SOIL SURVEY OF THE TRENTON AREA, NEW JERSEY.

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LOCATION AND BOUNDARIES OF THE AREA.

The area surveyed lies in the western central part of New Jersey and includes a small part of Pennsylvania bordering the Delaware River near the city of Trenton. The area is comprised within the meridians 74° 21′ and 74° 49′ west longitude and parallels 40° 5′ and 40° 35′ north latitude. The extent of the area is about 810 square miles or 518,464 acres. The survey includes parts of Hunterdon, Somerset, Middlesex, Mercer, Monmouth, Burlington, and Ocean counties, New Jersey, and Bucks County, Pennsylvania.

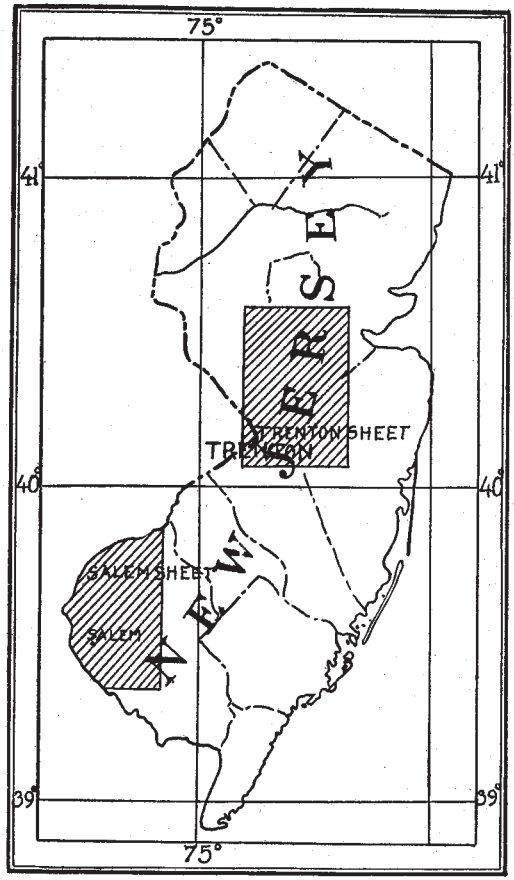

FIG. 3.—Sketch map showing areas surveyed in New Jersey.

HISTORY OF SETTLEMENT AND AGRICULTURAL DEVELOPMENT.

The present State of New Jersey was originally part of the grant given by King James in 1606, under the title Virginia. It was occupied at that time by different tribes of the Delaware Indians. In 1609, Henry Hudson, driven ashore by storm, explored the country inland as far as what is now Monmouth County. The first settlement in New Jersey, however, was that made under direction of the Dutch West India Company in 1623, when the fort at Nassau was built. In

the same year other Dutch settlements were founded along the Delaware.

Soon after this Gustavus Adolphus made a claim to the territory and sent out a colony composed of Swedes and Finns. They landed at Henlopen and bought of the Indians a tract of land extending from the coast to the falls near Trenton.

In 1640 the first English settlement was effected by a few families who took up lands along Salem Creek. Fourteen years later the Dutch overcame the Swedes and held possession of all the settled territory until 1664, when the English overthrew the Dutch rule. By treaty, however, the Dutch and Swedish settlers were allowed to remain practically unmolested. The country around Perth Amboy in the meantime had been settled by the Scotch. The same year Lord Berkeley and Sir George Carteret, by deed of the Duke of York, became sole proprietors of New Jersey. In the early days all lands were bought of the Indians before they were settled upon.

The soils were considered good, but variable, producing all kinds of small grains, indian corn, flax, and hemp. The barrens were used for grazing. Fruits, such as grapes, plums, apricots, peaches, pears, apples, quinces, and melons, were raised in abundance.

The earliest exports were horses, pork, beef, lumber (pipe staves and boards), flour, wheat, barley, rye, corn, butter, and cheese. Trade in these commodities was principally with Jamaica, the Barbados, the Canaries, and other islands, and also with Spain and Portugal. Oil and furs were shipped to England.

CLIMATE.

From the data available it would seem that there is considerable local variation in the climate and in the effect of climate upon the condition of the soils and upon the crops and agricultural practices in different parts of the Trenton area. The ocean's influence—greater as the ocean is approached—the differences of altitude, the level or broken topography, and the texture of the soil are the principal factors in this variation. In the country of rolling topography, and particularly in the vicinity of Creamridge, both the condition of surface drainage and the character of the soil tend to produce washing, while the clayey soils bake and clod badly under the heat of the summer sun. In Ocean County, the location of sandy soils, the extremes of daily temperature occur, and agriculture suffers most from drought and from erratic late and early frosts. The hill country is less likely to suffer damaging droughts, although there also many of the soils are light and open textured. In the area where the red shale formation occurs crops suffer from the hot, dry winds of the summer season, while in the trap-rock ridge the average temperature

is somewhat lower, and the slopes are often cold and wet with seepage waters.

In the following table the normal temperature and rainfall, based upon official records covering a period of ten years, are given for four stations, beginning with Freehold, in the eastern part of the area, and ending with Trenton, in the western.

Normal monthly and annual temperature and precipitation.

Month.	Freehold.		New Brunswick.		Somerville.		Trenton.	
	Temperature.	Precipitation.	Temperature.	Precipitation.	Temperature.	Precipitation.	Temperature.	Precipitation.
	°F.	Inches.	°F.	Inches.	°F.	Inches.	°F.	Inches.
January	29.7	4.16	29.5	3.82	27.9	3.76	33.4	3.55
February	31.4	3.86	29.3	3.64	30.1	3.99	34.9	3.60
March	37.6	4.69	38.8	3.99	38.5	3.81	40.9	4 49
April	47.9	3.56	50.1	3.68	50.0	3.05	53.7	3.61
May	60.0	3.77	61.4	4.02	61.3	4.28	65.2	3.92
June	69.2	2.99	80.7	3.80	70.2	3.88	74.5	3.94
July	73.2	4.32	76.3	4.92	74.9	4.89	78.9	5.53
August	71.4	4.45	73.9	4.93	74.1	4.17	76.9	5.17
September	64.9	4.94	67.0	3.94	67.7	3.37	68.8	4.05
October	53.2	3.47	55.1	3.45	54.4	3.08	57.2	3.87
November	42.6	4.05	43.3	3.93	43.4	4.51	46.8	4.18
December	33.9	3.43	33.3	3.57	33.6	3.69	37.6	3.43
Year	51.2	47.69	57.3	46.69	52.2	46.48	55.7	49.34

The prevailing wind movement, also on a basis of records covering a period of ten years, is from the northwest in the winter and southwest in the summer season. From observations during the survey the general rains are usually accompanied by northeast or southeast winds, while the thunder showers usually come from the northwest.

The average dates of killing frosts for the four stations are as follows: Freehold, spring, April 15; fall, October 16. New Brunswick, spring, April 15; fall, October 14. Somerville, spring, April 26, fall, October 9. Trenton, spring, April 12; fall, October 16.

PHYSIOGRAPHY AND GEOLOGY.

The country presents a beautiful and varied topography. Those areas more resistant to disintegration and decomposition stand out in prominent relief, showing the close relationship between the physical features, as wrought by atmospheric agencies, and the underlying geological formations. This relationship is particularly striking in the northern part of the area, where the trap-rock ridge and Sourland Mountain break through the rolling country of the Brunswick shale formation and rise in bold outlines to a height of 500 feet above sea level.

Although the differences are not so pronounced in the unconsoli-

dated area—the Coastal Plain—there is still considerable variation. In the sand areas of Ocean County the general level is only relieved by occasional gravel-crested hills. Another part of the Coastal Plain, occupied by the Cretaceous-Eocene formations, rises in a series of partially detached, steep-sided hills which extend from Creamridge to the hills northeast of Manalapan. These hills rise to an elevation varying from 160 feet to 300 feet above sea level, and form the most important drainage divide of the southern part of the area surveyed. The Cretaceous-Eocene reaches north and southwest to the gently undulating Pleistocene uplands and east to the dissected areas of the Pensauken formation.

A line of contact extends through the area, dividing the consolidated formations of the Triassic and Trenton-Philadelphia gneiss from the unconsolidated series of the Atlantic Coastal Plain. This divide extends in a generally northeast and southwest direction from Trenton to New Brunswick. Of the Triassic formations the Brunswick shales have the widest distribution. The rock itself is of an Indian-red color and is generally a soft and crumbling shale or argillite. It gives rise to the slightly undulating topography of the northwestern part of the area.

The Trenton-Philadelphia gneiss does not outcrop sufficiently to influence the character of the soils of the area. It generally comes to the surface along the deeper stream courses in the vicinity of Trenton, and along Stony Brook southwest of Princeton. In the neighborhood of Trenton it is covered with Pleistocene deposits, which form the Sassafras loam.

The trap ridge, Jura-Trias in age, consists of very hard, massive rocks varying from diabase and gabbro to gabbro diorite. It owes its position to the intrusion of a dike through the shale formation. This ridge, which varies in elevation from 100 to 300 feet above the general elevation of the surrounding country, is usually covered with large bowlders. The rock outcrops along Lawrence Brook, northwest of Fresh Ponds, and also southwest of Deans. Here it modifies slightly the character of the soil of this vicinity, which as a result has been correlated with one of the upland soil types. In the vicinity of Metuchen, southwest along the Raritan River to New Brunswick, Franklin Park, and Rockyrill, is found a remnant of glacial material, consisting of stones and pebbles of quartzite and chert, varying from one-half inch to 6 inches in diameter, many of them bearing the marks of glacial striation. This heterogeneous drift, reworked with the Brunswick shales, gives rise to one of the most important soil types of the area.

The Coastal Plain series owes its origin to the deposits of glacial material in marine waters as offshore sediments at a time when the land surface was much lower than at present. The deposits consist of

alternate layers of gravel, sand, and clay laid down in horizontal beds. The succession is very often interrupted and modified, as changes in elevation or deposition occurred, but generally they follow in a definite order.

Where exposed these deposits, under the agencies of erosion, general surface weathering, and the reworking of material by wave or stream action—each separately or all combined—have resulted in a variety of soil types varying widely in character and fertility.

SOILS.

The Trenton area is one of varied soils, there being fourteen distinct types besides Meadow shown on the map accompanying this report. All of these soil types have been found in preceding surveys. The subjoined table gives the total area of each of these soils and the percentage which each is of the whole area:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Penn loam	171,712	33.1	Penn sandy loam	10,816	2.1
Sassafras loam	84,672	16.3	Quinton sandy loam	8,640	1.7
Collington sandy loam	83,456	16.1	Penn stony loam	5,632	1.1
Norfolk sand	50,880	9.8	Sassafras gravelly loam	3,712	.7
Meadow	44,800	8.6	Westphalia sand	1,408	.3
Elsinboro fine sand	26,176	5.1	Windsor sand	512	.1
Cecil loam	13,952	2.7	Susquehanna gravel	192	.....
Alloway clay	11,904	2.3	Total	518,464	.....

SASSAFRAS LOAM.

The Sassafras loam is a dark-yellow or brown loam, with an average depth of 12 inches, underlain by a heavy loam or clay to a depth of 3 feet or more. The subsoil usually rests on a layer of gravel. The content of sand varies and in a few places the soil tends toward a sandy loam. This soil is found typically developed in the vicinity of Cranbury Station, Prospect Plains, Windsor, Newton, and Jamesburg. It also occurs on the divide between Lawrence Brook and South River, and on Northwestern Ridge, between Englishtown and Jamesburg.

The Sassafras loam is generally found occupying the level or gently rolling divides, ridges, and uplands of the central part of the area. The drainage is generally good.

This soil is sedimentary in origin and owes its comparatively wide distribution to the fact of its recent deposition, being one of the last sediments laid down. It was formed during Pleistocene time, when the part of the country occupied was submerged in the sea. The material composing the soil was transported from land areas farther

north. There is great similarity between the material making up this soil and that derived from the shale formation between Princeton and Trenton, which seems to point to a like origin in both.

The Sassafras loam is used chiefly for general farming. It is particularly well adapted to dairying. Corn, oats, wheat, and potatoes all produce good crops. The yield of corn varies from 35 to 70 bushels per acre, according to condition and cultivation of the land; oats from 35 to 50 bushels; wheat from 20 to 35; and potatoes from 75 to 150 bushels. Hay yields from 1 to 2 tons per acre. These yields represent the average range and are a fair indication of the productiveness of this type of soil. When the soil is in the best condition and heavily fertilized much larger yields are secured.

The potatoes grown on this soil are not so good as those produced on the Collington sandy loam, nor is the stand of rye or clover so heavy, but grass usually does well and makes excellent pasture of a permanent character.

Of the fruits the apple has shown a particular affinity for this soil, and its cultivation has in the past been quite successful, but many of the orchards are rapidly going to ruin, generally as a result of carelessness.

The following table shows the texture of the soil and subsoil of the Sassafras loam:

Mechanical analyses of Sassafras loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
7601	1 mile S. of Newton.	Brown loam, 0 to 10 inches.	1.45	2.26	8.28	6.30	9.94	10.08	53.38	8.80
7605	Cranbury.....	Brown loam, 0 to 8 inches.	1.67	2.28	9.16	7.50	24.54	8.72	37.70	9.90
7603	1½ miles N. of Oldbridge.	Brown loam, 0 to 10 inches.	2.70	2.10	6.20	6.98	10.54	10.70	52.54	10.38
7607	1 mile S. of Lawrenceville.	Clay loam, 0 to 6 inches.	2.40	.84	4.20	4.08	11.80	15.24	45.94	16.98
7602	Subsoil of 7601.....	Compact loam, 10 to 36 inches.	.98	1.48	5.80	5.64	10.56	11.34	49.16	15.70
7604	Subsoil of 7603.....	Compact loam to yellow clay, 10 to 33 inches.	1.63	2.64	8.76	7.60	8.76	8.52	46.16	17.18
7608	Subsoil of 7607.....	Loam, 6 to 36 inches.	.90	1.70	4.10	4.32	12.84	14.42	42.72	19.48
7606	Subsoil of 7605.....	Compact loam, 8 to 36 inches.	.84	1.90	6.48	5.80	17.40	8.88	35.80	23.58

SASSAFRAS GRAVELLY LOAM.

The Sassafras gravelly loam is a medium to coarse sand containing a large percentage of rounded gravel varying from one-half inch to 6 inches in diameter. The subsoil consists of the same material, which at a depth usually between 24 and 36 inches becomes somewhat sticky or loamy, and finally grades into sand or gravel.

The Sassafras gravelly loam occurs upon the sloping uplands or along the larger stream courses between Jamesburg, Hightstown, and Monmouth Junction.

This type owes its origin to the outcropping of the gravel bed underlying the Sassafras loam, or is the result of general surface washing or erosion. It is found in narrow streaks in conjunction with the Sassafras loam, and the contact between the two is indistinct, owing to their gradual blending.

The soil is usually well drained, but not droughty. Good crops of rye, clover, and potatoes are grown, but this type is especially well adapted to the stone fruits and grapes.

The following mechanical analyses show the texture of soil and subsoil of the fine earth of the Sassafras gravelly loam:

Mechanical analyses of Sassafras gravelly loam.

[Fine earth.]

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
7609	1 mile S. of Prospect Plains.	Gravelly loam, 0 to 18 inches.	1.41	12.10	20.64	17.20	11.92	7.30	19.20	11.00
7611	1 mile SW. of Hoffmans.	Sandy loam with gravel, 0 to 10 inches.	.45	2.22	10.80	17.94	19.84	10.62	24.14	14.36
7610	Subsoil of 7609.....	Gravelly clay, 18 to 36 inches.	.57	5.52	17.70	21.20	19.64	5.44	12.60	16.96
7612	Subsoil of 7611.....	Gravelly loam, 10 to 36 inches.	.43	7.14	14.50	15.20	23.12	6.24	6.98	26.60

COLLINGTON SANDY LOAM.

The Collington sandy loam is a red, brown, or yellow sandy loam, having a depth of 20 inches, underlain by a sticky sandy loam of the same or lighter color. This grades into a yellow or greenish-yellow clay resting upon a greenish or orange sand. Throughout the soil occur pipes and veins of iron crust, and occasionally the surface is strewn with iron-stained gravel. Although typical in all parts of the area mapped, the surface soil differs slightly with the state of decom-

position of the greensand, from which most of the soil is derived, with the position occupied, or with the length of time it has been under cultivation. These are local conditions which commonly influence the value of all soils, but in the case of the Collington sandy loam they are more pronounced than common and are the main factors influencing its value as an agricultural soil.

The Collington sandy loam occupies a larger area than does any of the other types found in this section of the Coastal Plain. It is practically confined to the middle, eastern, southern, and southeastern parts of the area surveyed, in the vicinity of Perrineville, Clarksburg, the Red Valley, Creamridge, Arneytown, and Ellisdale. There is also an area south of Englishtown.

The original material of this type is the greensand of the Cretaceous age, from which the soil has been derived either directly as a result of decomposition, or indirectly from these sands reworked. This type is found at all elevations and has a rolling or hilly surface.

Where the soil is deepest light farming and trucking are practiced to advantage; where thinner, grass and grain give excellent results, although generally this soil is best adapted to the production of corn, rye, and potatoes. The yields of corn vary from 35 to 70 bushels per acre. With rye an average yield of 20 bushels is secured, but 35 bushels have been produced under good general conditions and heavy fertilization. The production of potatoes on this type is very successful. This crop is at present practically limited to the area in the vicinity of Allentown and Hightstown. The average yield is 150 bushels per acre, but nearly 300 bushels per acre have been produced. Potatoes grown on this soil are earlier and of a better quality than those grown on the Sassafras loam, although not quite so good or so early as those produced on the Norfolk sand.

In the southern part of the area this soil is largely used for dairying purposes, as the soil is a little thin and the clayey subsoil near the surface. The yield of hay will average about 1½ tons to the acre, which is a little less than the Sassafras loam produces. The grass does not last as long as on the latter type, although a much better stand of clover can be secured.

Where this soil occurs in the more hilly country it is adapted to the production of the Kieffer pear. The color of this fruit is not so good nor the yield so large as in the Norfolk sand, though superior to the product of the Collington sandy loam of the lower levels.

The table on page 171 gives mechanical analyses of the soil and subsoil of this type.

Mechanical analyses of Collington sandy loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct*	*P. ct.*
7574	1 mile SW. of Machaponix.	Brown sandy loam, 0 to 18 inches.	1.07	1.34	8.64	27.84	35.62	15.24	7.22	3.86
7576	1 mile N. of Perrineville.	Coarse sandy loam, 0 to 24 inches.	.58	1.20	19.68	34.80	27.22	4.06	7.06	5.90
7572	½ mile W. of Davis..	Brown sandy loam, 0 to 9 inches.	.94	1.14	8.64	18.02	22.92	10.62	20.04	18.38
7575	Subsoil of 7574.....	Greenish-yellow clay, 18 to 36 inches.	.63	.56	4.50	16.36	28.08	16.20	20.10	14.20
7573	Subsoil of 7572.....	Sticky sandy loam, 9 to 36 inches.	.32	.64	8.06	18.78	28.38	14.00	13.78	16.36
7577	Subsoil of 7576.....	Sticky sandy loam, 24 to 36 inches.	.68	1.02	20.44	31.12	22.06	2.38	5.08	17.90

NORFOLK SAND.

The Norfolk sand is a gray, orange, or red sand of medium to coarse texture, usually having a depth exceeding 3 feet. Throughout the soil are found occasional gravel and clay strata, and oftentimes, especially in the higher elevations, iron crusts formed by the cementing of the sand by soil solutions. Occasionally on the surface and in the soil coarse rounded gravel occurs, varying from one-quarter to one-half inch in diameter. This material is derived from the cross-bedded sands and gravel areas of the deltas, particularly in the vicinity of Oldbridge and Jamesburg.

The Norfolk sand is extensively developed in the eastern portion of the area surveyed, particularly in the vicinity of Oldbridge, Spotswood, and Helmetta. Areas also reach out north and south along the Monmouth road between Smithburg and Prospertown.

This soil is found at all elevations, from the valley slopes of tidewater streams to the crests of some of the highest hills. It owes its distribution to the occurrence of upland deltas, ancient forelands, and the more recent terraces bordering the larger streams. In its origin it is purely sedimentary.

The Norfolk sand is a typical early truck soil. It extends along the Atlantic seaboard from New England to Alabama. In some localities it has reached a high state of cultivation and is now much more productive than the greater part of it in the area surveyed, where most of the type is still covered with a growth of shrubs and trees, chiefly pine, chestnut, and burr, basket, and chestnut oak, and their scrub variations.

The great diversity of topography of this soil gives it a wide local

range of agricultural value and use. For instance, in the forelands south of Oldbridge and Helmetta, where the water table is close to the surface, a fair return from grain can be secured, while as developed south of Burksville, at an average elevation of 140 feet, rye would not yield on the average 10 bushels to the acre. At these higher elevations the stone fruits have a much better quality and color than where grown on lower and wetter areas.

Generally the truck grown upon the Norfolk sand is of fine quality. The soil has a special adaptation, however, for the production of sweet corn, melons, cantaloupes, sweet potatoes, asparagus, peaches, plums, and strawberries and other small fruits.

In the vicinity of Burksville and along the Monmouth road many strawberries are raised. The berries show considerable variation in quality and quantity. They are found doing their best on the black sand bordering the streams, as here they do not suffer from drought. They are not injured particularly by the heat, except where planted in clearings surrounded by woods, where there is no circulation of air to keep them from firing. Blackberries do remarkably well in such places, being able to withstand considerably more heat, while they are less profitably grown near streams, the vines having a tendency to run to wood.

The asparagus grown upon this soil type is of the finest quality. This crop is specialized in the area southeast of Hightstown. It is a better product for the market than that grown upon the Collington sandy loam, as, though not so large, the shoots grow straighter.

The production of the Kieffer pear is doing much to utilize land which would otherwise be abandoned. The fruit grown on the Norfolk sand is superior to any sold upon the New York market. It reaches its height of perfection of quality and color upon the Norfolk sand in the hilly country in the neighborhood of Perrineville and northwest toward Englishtown.

The following table gives mechanical analyses of the Norfolk sand:

Mechanical analyses of Norfolk sand.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
7600	¾ mile N. of Oldbridge.	Fine to coarse sand, 0 to 36 inches.	0.10	4.32	26.90	29.80	33.84	1.86	2.40	0.74
7598	1 mile S. of Carr's tavern.	.....do	.34	2.08	7.52	28.66	41.52	15.84	1.90	2.48
7599	1 mile S. of Oldbridge.	Medium to coarse sand, 0 to 36 inches.	.82	1.48	19.00	38.18	31.24	4.78	2.58	2.60

ALLOWAY CLAY.

The surface soil of the Alloway clay is a brown, red, or gray clay loam, with a depth of 9 inches, underlain by plastic, tenacious red, yellow, or mottled clay to a depth of 3 feet or more. Throughout the soil and over the surface is a scattering of rounded quartz or cherty gravel, varying from one-fourth to one-half inch in diameter.

The Alloway clay occurs in one extensive area southwest of New Brunswick and in smaller detached areas, usually bordering the larger streams, in all parts of the survey. Its surface is level or gently rolling, and it is found at moderate elevations. Its condition is such as to give the impression of lowness. In fact, owing to the impervious nature of the soil and subsoil of this type, and to its general position, it is usually wet and poorly drained.

The Alloway clay is sedimentary in origin, being one of the finest of the offshore deposits laid down during the marine submergence. It is not only important where it occurs typically developed, but also in the influence of its materials upon the physical characteristics of some of the other soil types of the area. This clay has been largely reworked with a portion of the Sassafras loam, and it forms the characteristic subsoil of a phase of the Collington sandy loam and the Quinton sandy loam.

The soil is cold and refractory and only partly under cultivation. The rest of the area is at present largely meadow or swamp. Under careful management the soil closely resembles the heavier limestone soils of Pennsylvania, Maryland, and Virginia.

The most desirable tilth and productiveness can only be secured by establishing a good drainage system—which ought not to be difficult, since the areas usually border the streams—and by gradually loosening the subsoil to a greater depth by use of the subsoil plow. Frequent and generous applications of lime, neutralizing the natural acidity of the soil, will do much to improve its tilth. When properly drained and cultivated this soil is most productive, being particularly well adapted to the grains and grasses.

The following table contains mechanical analyses of the Alloway clay:

Mechanical analyses of Alloway clay.

[Fine earth.]

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
7566	Franklin Park station.	Heavy clay loam, 0 to 6 inches.	3.46	1.18	3.52	3.80	5.42	5.84	53.80	25.30
7567	Subsoil of 7566.....	Heavy mottled clay, 6 to 36 inches.	1.03	.80	3.96	4.98	6.88	7.10	46.82	28.76

QUINTON SANDY LOAM.

The Quinton sandy loam is a brown or yellow sandy loam, containing some fine gravel, with an average depth of 10 inches, grading into sticky sand and fine gravel, and underlain at a depth of from 15 to 18 inches by the same material intermingled with a considerable proportion of plastic yellow clay. The whole rests upon a bed of gravel or fine gravel and sand mixed.

This soil occurs in detached areas from the vicinity of Hightstown westward toward Trenton, and also around Princeton Junction. It occupies the ridges or the crests of hills in the areas of rolling topography.

The position and character of the Quinton sandy loam seem to indicate that it once formed ancient beaches or bars. It is clearly a sedimentary soil, and its freedom from clay or loam particles shows either that it was deposited in comparatively swift currents or else that it has been thoroughly reworked by stream or wave action. What plasticity it does possess in its subsoil, or here and there in the surface soil, is due to reworking with the material of the Alloway clay or with Sassafras loam—itself often a product of such reworking. Some areas of this soil occupy what were formerly stream deltas. Such areas are usually rather more gravelly than the typical soil, but are otherwise of about the same agricultural value.

The Quinton sandy loam has a limited distribution in the Trenton area, which gives but little opportunity to study its fertility and adaptation to crops. It is used largely for general farming, but is not so well adapted to this use as is the Sassafras loam. It is of too light a texture for grain and grass. However, corn, rye, clover, and potatoes do fairly well. This soil shows a special adaptation for growing nursery stock and all kinds of fruit. Of the fruits, the Elberta peach and Moore's Early grape are most successful, both showing a particular affinity for this type. The average yield of grapes is estimated to be 2½ tons to the acre. The yield of peaches depends on the age of the tree and the season. The quality of the fruit is said to be of the best.

The table on the following page gives mechanical analyses of the soil and subsoil of the Quinton sandy loam.

Mechanical analyses of Quinton sandy loam.

[Fine earth.]

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
7596	2 miles SE. of Lawrence Station.	Fine sandy loam, 0 to 18 inches.	1.55	2.60	11.36	10.58	25.22	22.12	18.70	9.42
7594	2½ miles SW. of Hightstown.	Medium to coarse sandy loam, 0 to 20 inches.	1.42	3.62	16.58	11.08	12.78	9.16	34.58	11.98
7597	Subsoil of 7596.....	Sticky sandy loam, 18 to 36 inches.	.44	3.44	11.26	8.72	22.66	17.14	18.72	17.26
7595	Subsoil of 7594.....	Sticky sand and gravel, grading into yellow clay, 20 to 36 inches.	.64	7.16	23.70	11.76	8.96	5.68	20.94	21.20

WINDSOR SAND.

This type is a coarse, gray, sandy soil containing considerable fine gravel. It occupies the hill slopes and is the result of an outcrop of the cross-bedded strata of sand and fine gravel of an ancient delta. This type is not under cultivation in this area and is covered with a growth of burr, basket, and scrub oak. It is known as the pine barrens of southern New Jersey and Maryland. In other places it is used to a limited extent for early truck and peaches.

The Windsor sand has a very limited distribution in the area, occurring only in the vicinity and southwest of Oldbridge.

ELSINBORO FINE SAND.

The Elsinboro fine sand is a yellow, reddish-brown, or brown sandy loam, with a depth of 10 inches, resting upon a subsoil much lighter in color, but of the same texture, extending to a depth of 3 feet or more. The soil contains a relatively large proportion of organic matter in areas bordering the river and streams, but this decreases as the distance from the streams increases. The great difference in color is mainly due to the variable amount of organic matter in the soil.

The Elsinboro fine sand occupies the level or gently rolling uplands, and also some of the valley slopes, below the Sassafras loam. As it occurs upon the higher levels it occasionally contains considerable gravel, while generally throughout the type there is a small quantity of this material present.

This soil is used largely for the production of early truck in the vicinity of Trenton, but with the extension of good roads its produce comes into competition with the earlier and better products of the truck lands of the Norfolk sand in Ocean County, and it is not so val-

uable as formerly as a general market-garden soil. On the other hand, the Elsinboro fine sand is well adapted to the production of late truck, and large areas are planted in tomatoes and peas for canning purposes. This is developing into a profitable special industry on this soil.

In Pennsylvania the Elsinboro fine sand was used largely for tobacco culture, but this has been abandoned, and the areas in that part of the survey are now used for general farming. It is not as well adapted to this as the Sassafras loam.

The following table contains mechanical analyses of the soil and subsoil of the Elsinboro fine sand:

Mechanical analyses of Elsinboro fine sand.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
7580	1 mile E. of Trenton.	Fine sand, 0 to 6 inches.	1.52	0.22	3.24	14.04	39.10	17.44	18.96	6.94
7578	2 miles E. of Tullytown, Pa.	Fine sand, 0 to 10 inches.	1.45	.56	2.40	3.02	17.24	29.34	39.36	8.08
7581	Subsoil of 7580.....	Fine sand, 6 to 36 inches.	.45	.10	3.54	17.72	36.44	17.02	17.70	7.48
7579	Subsoil of 7578.....	Compact fine sand, 10 to 36 inches.	.36	.20	1.74	2.14	18.86	33.48	35.10	8.48

WESTPHALIA SAND.

The Westphalia sand is a fine sand, of a loose, friable character and of variable color, having a depth of 3 feet or more. It occupies the slopes adjacent to the Norfolk sand on the forelands south of Helmetta and Oldbridge. It occupies but a small part of the area surveyed, and little or none of it is under cultivation.

The following table gives a mechanical analysis of a typical sample of this soil:

Mechanical analysis of Westphalia sand.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
7613	2 miles SE. of Helmetta.	Fine sand, 0 to 20 inches.	0.20	0.34	3.80	18.04	62.28	11.96	1.18	2.14

SUSQUEHANNA GRAVEL.

The Susquehanna gravel has the smallest distribution of any soil in the area surveyed. It consists of coarse sand and gravel, and is generally unproductive. It is used largely for road ballast, and is dug for this purpose from pits in the Sassafras loam or in the area northeast of New Brunswick.

PENN LOAM.

The Penn loam consists of an Indian-red, yellow, or brown loam having a depth of 10 inches and underlain by heavy loam or clay of the same color, resting upon bed rock.

This soil has a greater area than any of the other types mapped in the present survey. It occupies nearly the whole area of the consolidated formations, occurring to a large extent in the vicinity of New Brunswick, Middlebush, Metuchen, Princeton, Somerville, and Lawrenceville.

The Penn loam is derived, through the process of disintegration and decomposition, from the Triassic shales. The surface of the type is gently rolling, being slightly more uneven in the northeastern and northwestern than in the northern part of the area.

A gravelly or pebbly phase is found in the vicinity of Metuchen, southwest toward New Brunswick, Franklin Park, and Rockyhill; also west of Boundbrook. The gravel intermingled with the soil and subsoil is glacial drift material, but the quantity is not sufficient to materially affect the character of the soil. The gravelly phase, contrary to the usual experience with such soils, is thought by some to be less droughty than the typical soil.

A heavy phase, consisting of a heavy yellow clay loam, underlain by heavy clay, occurs between Princeton and Trenton. This is slightly more productive than the typical soil, especially where grain is the crop grown. It also withstands drought better, but the differences are not sufficient to form the basis of a new type.

Another heavy phase occurs adjacent to the Cecil loam on the trap ridge and on Sourland Mountain. The soil there is derived from a flagstone or argillite. It occupies the slopes of ridges. These slopes are subjected to almost continual wash, due to seepage water, while the surface is strewn with stone fragments. The soil closely resembles the Dunkirk shale loam of Chautauqua County, N. Y., and has a particular value for grape culture.

The slopes are usually much too steep and a great part of their area too thickly strewn with bowlders of the underlying trap rock to allow general farming, but are adapted to pasture, grapes, and apples.

The Penn loam, where free from stone and not too steep, is used largely for general farming, but is best adapted to grass and grain. It has a particular value for stock raising, although there is compara-

tively little done in this industry. In some sections dairying is an important interest.

The soil is deficient in organic matter and suffers to a considerable extent from an almost imperceptible wash. The thinness of the soil is attributed to this wash, the soil material being carried away almost as fast as the soft shales disintegrate. Although generally esteemed droughty in this area, in places the soil has been found most resistant to this condition, and in such places it almost equals the limestone soils of Pennsylvania in productivity.

This tendency to drought, however, can be overcome in some degree by the incorporation of organic matter in the soil, either by the application of stable manure or by plowing under green manuring crops, and by gradually deepening the soil in plowing. If the plow is run in the fall, the shale fragments brought to the surface will be almost disintegrated by the following spring.

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

Mechanical analyses of Penn loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
7584	3 miles SW. of Princeton.	Heavy red loam, 0 to 10 inches.	2.39	1.48	3.22	2.78	5.86	13.12	61.42	11.46
7586	1 mile NE. of Millstone.	Loam, 0 to 5 inches.	1.90	3.38	4.00	3.22	6.40	12.58	54.68	15.74
7582	1 mile E. of Flagtown.	Heavy red loam, 0 to 10 inches.	2.80	1.04	1.90	1.12	2.34	6.14	64.44	23.02
7588	1 mile W. of Middlebush.	Heavy loam, 0 to 5 inches.	1.38	3.40	7.20	4.50	7.58	5.04	41.62	29.62
7587	Subsoil of 7586.....	Heavy loam, 5 to 24 inches.	1.28	3.50	5.22	3.42	6.44	12.06	53.76	15.54
7585	Subsoil of 7584.....	Heavy red clay, 10 to 36 inches.	.82	.62	1.46	1.26	3.80	10.24	64.86	17.76
7583	Subsoil of 7582.....	Red clay 10 to 36 inches.	1.78	.78	3.18	1.64	3.64	12.74	48.44	29.60
7589	Subsoil of 7588.....	Heavy red clay, 5 to 30 inches.	1.01	2.92	7.44	4.70	8.44	5.40	36.48	34.34

PENN STONY LOAM.

The soil is a brown or yellow sandy loam 10 inches deep, underlain by a gritty yellow clay, which grades into a red clay at a depth ranging between 24 and 36 inches. Over the surface and through the soil are found considerable quantities of rounded gravel and bowlders varying from one-half to 6 inches in diameter.

The Penn stony loam is practically limited to the area occupying the

divide northeast of New Brunswick and to the two very small areas west of Boundbrook. This soil is of a heterogeneous composition, being derived from the glacial drift reworked with the Penn loam. A variation from the type occurs along Lawrence Brook, northwest of Fresh Pond, and west of Deans. Here the soil is a sandy loam, gradually getting heavier as the depth increases.

Such crops as wheat, corn, rye, and clover are grown on the Penn stony loam, but it is best adapted to late truck, especially cabbage and tomatoes.

The following table gives mechanical analyses of the fine earth of soil and subsoil of the Penn stony loam:

Mechanical analyses of Penn stony loam.

[Fine earth.]

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
7592	¾ mile E. of Piscataway.	Sandy loam containing gravel, 0 to 10 inches.	1.71	3.84	7.98	7.00	13.10	9.54	40.86	16.98
7593	Subsoil of 7592.....	Sand and clay, 10 to 30 inches.	.62	2.30	7.82	7.68	13.78	9.66	36.64	21.84

CECIL LOAM.

The Cecil loam is a brown or red clay loam with a depth of 10 inches, underlain by a heavy red clay, which rests directly upon the trap rock in place. Throughout the area of this soil occur many massive bowlders, varying in size from 1 foot to 5 feet in diameter. These rocks are either diabase, gabbro, or gabbro diorite, and owe their presence to outcrops of the underlying trap rock.

The Cecil loam occupies the central portion of the trap ridge and Sourland Mountain. It owes its origin to the weathering of the rocks already mentioned. With the exception of the level uplands the surface soil of the Cecil loam is comparatively thin; on the steeper slopes there is little except the outcropping rock. Very little of this type is under cultivation. The difficulties of clearing are great, and although occupying rolling ridges the soil is wet and cold. Where cleared, the soil is producing good crops of grass, rye, buckwheat, and corn, but poor crops of wheat and potatoes, especially in years of moderate rainfall. Peaches, however, do remarkably well, having a better quality and color than any produced on the other soils of the area. Generally

the type is adapted only to forestry or pasture. The pastures are said to be quite resistant to drought and to last a long time without reseeding.

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

Mechanical analyses of Cecil loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
7568	½ mile W. of Amwell	Heavy red loam, 0 to 6 inches.	3.32	1.78	3.56	1.74	4.80	7.40	63.00	17.72
7570	2 miles N. of Princeton.	Clay loam, 0 to 8 inches.	1.78	.26	1.44	1.10	3.66	7.22	66.12	20.20
7569	Subsoil of 7568.....	Gritty red clay, 6 to 36 inches.	1.91	1.46	3.20	1.92	4.68	6.72	64.00	17.66
7571	Subsoil of 7570.....	Gritty red clay, 8 to 36 inches.	.58	1.42	3.94	2.50	6.12	7.30	49.62	29.10

PENN SANDY LOAM.

The Penn sandy loam is composed of a sandy loam, generally of a brown-red color, of medium to coarse texture, and of a depth of 3 feet or more. It occurs in the vicinity west of Boundbrook, bordering the Raritan, and north and northwest of Metuchen. Areas are also found along the Millstone River, in the neighborhood of Hillsboro, Westons Mills, and East Millstone.

The topography of this soil is that of the level to gently sloping uplands. It owes its origin to the weathering of the sandy shale of the Brunswick formation, or to an alluvial deposit of glacial origin along the rivers and within the range of their former overflow. As it occurs near the present stream courses it contains some rounded gravel, sometimes very fine and again ranging from one-quarter to one-half inch in diameter. As it is found along the Millstone River it is somewhat heavier and better adapted to general farming.

Generally the soil is too light for use as pasture or for growing grain, with the exception of rye. It is, however, particularly well adapted to early truck crops, of which early potatoes are probably the most profitable.

This soil is generally well drained, but some sections are subject to overflow in times of freshet.

The table following gives analyses of the soil and subsoil of this soil type.

Mechanical analyses of Penn sandy loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
7591	1 mile E. of Boundbrook.	Fine to medium sandy loam, 0 to 30 inches.	0.54	1.08	8.46	16.28	38.76	10.24	17.40	7.56
7590	3 miles E. of New Brunswick.	Brown sandy loam to medium sand, 0 to 30 inches.	2.28	1.00	6.10	14.32	32.94	6.62	25.20	12.66

MEADOW.

Meadow is a term used to signify soils in a wet and poorly drained condition, irrespective of their texture or position, and it must not be confused with the prevalent usage of the word conveying the idea of grass lands. In the Trenton area the Meadow tracts generally occur along the streams. There is considerable difference in the proportion of Meadow in the several soil types. It is noticeable that along the streams traversing the Penn loam comparatively little Meadow occurs, for the reason that these streams have usually cut through the underlying rock, and their escarpments are well drained and can be readily cultivated. In the Penn sandy loam a much larger area occurs, and in favorable seasons good grass crops are secured. Next to the Penn loam the Collington sandy loam has the least Meadow, while the Norfolk sand and Sassafras loam include large areas of land in this condition.

The Meadow of the Norfolk sand has a particular value, especially where it contains thick deposits of peat—a feature characteristic of the Meadow in this soil formation—since these peat meadows are successfully used in cranberry culture.

AGRICULTURAL CONDITIONS.

Throughout the area the farmers follow a system of mixed agriculture, although the boundaries of each soil type limit crop specialization more or less definitely. The system shows a somewhat advanced stage in the adaptation of soils to crops.

The degree of prosperity varies in different parts of the area. Taking the character of the farm buildings and the general condition of the farms as a basis, the most prosperous communities are found upon the Penn loam of the consolidated area and the Sassafras loam of the Coastal Plain formation. For agricultural purposes the Penn loam is worth from $25 to $60 an acre; the Sassafras loam from $20 to $150, the

differences in price in each case being dependent mainly upon location with respect to market and transportation facilities. The farm buildings usually consist of a large and comfortable dwelling and one or more commodious barns for hay and stock. In the northeastern and northwestern parts of the area many farms have been bought by wealthy business men of New York and neighboring cities for summer homes, and many costly residences have been built. The farms are improved with neatly trimmed hedges or patent wire fences.

As the distance from the area of the consolidated formations increases as one passes through the Coastal Plain, the buildings gradually become poorer and general conditions less prosperous. But little hay and grain are grown on the lighter soils of this region and consequently large barns are not needed. In the middle south and southwest the state of the agricultural classes again becomes much better. This area includes Creamridge, a part of the country noted in this section for its fine buildings and thriving farms. Over 50 per cent of the area surveyed is heavily encumbered by mortgages.

Where farms are rented the system of tenure is variable, but farms in the Coastal Plain are generally worked on shares, while in the consolidated area a money rent is customarily asked. The farms are of all sizes, from 5 up to 1,000 acres.

Considerable difficulty is experienced in securing good, reliable help. The area surveyed includes within its boundaries the cities of Trenton and New Brunswick, and lies close to Philadelphia and New York, and the labor, therefore, is apt to be made up largely of transients. An intelligent man can generally command a higher wage, in employment requiring fewer hours, in the city than he can secure on the farm.

In considering the character of the products upon which the agriculture of the area is based, and in pointing out the relation of these products to the several soils, it seems necessary to emphasize by repetition some of the more important facts already dwelt upon in previous chapters of this report.

There are fifteen different soils in the area. These include soils resulting from the disintegration and decomposition of the consolidated formations, and from the weathering of the later Pleistocene sediments of the Coastal Plain.

In the former area the Penn loam has the largest distribution, occupying nearly the whole area of the northern part. It is largely used for general farming, but is best adapted to grass and grain. With the exception of a few areas where the soil is deeper it is generally considered too droughty for the best results. But this is not an irremediable condition of the soil, being rather the result of imperfect methods of management. The soil is generally deficient in organic matter and is subject to an almost imperceptible wash. In the depres-

sions where organic matter and a deeper soil have accumulated the soil maintains a good supply of moisture, and crops are carried through dry periods as well as upon any other soil in the area. If, in place of the shallow culture generally practiced at present, there should be a gradual deepening of the soil, by deeper plowing, and the incorporation of organic matter, the natural conditions would be materially improved. It is an excellent grass land and admirably adapted to raising stock. In some sections dairying is also an important interest on this type.

The Cecil loam, owing to location, is generally adapted only for hill pastures and forestry. In some places, particularly on Sourland Mountain, areas of this soil offer good opportunities for raising sheep. The pastures produce an excellent quality of grass and are remarkably persistent. For agricultural purposes this land is worth from $12 to $35 an acre. The farm buildings are usually inexpensive and not in the best of repair. The fences are usually made of the bowlders collected from the fields. The Cecil loam, however, has a particular value as a peach soil. In no other section of the area surveyed can the peaches compare with the mountain peaches in color and quality. The trees bear abundantly, but there is room in many orchards for the introduction of better methods of culture.

The Penn sandy loam is adapted to light farming and the production of truck, for which purposes it is largely used.

The Penn stony loam is used largely for general farming, but it is better adapted to light farming and late truck. It is somewhat difficult to work, owing to the large percentage of large and small rounded gravel scattered through the soil. It is well drained, but not droughty, and is highly esteemed for its production of late truck and fruit.

Of the sedimentary soils of the Coastal Plain, the Sassafras loam has the largest extent. This type is used for general farming and is well adapted to this purpose. It has an especial value as a soil adapted to dairy farming and to the production of apples. The yield of hay does not average so high as on the Penn loam, but the Sassafras loam makes excellent grazing land. The meadow pastures are good and last a long time. With this soil, even more than with the Penn loam, deeper plowing should be practiced. In some places there is need of drainage, which in most instances can easily be had by ditching to the underlying gravel bed, found usually between 1 and 3 feet below the surface.

In order of extent the Collington sandy loam comes next to the Sassafras loam. This type is especially adapted to the production of corn, rye, and potatoes. The corn produced on this type is superior to any other grown in the area, and the rye can not be equaled for length of straw and yield of grain, although it is closely approached by that produced on the Sassafras gravelly loam or on the Quinton sandy

loam. The production of potatoes on the Collington sandy loam is gradually developing into a special industry. The yield is heavy and the product of fine quality. The hilly country on the drainage divide of the southeastern part of the area is largely covered by the Sassafras loam, and the soil there has shown a marked adaptation to the Kieffer pear, while the general features of soil, climate, and topography of this section would seem to indicate ideal conditions for grape culture. The Kieffer pear, although of fine quality as grown upon the hilly areas of this soil type, is not as good as that produced on the Norfolk sand, especially those areas of Norfolk sand occupying the highest elevations. Generally the pear trees grown upon the Collington sandy loam have a tendency to run to wood, and the fruit is not highly colored. On the higher areas of the Collington sandy loam the fruit, although not so large as when grown at lower levels, is of better quality and color. On the lower areas the fruit generally rusts.

The Norfolk sand occurs in the eastern and southeastern parts of the area mapped and is found at all elevations. It is a typical early truck soil, but owing to the proximity of the underlying water table, or in other cases to elevation, its adaptation is somewhat modified. In the areas having a high water table it is capable of producing fair crops of grain, clover, tomatoes, and cabbage. Where the ground water is lower it yields the best quality of early truck, such crops as sweet corn, melons, cantaloupes, asparagus, and all kinds of stone and cane fruits being most profitably grown. Comparatively little of this soil is under cultivation, the greater part being covered with a forest of pine and burr, basket, and scrub oak.

The Elsinboro fine sand is not nearly so early as the Norfolk sand and is better adapted to late truck. It produces good crops of corn, tomatoes, cabbage, asparagus, and potatoes, the best of which are of better quality than those grown upon the Collington sandy loam, though the yields are much lighter. The areas of this type occurring in Pennsylvania, along the Delaware River, are at present largely used for dairy farming Formerly they were used quite generally for tobacco culture. This crop has now been practically abandoned, as it was found impossible to compete with the Connecticut Valley growers. The soil is adapted to a wrapper leaf. At one time this tobacco was sold almost entirely for export to Germany, but since the change in the tariff there it has not been raised to any extent.

Comparatively little of the Alloway clay is under cultivation. It is a cold and wet soil, but with thorough drainage is most productive and well adapted to grain and grass.

The Quinton sandy loam is especially adapted to such crops as rye, corn, clover, and potatoes, although not so well adapted to these as is the Collington sandy loam. It has shown, however, that it is a very useful soil for growing the Elberta peach and Moore's Early grape

and for nursery stock generally. The yield of grapes is estimated to average 2½ tons to the acre.

The Sassafras gravelly loam has only a limited distribution within the area surveyed. It would have the same value as the Susquehanna gravel had it not been reworked with the Alloway clay or the silt of the Sassafras loam. As it is, it yields fine crops of rye, clover, and potatoes and is especially well adapted to peaches and other stone fruits.

The Windsor sand is not under cultivation, while the Westphalia sand is cultivated to a very limited extent. The Susquehanna gravel has the smallest area of any of the soil types in the present survey. It is one of the most unproductive of soils. The gravel of this formation is used for road ballast.

Much of the area classed as Meadow could readily be reclaimed by underdrainage. Lands now used only for pasture, and for this only a part of the year, could at small cost be converted into grass lands of great productiveness and permanency. Drainage tiles should be used for this purpose. Tiles are manufactured in large quantities from the various clay deposits underlying the different soil formations and are comparatively cheap. On the Meadow cranberry culture forms a very important and growing industry. The New Jersey cranberries find their way into all the important markets of the United States and Canada.

Commercial fertilizers are very generally used on the soils of this area. Great quantities of stable manure are brought into the area from New York and other near-by cities. This manure is used in the southern part of the area, especially in the growing of truck. The use of city manure is said to be gradually decreasing. It is usually heavily watered in the cars and is apt to be damaged by too rapid fermentation. It is also disliked because it contains so many weed seeds. Lime is generally applied to the soil in varying amounts and at intervals of about five years. Its use is thought to be very necessary, especially upon the Alloway clay, the Penn loam, and the Sassafras loam, where, besides neutralizing the acidity, it gives a better tilth. The applications can not be generally heavy enough, as over 70 per cent of a large number of determinations show the soils to be acid. Formerly large quantities of greensand marl were used, but now, except in the immediate neighborhood of some of the richer deposits, this natural fertilizer is but little employed.

The area surveyed is traversed by the New York, Amboy and Pemberton divisions of the Pennsylvania Railroad system, the Central Railroad of New Jersey, and the Philadelphia and Reading Railroad. These roads afford ready and rapid transportation to the neighboring markets.

The country roads are fairly good. The better roads are being gradually extended out from the larger towns, and some already reach

considerable distances back into the country. Consequently a great deal more carting is done than in most areas, 25 miles not being an unusual distance for wagon transportation of even the more perishable products. From the sandy area of Ocean County early truck is hauled in wagons to Trenton. This has seriously affected the growers of truck in the neighborhood of Trenton, who use the Elsinboro fine sand, a later soil, for truck growing. The principal markets for the products of the area surveyed are New York, Trenton, and Philadelphia. With the great diversity of soils, each having its special value for certain staple crops, the proximity to the important markets, and the exceptionally good facilities for transportation, this ought to be one of the most productive and prosperous areas of the Atlantic seaboard.

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