpeas, alsike, crimson clover, and alfalfa are coming into use for forage and for improving the land.

The rotations commonly practiced are the three and five field systems, the former being corn, wheat and grass, and the latter corn, wheat, grass, wheat, and grass. Tomatoes, clover, and cowpeas can be introduced into the system profitably. It is a frequent and advisable practice to sow cowpeas or crimson clover in corn at the last cultivation. Wheat averages nearly one-third more after a clover-timothy sod and after tomatoes than after corn. It is not advisable to grow tomatoes after tomatoes.

Large quantities of commercial fertilizer are used. The grades for wheat, corn, and grass average something like 1-9-2 in analysis.

The price of land varies from about \$30 to \$75 an acre, according to location, the kind of soil, and state of improvement.

The Sassafras sand is a light, well-drained, and naturally warm soil especially adapted to truck crops like garden peas, asparagus, and early Irish potatoes. It is kept in best condition by turning under crops of cowpeas and crimson clover and applying barnyard manure at frequent intervals.

The Sassafras loamy sand is a gently rolling, light loamy sand well suited to sweet and Irish potatoes, strawberries, asparagus, dew-

berries, and sometimes producing fair crops of corn. It also requires the addition of considerable vegetable manure.

The Sassafras sandy loam is the most extensive and widely distributed type of the area, occurring throughout the uplands. It is an excellent general farming soil and the best tomato soil of the area. It is also especially suited to strawberries, potatoes, asparagus, peaches, pears, dewberries, and other small fruits. Under favorable conditions of weather and soil management, wheat yields from 15 to 30 bushels, corn from 35 to 65 bushels, hay from 1 to 2 tons, and tomatoes from 4 to 12 tons per acre. The type is easily handled.

The Sassafras loam is the best all-around general farming soil of the area, producing under favorable conditions 18 to 35 bushels of wheat, 40 to 75 bushels of corn, 1 to 2½ tons of hay, and an average of about 4 tons of tomatoes per acre. It is the best wheat and corn soil of the area. Peaches, pears, cantaloupes, and all kinds of forage crops yield well.

The Sassafras silt loam is an excellent soil. The surface is generally flat and sometimes requires ditching to remove surface water. It is the best grass soil and gives excellent yields of wheat and corn as well. The type is not particularly suited to truck crops, although tomatoes, cabbage, and some other vegetables do fairly well.

The Sassafras fine sandy loam is confined largely to the lower flat lands. The larger areas are found along the water front of Queen Anne and Talbot counties. Where the drainage is good the yields approximate those of the Sassafras sandy loam. It is, however, probably a better grass soil than the Sassafras sandy loam.

The Elkton sandy loam and Elkton loam are flat or depressed poorly drained soils that make poor yields under present conditions. They need to be drained and limed. The total area is not very extensive.

The Elkton silt loam produces good wheat and grass, but poor average crops of tomatoes and corn. The soil has the same texture and is derived from the same materials as the Sassafras silt loam, but poorer drainage has given rise to an unfavorable structure in the soil and an unhealthy, stagnant condition in the subsoil. The soil is benefited by turning under coarse manures and applying from 40 to 50 bushels of lime per acre to grass sod every three to five years. This soil should be used largely for growing grass and forage crops in connection with stock raising.

The Portsmouth sandy loam and Portsmouth loam are black, spongy soils of high organic matter content. When drained they produce excellent strawberries, dewberries, and corn. Winter crops, like wheat and grass, are apt to heave during alternate freezes and thaws. Considerable areas in northern Caroline County could be

reclaimed by deepening, straightening, and extending ditches and natural drainage ways.

Meadow constitutes the low, wet strips of land along streams and the flat, semiswampy bodies around the heads of streams. All of the latter and many of the strips along water courses could be reclaimed. Excellent corn can be grown on this type.

Tidal marsh consists of the marginal fringes along the shore line and larger streams subject to tidal overflow. The material generally consists of oozy sediments interspersed with roots of coarse marsh grass. In order to reclaim this type diking would be necessary to keep out tide water.

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