

Issued December 12, 1912.

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

SOIL SURVEY OF PLYMOUTH COUNTY,
MASSACHUSETTS.

BY

W. E. McLENDON AND GROVE B. JONES.

J. E. LAPHAM, INSPECTOR IN CHARGE OF NORTHERN DIVISION.

[Advance Sheets—Field Operations of the Bureau of Soils, 1911.]



WASHINGTON:
GOVERNMENT PRINTING OFFICE.

1912.

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS,
Washington, D. C., May 16, 1912.

SIR: A number of requests are on file in this office for an extension of the soil survey work in the State of Massachusetts. Among these are very urgent requests from prominent citizens of Plymouth County. The office found it possible to take up the work in this county during the field season of 1911.

The accompanying report and map embody the results of this survey, and I have the honor to recommend that they be published as advance sheets of Field Operations of the Bureau of Soils for 1911, as authorized by law.

Respectfully,

MILTON WHITNEY,
Chief of Bureau.

Hon. JAMES WILSON,
Secretary of Agriculture.

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SOIL SURVEY OF PLYMOUTH COUNTY, MASSACHUSETTS.

By W. E. McLENDON and GROVE B. JONES.

DESCRIPTION OF THE AREA.

Plymouth County is situated in the southeastern part of Massachusetts, occupying roughly the eastern half of that region of the State lying between Rhode Island on the west and Massachusetts Bay and Cape Cod on the east. It is bounded on the north by Norfolk County and Boston Bay, on the east by Massachusetts and Cape Cod Bays and Barnstable County, on the south by Buzzards Bay, and on the west by Bristol and Norfolk Counties. The western boundary is an irregular line paralleling in a general way the coast line on the east, and in this direction the county has an average length of about 35 miles, while perpendicular to this it has an average width of about 20 miles. Its greatest length is 48 miles, attained in almost a due north and south line between Hull in Boston Bay and Mattapoissett Neck in Buzzards Bay. The county includes 27

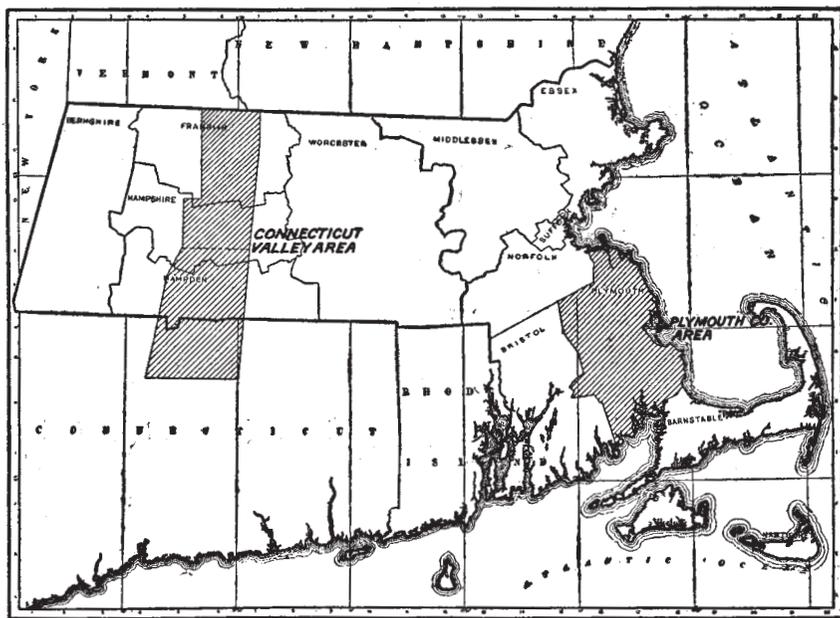


FIG. 1.—Sketch map showing areas surveyed in Massachusetts.

Bay and Cape Cod on the east. It is bounded on the north by Norfolk County and Boston Bay, on the east by Massachusetts and Cape Cod Bays and Barnstable County, on the south by Buzzards Bay, and on the west by Bristol and Norfolk Counties. The western boundary is an irregular line paralleling in a general way the coast line on the east, and in this direction the county has an average length of about 35 miles, while perpendicular to this it has an average width of about 20 miles. Its greatest length is 48 miles, attained in almost a due north and south line between Hull in Boston Bay and Mattapoissett Neck in Buzzards Bay. The county includes 27

Towns.¹ These include a total land area of 446,720 acres, or 698 square miles, besides numerous fresh-water lakes and ponds.

Cohasset, a detached township of Norfolk County, is also included in the survey on account of its position between Scituate, Hull, and Hingham Townships. It has an area of about 11 square miles.

The substructure of Massachusetts is made of solid rock formations and the broad surface features of the State correspond to the surface lie of these rock formations. Resting upon the solid rocks, however, there is a layer of unconsolidated material varying considerably in thickness, masking and in places completely obliterating the details of the rock-surface features.

The rock surface of the State slopes eastward and finally passes below sea level along a line running through Plymouth County approximately from Scituate to the southeastern corner of the county. About two-thirds of the area of the county lies west of this line.

The coast line would be here if there were not a thick layer of the unconsolidated material lying on top of the rock east of this. In other words, east of this line the whole of the surface is formed by a mass of unconsolidated material the base of which rests on the solid rock below sea level. East of this line the surface features are wholly due to the original lie of this material, this being a function of the process by which it was laid down, and subsequent modification by erosion. West of the line above mentioned the surface is determined in part by the layer of unconsolidated material, in part by the solid rock, and in part to the solid rock in general features with modification of detail by the layer of loose material.

As a whole the surface features are of four kinds, leaving out of consideration the details of the coast line.

(1) The coastal belt, beginning in Scituate and extending southward along the coast to the county line, is a rolling, hummocky belt, rougher, as a whole, than the rest of the county, the roughness consisting of roundish hills and basins with no regularity of arrangement, rather than of hills and creek valleys. It is the roughest part of the county so far as topography is concerned, has a maximum number of very large stones, but is not so gravelly as one of the other areas. This belt is from 3 to 5 miles in width. This will be called the Plymouth morainic belt, since it is mainly made up of a terminal moraine.

(2) Extending southwest from this belt in the southern part of the county is a region that consists essentially of a broad plain sloping gently southward. It is not at present wholly intact, but has been channeled by erosion, in some places thoroughly cut to pieces

¹ The term "Town" as used in this report is synonymous with "Township" as used throughout most of the United States.

by valleys about 100 feet deep, in others still preserving considerable areas of the original smooth surface. This area lies south of Plymouth. It is covered with a stunted growth of scrub oak and pine, very little attempt being made to cultivate it. This area can not be said to extend north of Plymouth, though throughout the western part of the county there are small areas that resemble it, though these areas are unimportant. This region will be called the Carver Plains.

(3) West of the Carver Plains in the south and the Plymouth morainic belt in the north lies an undulating region, smoother than either of the preceding. Its northern end lies approximately along the southern boundaries of Hingham and Cohasset. About all that need be said about it is that it is a region of gently undulating topography, not a hilly region like the Plymouth belt, nor a plain region like the Carver area. This will be referred to as the Brockton area.

(4) In Hingham, Cohasset, and Hull there is an area whose northern part belongs with the Drumlin topography of the Boston basin, whose southern part is essentially like the Brockton country, and whose central part contains a considerable area of plains country like the Carver Plains, the rest having somewhat the Brockton character.

The drainage of the county is effected mainly by three rivers and their tributaries, although there are a number of small streams in the coast region extending anywhere from 2 to 8 miles inland. Most of the drainage of the southern part of the county is southward through the Neweantic River into Buzzards Bay. Other more important streams of this region are the Agawam, Wankinco, Sippican, and Mattapoisett Rivers. The central and western portions drain to the west through the Taunton River and the north-central portion to the east through the North River. The extreme northern end is drained by the Weir and Fresh Rivers and Bound Brook, while along the east coast south of North River are several short streams, the most important of which are the South, Green Harbor, and Jones Rivers. The rivers are navigable only to small boats and this generally only within the tidal zone. They are not utilized to any extent for power purposes.

The landing of the Pilgrims on the *Mayflower* in 1620 marks the beginning of English settlements in Plymouth County, or what is known as the Old Colony District. From the landing place, where the city of Plymouth stands, settlements extended northward along the coast and gradually inland, until a large proportion of the better lands were taken for farming purposes. The descendants of the early settlers and other English people that afterwards moved in constituted a very large percentage of the population until about 30 years ago. Since that time there has been quite an influx of immi-

grants, principally Irish, French and English Canadians, Germans, and Swedes, so that now possibly not more than 50 per cent are native-born English. Some of the foreign element have taken up farming, but most of them work in the mills and factories or follow other industrial lines. In 1880 the total population of the county was 74,018, of which 7,943 was foreign born, while in 1900 it had a population of 113,985 with 21,994 foreign born. The census of 1910 gives the county a total population of 144,337.

The city of Plymouth, with a population of 12,141, is the county seat. It is situated in the eastern part of the county, overlooking Massachusetts Bay. Brockton, in the northwestern part of the county, with a population of 56,878, is the largest city, being an important manufacturing center, especially for shoes and shoe machinery. To the east and south of Brockton, within a radius of 8 miles, are several other important industrial towns and cities, with populations ranging from 3,000 to 7,000. Among these may be mentioned Rockland, Whitman, Bridgewater, Abington, and North Abington. Middleboro, in the southwest-central part of the county, is also an important industrial city, with 8,214 inhabitants. The region south of Middleboro has no large towns or cities and is rather thinly settled, except along some of the main roads and along the Buzzards Bay front, noted as a summer-resort section. The extensive sandy region between Buzzards and Cape Cod Bays, north of Plymouth, and thence in a narrower strip to Marshfield, is very sparsely settled. The South Shore or coast region from Plymouth north to beyond the county line is lined with summer resorts and picturesque residential towns. Among the latter may be mentioned Hingham, Hull, Cohasset, Scituate, Marshfield, Duxbury, South Duxbury, and Kingston. The South Shore, especially as far south as the North River and inland some 6 miles south of Hingham, is becoming more and more a part of the Boston metropolitan district, and even around the smaller industrial centers a great many live in the county who work or have business interests in the town.

The county has an excellent system of roads, except in the deep sandy sections, where scarcely anyone lives, and even here a few of the thoroughfares have been taken over and macadamized by the State. In the best developed sections a great many of the roads have been macadamized and are kept up by the State, and each township has done a great deal toward improving the others. Some of the best improved roads have been oiled to keep down dust and prevent wear.

Many of the country residents through the densely populated sections have the advantages of waterworks and electric lights, and rural mail-delivery service is maintained wherever there is any need

for it. The school facilities of the county are excellent. Besides good graded and high schools in the towns and cities, schoolhouses are found at convenient intervals through the country.

The railroads of the county are excellent, giving quick and rapid service to Boston and points west. All the lines belong to the New York, New Haven & Hartford system. From South Braintree about halfway between Brockton and Boston there are three radiating double-track lines. One of these runs almost due south to Taunton and thence more southeasterly to New Bedford, crossing the west edge of Lakeville Town. Another extends through Brockton, Bridgewater, Middleboro, and Wareham and on over into Barnstable County. The third extends through North Abington and Abington to Whitman and from there one single-track line runs to Bridgewater and another to Plymouth. A branch line from Abington gives an outlet for Rockland and Hanover, and West Bridgewater is on a short line connecting the Cape Cod and New Bedford lines. Another important line extends from Braintree eastward and southward along the South Shore to Plymouth, being double tracked from Braintree to Green Harbor and from Kingston, where it joins the Whitman line to Plymouth. A line extends west from Plymouth to Middleboro and two from here, one to Taunton and another to Fall River. In addition to the steam roads, interurban electric lines connect nearly all of the towns and cities. These afford a convenient passenger service, especially for local travel, and over most of them a quick express service is maintained. Water transportation is confined to a limited service between Boston and Plymouth and to the summer passenger traffic, mostly between Boston and Hull and Nantasket.

The county is very favorably situated in reference to the large markets. Even were this not true about all of the farm products except the cranberries, which go to all sections of the country, would find a ready market in the local towns and cities. In fact, a great many products that could be grown to advantage in the county are now being shipped in. The nearest large market is Boston, which is only about 10 miles north of the county, or to be more exact, 17 miles from Hingham, 20 miles from Brockton, 28 miles from Bridgewater, and 32 miles from Middleboro. New Bedford is only about 4 miles west of the southwestern corner and Fall River and Providence are not far from the western boundary.

CLIMATE.

The average climatic conditions in Plymouth County are represented in the table below, which is compiled from the records of the Weather Bureau station at Middleboro. Some variations from the

Middleboro conditions occur on account of differences in the distance from the water front, surface relief, elevation, and drainage. For instance, near the coast, as at Hingham, the early fall and late spring frosts are not as severe as a rule as they are farther inland, and the hottest days of summer are less oppressive on account of the sea breezes. The variations, though slight, may mean a difference of a week or more in the length of the growing season, especially for the more hardy plants. Depressed areas and wet bottom lands are more subject to frost than the ridges, and some parts of the same ridge and different ridges more so than others, depending upon the protection from the winds, the thoroughness of drainage, etc. The relation of such features to the rain and snow fall is not so apparent. In fact, there are no such local variations, except that during the summer months some sections seem to be visited more frequently by thunder showers than others. Most of the winter precipitation is in the form of snow, and that of the spring and fall comes as general rains, while in the summer it is principally in the form of thunder showers.

The region in general is characterized by long, cold winters with a heavy snowfall, and short, cool summers, usually accompanied by one or more short spells of intense heat and high humidity. That the summers are considered very pleasant on the whole is attested in the throngs of tourists coming from all sections of the country. The South Shore from Hingham to Manomet, east of Plymouth, and the Buzzards Bay front is literally lined with summer resorts, and a number of summer cottages are found around the inland lakes or ponds.

In the table it will be seen that the winter months have a mean temperature of 28° F., but with extreme variations from -23° F. to 64° F. The average depth of snow for the same months is about 9 inches. Usually it does not snow after the first of April and not much in the fall until toward the latter part of November and sometimes not until some time in December. The mean annual precipitation is about 48 inches, being greatest in the months with heaviest snowfall. The average date of the last killing frost in the spring is May 12 and of the first in the fall September 30. This gives an average growing season of about four and one-half months, which is long enough to mature good crops of corn, hay, and other general crops, besides many varieties of vegetables and fruits.

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

Month.	Temperature.			Precipitation.			
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year.	Total amount for the wettest year.	Snow, average depth.
	° F.	° F.	° F.	Inches.	Inches.	Inches.	Inches.
December.....	30	64	-10	3.7	1.3	4.1	6.6
January.....	27	60	-23	4.2	4.1	3.9	9.2
February.....	27	61	-12	4.2	2.5	3.6	11.3
Winter.....	28			12.1	7.9	11.6	27.1
March.....	35	69	2	4.8	4.5	5.6	5.8
April.....	45	86	12	3.4	1.4	2.1	T.
May.....	55	93	22	3.8	4.8	5.0	0.0
Spring.....	45			12.0	10.7	12.7	5.8
June.....	64	94	33	2.8	2.8	1.8	0.0
July.....	69	96	41	3.0	1.6	3.8	0.0
August.....	67	94	37	3.1	4.0	5.6	0.0
Summer.....	67			8.9	8.4	11.2	0.0
September.....	62	94	26	3.8	2.5	9.4	0.0
October.....	50	83	19	4.7	1.8	3.6	T.
November.....	40	74	1	4.2	7.2	10.2	3.4
Fall.....	51			12.7	11.5	23.2	3.4
Year.....	48	96	-23	45.7	38.5	58.7	36.3

AGRICULTURE.

The beginning of the agricultural development of Plymouth County dates back to the landing of the Plymouth colony in 1620. For a long time afterwards, however, very slow progress was made, and something like 200 years passed before even the better sections became fairly well settled. A large proportion of the county, including the rough morainic areas and extensive sand plain region extending from near Plymouth, Duxbury, and Marshfield on the north through to the Barnstable County line and Buzzards Bay on the south and smaller areas of similar character farther north and west, have never been occupied to any extent for agricultural purposes. The original growth, which consisted very largely of white pine, has long since been removed, and in its stead is now found a covering of scrub-oak bushes or in places a mixed growth of scrub oak and pitch pine. These uplands are still considered of little value, but through them are numerous areas of Muck, ranging from less than an acre to hundreds of acres in extent, which are now being used extensively for the growing of cranberries and where developed are valued much higher than any other lands in the county. Until the cranberry industry

was taken up on a commercial scale in the region these muck lands, too, were considered practically valueless.

Most of the other sections of the county, on the other hand, present quite a contrasting scene. Here, too, a considerable percentage of the lands is still in woods, although about all of the original timber has been removed, but there are numerous well-kept farms and farm houses and other evidences of a prosperity that has prevailed since early colonial days. The best and most extensive agricultural improvements have taken place in a narrow strip of country extending from Plymouth to north of Duxbury and through the northern, central, and western sections of the county, or, roughly, the territory covered by the Gloucester loam and sandy loam and parts of the Carver sandy loam.

The system of farming evolved by the early settlers has not undergone any radical changes to the present time. Methods of course have improved and new crops have been introduced, while some others have practically ceased to be grown, but with the majority of the farms the general crops are about the same.

Corn, hay, and oats were some of the most important crops and a very large acreage was devoted to pasture, as is the case now. Considerable attention was also given to the raising of hogs, cattle, and sheep, and the sale of these was the chief source of revenue. Among the minor crops were wheat, rye, barley, beans, potatoes, etc., intended principally for home use. General farming is still by far the most extensive type. Among the more important general crops are hay, with a total acreage greater than that of all of the others combined, corn, and oats. Along with this dairying has developed into an important industry, but the raising of beef cattle, hogs, sheep, and horses has become an insignificant part of the agriculture. In the special lines the most extensive acreage is devoted to cranberries, and the culture of this fruit is an important source of revenue. Irish potatoes, miscellaneous vegetables, and strawberries are also profitable crops, and poultry raising is an important industry. Nearly every farmer has at least a few apple trees, and here and there are found some peach, pear, and cherry trees, but there are only a few strictly commercial orchards in the county. The summer apples are not much in demand, that is, as a rule they do not command a satisfactory price in the market, but considerable quantities of late fall and winter apples are shipped to market, and these form one source of the farm revenues.

Anyone driving over the county, who is at all familiar with the general agriculture of the country and the markets afforded, can not help being impressed with the excellent opportunities for profitable farming. A large proportion of the county is occupied by naturally productive, well-drained, and easily tilled soils that are adapted to a

variety of agricultural and horticultural industries, and near at hand is almost an unlimited market for nearly all kinds of farm produce. Yet in the face of this only a few of the opportunities afforded are being taken advantage of to the extent they should be. In fact, except for a few crops, the agriculture of the region has suffered a decline extending over a decade or more and is becoming more and more subordinated to other lines of industry. Though the county was ranked principally as agricultural until about 30 years ago, it is now looked upon chiefly as a manufacturing and resort section. Until about 1850 general farming was practiced almost exclusively, and while very few made large fortunes nearly all made a good living and found it possible to build comfortable homes. Then, from the coming of the railroads until about 1875 marked the most prosperous period the farmers have experienced.

However, at the same time the movement to the cheaper and what were then considered the much richer lands of the west had gone on to the extent of badly depleting the farming population. More disastrous still was the rapid development of manufacturing in the region. The mills and factories required an immense amount of labor and the pay offered attracted large numbers from the farms. As a result a number of farms were abandoned outright and others were partly neglected on account of the scarcity of labor. All of the general crops grown, the raising of stock, and some of the special crops continued to decline both in acreage and yields until about 10 years ago, when a turn for the better set in. Very few abandoned farms are now to be found. Some places have been bought in by the owners of adjoining farms; some of the old places have been bought for summer homes, and others for occupation the year round by people having business in Boston and other near-by cities. Especially is this the case near the railroad along the South Shore and along the inland car lines.

Those immigrants of foreign birth or extraction now being attracted to the farm generally buy small tracts of 10 to 50 acres. A large number of the workers in the shoe factories in Brockton, Whitman, Bridgewater, and other towns have homes in the country near the car lines, and they generally farm on a very small scale, either devoting their spare time to raising poultry or to growing vegetables and berries for the market.

The majority of the small farms are used in the production of vegetables, berries, and other special crops, while the larger ones are devoted very largely to hay and pasture and dairying.

A concrete idea of the extent of the agricultural development of the county can be had by glancing at the returns of the United States census. In 1880 the total acres operated in farms was 194,787 with 86,002 acres improved. In 1890 there were but 144,381 acres

in farms with 56,922 acres improved. While in 1900 a slight increase was shown in acreage, a falling off occurred in the following 10 years, the census of 1910 giving a total of 136,915 acres in farms with 50,196 acres improved. In 1880, 39.4 per cent of the total land area of the county was in farms, and 44.1 per cent of the area in farms was improved, as against 31.7 per cent in farms and 36.7 per cent improved in 1910. While the area of land in farms has decreased considerably in the last 30 years the value of farm property has not shown a uniform movement. There was first a decrease in the value of the land, fences, and buildings from \$8,450,076 in 1880 to \$6,219,820 in 1890, but from this low point there has been a marked recovery to \$9,559,401 in 1900 and to \$15,245,614 in 1910. Other evidences of a rapidly improving tone in the agricultural conditions are to be had from the same source. As recently as 1900 the total value of the farm implements and machinery was \$252,160; of live stock \$680,211, while in 1910 the implements and machinery were valued at \$760,942, and domestic animals at \$1,246,689. Striking gains also will be noted in connection with some of the crops.

Dairying is an important industry and the chief source of revenue with many farmers, but it could be gone into much more extensively with assurance of profitable returns. The best soils for the purpose are the Gloucester loam and Gloucester sandy loam. The Gloucester stony loam can also be used successfully for pasturage in connection with the better lands. According to the census of 1910, there were 6,549 dairy cows in the county. Most of the milk is sold fresh in Boston and other nearby cities. There seems to be no reason why cheese making could not be established on an extensive scale and made profitable. In 1890 there were 1,695 pounds of cheese made on the farms in the county.

The raising of live stock, beef cattle, hogs, and sheep has declined to the point where it is no longer important, except on a comparatively few farms. In 1910 there were but 9,315 cattle in the county, including the milch cows; 4,978 hogs, and 343 sheep. There should be at least a few hogs on nearly every farm, as they can be kept at a very small cost, and there is no doubt that raising hogs on an extensive scale could be done very profitably where good yields of corn and other necessary crops can be grown. Sheep and cattle raising might prove profitable where large bodies of land too stony for general farming but suitable for permanent pasture can be had in connection with some of the more desirable farming lands. The Gloucester stony loam and the uncleared areas of the Gloucester loam and stony sandy loam and sandy loam can be converted into good pasture lands without going to the expense of removing much of the stone. At the same time cattle on the farm afford the easiest and one of the most satisfactory means of keeping the soil in a highly productive state.

Of course, in connection with dairying and cattle raising it is necessary to grow large quantities of hay and coarser forage and to devote a large acreage to pasture. More land is now used for these purposes than for all other crops combined. In 1910 there were 18,381 acres in hay and forage crops, producing 32,226 tons. There were 4,908 acres in timothy alone, 6,018 acres in timothy and clover mixed, and 70 acres in clover alone. There were 323 acres in millet and Hungarian grasses, producing 966 tons, and 4,485 acres in other tame and cultivated grasses, producing 5,513 tons of hay. The coarse wild grasses that thrive in the tidal marshes make a coarse hay and of this 1,245 acres were mowed in 1909, producing 1,350 tons. Clover is not grown nearly to the extent it should be, either as a forage crop or a means of improving the land. As a rule it does not do very well, but it should succeed on the better soils such as the Gloucester loam and sandy loam. In all probability the failure of this crop is due to a deficiency of lime and a consequent acidity of the soil. Liberal applications of lime should overcome the trouble. None of the soils are particularly adapted to alfalfa, but it can be grown successfully on the well-drained loamy types, especially the Gloucester loam and sandy loam. They should first be brought to a high state of cultivation, and then heavily limed before the crop is sowed. In addition to liming it is advisable to inoculate the soil by applying soil from an established alfalfa field or by treating the seed with a bacterial culture.

Corn is grown mostly in small patches, though by some considerable areas are planted for ensilage. Good crops of corn can be produced on any of the better uplands. Good crops of oats, too, can be grown on the Gloucester loam and sandy loam, and wheat ought to do well on the same types, especially on the loam. Neither of these crops, however, need be expected to give satisfactory yields unless the land is kept in a highly productive state, such as can be brought about by the proper rotation of crops. In 1909 there were 1,351 acres in corn, producing 59,547 bushels, an average of about 44 bushels per acre. This is a higher average yield than prevails through the corn belt of the Central West.

There were 98 acres planted in rye in 1909, producing 1,591 bushels. Some of the lighter sandy lands not particularly adapted to other general crops will grow good crops of rye. The field or navy bean now grown only in a small way could also be included in the general agriculture, especially on the less stony Gloucester soils. These should grow as good crops of beans as are secured on some of the soils of Michigan or New York, which are used extensively for the purpose.

There are a number of poultry farms in the county, especially in the northern part. Nearly every farmer has some poultry to market, and the prices secured for both poultry and eggs are generally very satis-

factory. Many of the standard breeds are raised, but the white Plymouth rock seems to be the favorite. From the last census we find the number of poultry, mostly chickens, given as 138,341 and valued at \$120,497. There is still room for an expansion of this industry without injuring the market.

While there is an abundance of apples for domestic purposes and considerable quantities are sold, fruit production on a commercial scale has not received much attention. Generally the home orchards are poorly kept, and as a result a large proportion of the fruit is of inferior quality. There is no profit in growing a poor grade of apples, but first-class fruit always commands a good price. Apples can be grown profitably over a large part of the county, but perhaps to the best advantage on the Gloucester and Carver soils. The rough lands near Plymouth, which are not used for any purpose at present, possibly would grow good apples, at least in the most favorable areas. Cherries also thrive, but are not grown to any extent. Pears and grapes do well.

The Irish potato is one of the most extensive of the cultivated crops, in 1909 there being 1,310 acres planted, producing 158,103 bushels. This crop can be grown successfully on any of the well-drained soils, but gives the most satisfactory results on the Gloucester loam, the Gloucester sandy loam, and the Carver sandy loam, and it is on these types that most of the crop is produced.

Vegetables for the market are an important source of income with a large number of farmers. In 1899 there were 1,795 acres devoted to this line of farming, and the value of the products was \$198,905. Some of the small farms are devoted almost exclusively to the growing of vegetables, including beans, peas, lettuce, carrots, turnips, squash, etc. Along with these are also found patches of strawberries, which give good yields. The home-grown berries command a high price in the local market. Blackberries and raspberries are grown on a small scale and do exceptionally well. There seems to be no reason why the growing of vegetables and the small berry crops mentioned should not play a more important part in the agriculture of the county. Not enough of any of them are grown to supply the local demand much less to make adequate shipments to outside markets. Enormous quantities of vegetables and fruits are consumed by the summer residents who flock to the county each year. Growing the berry crops for canning ought to prove a profitable industry.

A larger acreage is devoted to cranberries than to any other crop except hay, and it is the principal money crop of the county. It does not play such an important part in the local agriculture, however, as most of the industry is controlled by a cranberry company with headquarters in Boston. It is unfortunate that the industry has not been gone into more extensively by farmers living in the county, as it

is very profitable and would afford a means of building up the neglected areas. The bogs controlled by the syndicate are generally looked after by overseers, and the necessary help is furnished to a large extent by a floating population. According to the census of 1900, 60.6 per cent of the cranberries grown in the United States came from Massachusetts, and most of these from Barnstable and Plymouth Counties. Plymouth County excels Barnstable in both acreage and yields, and produces nearly one-third of the United States supply. To be more exact, there were 2,338 acres in this crop in 1899, producing 331,091 bushels, while in Barnstable there were 2,120 acres, producing 211,912 bushels. Doubtless the 1910 census will show a still larger acreage, as new areas are being cleared every year. From 50 to 60 barrels per acre is considered a good yield. The berries bring about \$6 a barrel.

The cost of getting a cranberry bog started is high even under the most favorable circumstances, and no doubt that is one reason why the industry is not gone into by more of the farmers with limited means. The land in the rough or native state sells anywhere from \$10 to \$100 an acre, \$25 being about the average price. To clear and get a crop started properly costs anywhere from \$100 to \$500 an acre. That the crop is profitable even with these great expenses is seen in the selling value of established bogs, which ranges up to \$1,000 an acre. The desirability of an area for growing cranberries depends primarily upon two things—the nearness of an abundance of sand and the supply of water for irrigation. The question of sand alone has caused the industry to be confined almost entirely to the eastern half of the county, where the uplands consist of sand to great depth, although there is an extensive acreage of good cranberry soil in the western part of the county. Within the sandy region there is still an abundance of Muck awaiting development that is just as suitable for the purpose as most of the areas now used. Irrigation is not requisite to the growing of successful crops, the chief benefit from this source being to protect the berries from frosts in the fall by flooding the fields.

If the areas of Muck are timbered, as most of them are, the first thing done in clearing is to cut down the trees and pull out the roots. In case the Muck is rather coarse at the surface some of this may be removed also. After the trees and roots are removed the surface is reduced to a perfect level. Ditches some 2 feet deep are cut around and at frequent intervals through the field. Then about 3 inches of sand is applied to the surface. The sand gives a comparatively firm surface and makes it possible to gather the berries with the greatest facility. After the sand is applied and leveled the land is ready for planting. Generally the plants are set out in checks about 15 inches

apart each way, and it takes three years to form a good sod and to bring the plants into full bearing. While it is not the usual practice, some of the best growers apply an extra half inch of sand every year. The sand sinks gradually into the underlying Muck and unless more is added from time to time the surface becomes soft. The extra layer of sand also tends to keep down weeds. More or less weeding is necessary until a good sod is formed, then very little is required. Most of the weeding was done by hand originally, but now a great deal of it is done by machinery. Using mechanical pickers it costs about 15 cents a barrel to gather the berries, but where the berries are picked by hand the expense is considerably greater. Laborers during the picking season are paid 35 cents an hour and for weeding 15 cents an hour.

The areas easiest irrigated are those lying along stream courses and occupying parts of ponds that have been reclaimed. Many of the large areas, however, are irrigated by conducting water from ponds at some distance.

Better methods are coming into more general use among the farmers every year and more attention is being paid to the rotation of crops as a means of keeping the soil in a productive state, but there is still room for much further improvement along this line. In some instances soils are being used for crops to which they are not adapted, and their use for such crops should be discontinued. Other soils now give unsatisfactory yields even of crops to which they are well suited. In cases of this kind better soil management is all that is necessary.

Commercial fertilizers are coming into more general use every year. Light applications are sometimes made to the corn and grass land and they are in general use for the potato and other truck crops. In 1889 the amount expended for fertilizer was \$39,418, while in 1899 the amount was \$61,300 and in 1909, \$93,614. Of a total of 2,512 farms in 1910 commercial fertilizers were used on 1,480.

In the census reports every tract of land of 3 acres or more that is used for farming purposes is enumerated as a farm. According to this authority there are but 21 with over 500 acres, and the large majority contain between 10 and 100 acres. The average size of farms is given as 54.5 acres, with an average of 20 acres of this improved. The color and nativity of the farmers are as follows: Two thousand and seventy-eight farms are operated by native whites, 426 by foreign-born whites, and 8 by negroes and other nonwhites. Out of the total of 2,512 farms, 2,260 are operated by the owners, or roughly 90 per cent; 136 are operated by tenants, and 116 by managers. Most of the tenants pay a stipulated cash rent. The landlord generally exacts an amount which will equal at least 6 per cent on his investment.

Farm labor is very scarce and is getting scarcer every year. On this account the best opportunities lie in the direction of the small farm, where the farmer can depend upon his family for most of the necessary help. By the day the usual wage is \$2, and by the month from \$25 to \$30, with board.

There is a wide range in land values in the county for the same type of soil, depending upon whether cleared or timbered, distance from market, and nature of improvements, as well as for the different classes of land. Areas with a good growth of white pine are worth \$50 to \$100 an acre regardless of the kind of soil, while the cut-over lands now supporting a scrub oak or some other growth not suitable for lumber sell for \$5 to \$25 an acre. The rough sandy areas have scarcely any value. Good mowing lands, as furnished by the Gloucester loam and sandy loam, are worth from \$100 to \$150 an acre and the same types under cultivation anywhere from \$50 to \$200 an acre. There are a number of small farms throughout the county that can be had for about the value of the buildings. As previously stated the cranberry bogs are held at the highest price of any lands in the county, being valued up to \$1,000 an acre. Where there is a great deal of stone to remove, as has been the case in the cleared areas of the Gloucester loam and sandy loam, it costs more to bring the land under cultivation than is asked for it in the timbered state. Land values on the whole have been advancing rather rapidly in the last 10 years. That this is so is only another indication that farming is now looked upon with more favor and the general farming conditions are rapidly improving.

SOILS.

Classifying the soils of Plymouth County in the most general way they fall into two main groups, the uplands and the lowlands. The latter group which is much the less extensive includes the stream bottoms, tidal marshes, and other wet lands occurring in pondlike depressions and fringing some of the ponds. In the upland group there are four subgroups, besides some areas miscellaneously classified as the Coastal beach and Rough stony land. Two of the subgroups or, in the technical nomenclature of the soil survey, series are derived from glacial till mostly of local origin overlying granite and highly metamorphosed rocks occurring in the Brockton area as described above. Areas with fair to good natural drainage and usually occupying gently rolling topography constitute the Gloucester series and those in a poorly drained condition, owing to their very flat or slightly depressed surface, constitute the Whitman series. Another series, the Plymouth, occupies rough, morainic areas which in places at least are characterized by only a thin layer of glacial till, underlain by stratified sands supposedly of preglacial origin. This occurs in the

Plymouth morainic belt. The fourth subgroup is derived from stratified drift, occurring in the form of kames, outwash plains, and filled in valley areas, possibly also including some areas of morainic origin, the topography ranging from level to undulating and irregularly rolling. These areas are classified and mapped as the Carver series, and they occur in the Carver plains.

The soil-forming material varies not only in origin and mode of occurrence but in its mechanical composition, ranging from coarse sand and fine gravel to clay, or in some places consisting almost altogether of organic remains in an advanced stage of decomposition. Other modifications are brought about by varying quantities of stone strewn over the surface and mingled with the soil material and by outcrops of the underlying rock. The relative proportions of the different grades of material determines the texture of the soil, and its texture in a large measure determines its desirability for farming purposes and adaptability to certain crops, other conditions being favorable. So with the different series separated upon the broader differences of origin and mode of occurrence they are further divided into grades or types based primarily upon differences in texture. Then there may be minor differences in texture, origin, color, and drainage features, giving rise to phases in the different types.

The Gloucester and Whitman series are confined very largely to the western physiographic division of the county described in a previous chapter, or roughly the western two-thirds, over most of which bed rock occurs above sea level. Prior to the glacial period the different rocks had been undergoing disintegration and decay for a long time, a mantle of soil had formed over them, and enough erosion had taken place to produce a gently rolling topography. The original surface features were somewhat changed by glacial action and the soils which were strictly residual were ploughed through, pushed forward a greater or less distance, and mixed with varying quantities of material brought from beyond the area by the ice sheet. In some places a much deeper mantle of loose material was built up; in others about all of the original material was removed, leaving the bedrock exposed. As the general direction of the glaciation was southward it is expected that the material from one geological formation would be pushed onto those to the south. Such has been the case, yet the bulk of the material is from the underlying rock and has not been moved far from its place of origin. Through the same region other conditions were brought about during the recession of the ice sheet, numerous deposits consisting for the most part of stratified drift occurring as kames, outwash plains, and filled-in valleys. These, however, give soils belonging in another group and are not to be considered in connection with the Gloucester and Whitman series.

The central part of the county from the western boundary to within 6 to 10 miles of the coast is in the Coal Measures region or what is known geologically as the Narragansett Basin, being included in a line passing just to the north of Brockton, through North Abington, thence northeast to beyond Hanover, and thence south by Silver Lake, North Plympton, and Nantasket to the head of Assawompsett Pond and westward out of the county. Quite a variety of rocks occur in the Coal Measures, but those reaching the surface are mostly schistose to flaggy feldspathic sandstones, in places appearing very much like a schistose gneiss. Skirting the sandstones, probably as an older formation, is a thin band of reddish slates and both to the north and south of the Coal Measures region as well as throughout the eastern part of the county below sea level, the formations consist of granites and other highly crystalline rocks. In the southern part of the county, particularly in Mattapoisett Town, is found a coarse-grained pink granite which is very resistant to weathering, giving rise to some very stony areas. Those in the northern part of the county, on the other hand, are somewhat finer grained, and the resultant soil is correspondingly finer than that overlying the coarser granites. Here the influence of other rocks to the north of the area is seen in the stone content of the soil, a part of which is from dark-colored slates.

The red slates skirting the region of the Coal Measures are not extensive enough to have any marked modifying influence upon the soils, but over a considerable zone where the material has been pushed southward some of the gravel content of the soil is from this formation. The stoniest areas, where very little soil has accumulated and the rock outcrops frequently, are classified and mapped as Rough stony land. From this extreme there are all gradations in the stone content of the soil to where little or none is found and the soil-forming material varies from a sandy loam to a light loam. So with these differences the Gloucester series includes four types, a stony loam, loam, stony sandy loam, and sandy loam, and the Whitman series two types, a loam and a sandy loam. The Gloucester loam and sandy loam are by far the most extensive and important agriculturally.

In the eastern part of the county a different order of things prevails. The rocks dip below sea level and the surface material and configuration is almost entirely glacial, consisting of rough terminal moraines, kames, and outwash plains. The rough morainic country is confined to Manomet Hill and an irregular strip of country to the south and east of it, and to considerable areas west of Plymouth and in Marshfield Town. A well-developed kame and kettle topography is developed in the vicinity of Plymouth and in places along the coast to north of Duxbury. From this rougher country skirting the coast extensive gently sloping outwash plains extend to the south and

southeast, the topography becoming somewhat level and the texture of the soil material finer in the direction of the slope of the plains. Going westward out of the main outwash plain belt of the county the stratified material takes more to the valleys and the till ridges comes more into evidence. Chiefly on account of the rough topography of the highest morainic areas they are separated as the Plymouth series, there being but one type recognized. All of the other areas of stratified drift constitute the Carver series, in which a gravelly sandy loam, coarse sandy loam, sandy loam, and fine sandy loam were recognized.

No series distinctions were attempted in the lowlands, and the classification had to be based both upon the texture of the material and the drainage conditions. All of the marshy areas along the coast affected by the tides are grouped as Tidal marsh, although the soil varies from a dark loamy sand or sandy loam to true Muck. Inland areas with a mucky soil of a depth of 9 inches or more are classed as Muck, while other wet strips principally along the streams where the soil may not be mucky at all or mucky for only a few inches are classed as Meadow.

With the bench sands and gravel classed as Coastal beach, and including Meadow, Tidal marsh, Muck, and Rough stony land as types, 16 types of soil were recognized and mapped.

Their names and relative and actual extent are given in the following table:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Carver coarse sandy loam.....	72,000	16.1	Tidal marsh.....	9,600	2.1
Muck.....	67,968	15.2	Whitman sandy loam.....	8,192	1.8
Gloucester loam.....	64,192	14.4	Rough stony land.....	8,000	1.8
Carver sandy loam.....	62,400	13.9	Whitman loam.....	4,736	1.1
Gloucester sandy loam.....	54,464	12.2	Meadow.....	4,224	.9
Carver gravelly sandy loam...	43,456	9.7	Coastal beach.....	3,008	.7
Plymouth stony sandy loam...	19,520	4.4	Gloucester stony loam.....	2,496	.6
Gloucester stony sandy loam...	11,840	2.7			
Carver fine sandy loam.....	10,624	2.4	Total.....	446,720

GLOUCESTER LOAM.

The surface 6 to 8 inches of the Gloucester loam consist of a brown, light, mellow loam to heavy fine sandy loam with a rather high percentage of silt. Usually small quantities of subangular gravel and some fragments of stone are found in the soil, and where the type has not been cleared the surface is strewn with angular bowlders of granite and gneiss and slabs of schist. In the cleared lands enough stone has been removed from the surface to build fences around practically all the fields. With the surface stone removed the soil

does not contain enough stone or gravel to interfere seriously with tillage, being easy to handle, a good retainer of moisture, and naturally productive.

The subsoil to a depth of 2 to 2½ feet is not much different in texture from the soil, but is more compact and yellowish to light brown in color. Below the depths stated the material becomes gradually lighter downward, or in some areas there is an abrupt change into lighter sandy and gravelly material and the color becomes more a light brownish gray. In places the subsoil is almost stone free, while in other places it contains a considerable admixture of pebbles and in a few places a small quantity of larger rounded gravel.

The Gloucester loam is the most important and the best developed type of soil in Plymouth County. It is the main upland type in the northern part of the county, or, roughly, the section covered by Scituate, Norwell, Hanover, Rockland, Whitman, Abington, Brockton, East Bridgewater, West Bridgewater, and Hanson Towns; also occurring to some extent in Hingham and Hull Towns, in Cohasset Town, of Norfolk County, and along the northern edge of Bridgewater, Pembroke, and Marshfield Towns. It does not occur south of a northeast and southwest line, passing near the town of Bridgewater and the villages of South Hanson, Pembroke, North Pembroke, and Marshfield.

The surface features are level to gently rolling. The areas occupy low ridges and hills, which in most instances slope gradually toward the streams and smaller drainage ways. Strips of level land occur along the crests of nearly all of the ridges, being quite extensive in places, as between Queen Ann Corners and North Hanover and north of Rockland toward South Weymouth. The general surface features are shown by the contour lines on the soil map.

Fairly good natural drainage has been established except in some of the flat and slightly depressed areas which are constantly too wet to produce satisfactory crops. By tiling or providing open ditches such areas could be converted into good farming lands. Any of the low-lying flatter lands would be benefited by tile drainage. The streams are sluggish in their flow and the smaller ones contain water only during wet weather.

The type is derived from glacial till overlying granite and Coal Measures sandstone at depths of 3 to 25 feet or more. The material is partly of local origin and partly from other rocks occurring to the north of the area. The influence of the material coming from beyond the area is best seen in the gravel and fine stone content which includes a variety of rocks, dark slate being one of the most plentiful. The till shows no signs of stratification within 3 feet of the surface, and

usually to much greater depth, but in places it is comparatively shallow and overlies stratified sand and gravel.

Nearly all the original timber was removed long ago. It consisted of white pine, oak, hickory, elm, maple, beech, and other hardwoods. Some areas were occupied altogether by pine, others by a mixture of pine and hardwoods, and still others by little else than hardwood trees. The unimproved cut-over lands are now growing up in oak, maple, birch, and other deciduous species.

A large proportion of the type is cleared and improved, being used for both general farming and a variety of special crops. Corn and hay are the most important of the general crops, although a number of others, including oats, rye, and clover, are grown in a limited way. An extensive acreage is devoted to pasture, especially on the larger farms, and dairying is followed by a large number of the farmers. Diversification is practiced to the greatest extent on the small farms. On some of these the farmers are devoting most of their time to raising poultry and on others to the production of truck crops, including cabbage, beans, peas, beets, turnips, carrots, lettuce, Irish potatoes, strawberries, blackberries, and raspberries. Apples and pears do well, but the trees as a rule do not receive much attention. The navy bean should prove a profitable crop, although it is not now grown to any extent.

The truck crops all do well where they are given the proper care, and they command good prices in the local markets. Corn yields from 25 to 75 bushels and oats from 30 to 60 bushels per acre. The average yield of hay is somewhat over 1 ton to the acre.

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

Mechanical analyses of Gloucester loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
130217.....	Soil.....	5.5	16.0	8.6	14.7	13.4	29.4	11.6
130218.....	Subsoil.....	8.6	17.3	9.0	13.8	13.2	30.6	7.4

GLOUCESTER SANDY LOAM.

The soil of the Gloucester sandy loam, to a depth of 6 to 10 inches, is a brown, medium-textured sandy loam. The subsoil to an average depth of about 2½ feet is a light or yellowish brown sandy loam becoming less coherent downward. Below this the color changes to brownish gray or gray and the texture to a rather light sandy loam, or in some places to a loamy sand or coarse sand. Numerous fragments of stone, consisting mostly of granite and ranging up to a foot

or more in diameter, are strewn over the surface of all uncleared areas and some subangular gravel usually is found in the soil and subsoil, areas here and there being very gravelly below a depth of 3 feet. In the cleared lands about all of the stone has been removed from the surface, although in places the larger stones, generally 3 feet or more in diameter, are left in the fields. The soil is easily handled and can be kept in a high state of productiveness by good tillage and the proper rotation of crops.

This is an extensive type, ranking next to the Gloucester loam in agricultural importance. Its most extensive development is in the southwestern and southern portions of the county, extending south from Bridgewater to Buzzards Bay. In the towns of Plympton, Middleboro, Lakeville, and Rochester it is the main upland soil. Other important areas occur farther east in Pembroke and Duxbury Towns.

The Gloucester sandy loam occupies low, rounded ridges and hills and broader stretches ranging from nearly level to gently rolling in topography. Good drainage has been established, except in local depressions and some of the lower lying flat areas.

The type is derived from sandy till with more or less rounded or subangular gravel in it. The material is very largely from granites and gneiss, as is evidenced in the gravel and stone content, and a part of the material is from the local rocks. The till extends to depths of 3 to 25 feet or more. In places it overlies bedrock at comparatively shallow depths, while in other places it may be shallow and overly sandy and gravelly stratified material. Generally where the deeper subsoil is stratified the soil is somewhat lighter in texture and more leachy than it is in the typical areas.

The original timber consisted of white pine, oak, hickory, maple, etc. Approximately half the area of the type is uncleared, but most of the original timber has been removed and a second growth of oak, birch, and other hardwoods has taken possession of the land.

A considerable proportion of the type is devoted to permanent pasture. Grass for hay is the most extensive crop. Of the cultivated crops corn has the largest acreage, although many others are grown in a more limited way, including oats and rye.

Poultry raising is an important industry with many of the farmers, and some grow potatoes, berries, and miscellaneous vegetables for the market. Dairying is followed to some extent, but it should be a much more important industry. Apples and pears do well, but are not grown largely for market. All of the crops give good yields if properly cared for and the seasons are not too unfavorable. Corn yields from 25 to 60 bushels, oats from 30 to 60 bushels, hay from 1 to 1½ tons, and potatoes from 100 to 250 bushels per acre.

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

Mechanical analyses of Gloucester sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
130225.....	Soil.....	3.4	15.4	12.5	22.0	12.4	24.6	8.8
130226.....	Subsoil.....	4.8	13.4	11.2	20.7	16.2	27.3	6.1

GLoucester Stony Sandy Loam.

The soil of the Gloucester stony sandy loam, to a depth of 6 to 9 inches, consists of a brown, medium-textured sandy loam, underlain by a light-brown sandy loam extending to a depth of 3 feet or more. Usually the subsoil grades somewhat coarser in texture as the depth increases, and below 2 to 2½ feet the color changes to light brownish gray. The deeper subsoil may be either a light sandy loam or loamy sand. Some gravel and stone occur through both soil and subsoil of most areas, and the surface is thickly strewn with angular fragments of stone ranging up to several feet in diameter. The type differs from the Gloucester sandy loam mainly in the greater quantity of stone on the surface. After removing all of the stone that can be carried by hand or carted off, enough large stones are left to make cultivation difficult and unsatisfactory. From the cleared areas enough stone has been removed to build fences around every 5 acres or less.

The Gloucester stony sandy loam is not an extensive type in Plymouth County, the largest areas occurring in Mattapoissett, Marion, Rochester, and Lakeville Towns.

The topographic features range from gently rolling to steep, hilly, and broken. The areas in Lakeville and Wareham are hilly and rough and this is characteristic of the type as it occurs extensively in Bristol County just to the west. The large areas near Mattapoissett are gently rolling, like the general run of the Gloucester sandy loam, although much more stony. The natural drainage is good except in local spots through the leveler areas.

The Gloucester stony sandy loam is derived from shallow sandy till overlying coarse-grained granites and gneiss. The granite exposed in many places near Mattapoissett is pink and quite coarse grained. The depth to bedrock varies from nothing where it outcrops to 10 feet or more below the surface. Most of the stone and gravel is granite and no doubt most of the fine soil material is of the same origin.

About all of the original forest growth, consisting chiefly of white pine, oak, maple, hickory, and chestnut, has been removed. Small oak is the principal growth on the cut-over lands.

Small areas of the type are cleared and used for farming, hay and corn being the principal crops. On account of the very stony character of the soil it is best adapted to pasture. The different crops yield about the same as on the Gloucester sandy loam.

GLOUCESTER STONY LOAM.

The soil of the Gloucester stony loam consists of 6 to 8 inches of brown friable loam containing a high percentage of silt. The subsoil to a depth of $2\frac{1}{2}$ feet is a light-brown, friable loam and below this it may be either a light loam or fine sandy loam with a light-brown or yellowish to grayish color. The surface is thickly strewn with small to large fragments of stone, and the bedrock outcrops in places. There may or may not be a small quantity of gravel in both soil and subsoil.

The Gloucester stony loam is the least extensive of the upland types, being confined to small areas in the northern part of the county. It occurs as high, rounded hills and on steep slopes and owes its origin to shallow, very stony till. It is an intermediate type between the Gloucester loam and the Rough stony land. The topographic features are such as to afford good natural drainage.

No attempt has been made to bring this type under cultivation, although some of it is cleared for pasture. It makes good pasture lands without the removal of much if any stone from the surface, and this is the best use to which the type can be put.

ROUGH STONY LAND.

Rough stony land includes areas so stony and rough as to have practically no value for cultivated crops, although affording some good timber and pasturage. It represents the extreme condition of stoniness in the uplands, the areas ranging from a very stony loam to almost pure rock outcrop. The surface is thickly strewn with fragments and larger masses of granites and this rock outcrops extensively. The soil to a depth of 6 to 10 inches is a brown loam similar in texture to the soil of the Gloucester loam and stony loam, and the subsoil is a light-brown or yellowish-brown loam grading somewhat lighter in texture with depth. Both soil and subsoil contain varying quantities of angular rock fragments and in places some gravel. The depth of the soil material varies from zero where rock outcrops to 8 feet or more.

The type occurs on some of the rougher hillsides and follows granite ledges which have crumbled to some extent. In its most extensive development, however, it occupies rolling to very irregular hummocky topography.

Rough stony land is not an extensive type, but occurs in several areas in the northern part of the county. The larger of these are

found northwest of Brockton and Abington, in the northern part of Norwell and Scituate Towns, and the western part of Hingham Town, and in Cohasset Town of Norfolk County.

Small areas cleared of most of the stone are used for building sites. The remainder of the type is forested with oak, hickory, chestnut, cedar, and other trees. Its best use is for forest lands and woodlots.

WHITMAN LOAM.

The soil of the Whitman loam, from 6 to 10 inches deep, is a dark-gray to black loam, resting upon a gray, yellowish or light-brown loam often mottled to a depth of about $2\frac{1}{2}$ feet. Below this the material continues about the same in color, but may vary in texture from a light loam to sandy loam. The soil to a depth of 4 to 6 inches is rich in organic matter, and in many places it has a surface covering of an inch or so of partially decayed vegetation or leaf mold. Both soil and subsoil contain considerable stone and the surface is strewn with angular fragments of granite and other rocks.

The Whitman loam is not an extensive type in Plymouth County. One of the largest areas occurs in Marion Township, at the southern end of the county. This is somewhat different from the general run of the type in that the soil contains a higher percentage of silt and proportionately less sand. The other areas mapped are found to the north of Bridgewater in East Bridgewater, West Bridgewater, Brockton, Abington, Whitman, and a few other of the nearby towns.

Except the area in the southern part of the county, this type is closely associated with the Gloucester loam, the two being of the same origin and owing their difference to drainage. Where the Gloucester loam occupies the rolling well-drained uplands the Whitman loam is confined to narrow shallow swales and broader flat and depressed areas. The area in the southern part of the county bears the same topographic relation to the Gloucester sandy loam but is heavier in texture than the associated type. All areas are poorly drained and some are in a waterlogged condition the year round.

The Whitman loam supports a forest principally of oak, with scattering white pine, maple, and birch, or, if the original growth has been cut off, the principal trees are birch and poplar. None of the type is under cultivation on account of its wet condition. Practically all of it would require artificial drainage before it could be farmed successfully. With good drainage established it should produce satisfactory crops of corn, oats, and hay and probably could be used advantageously in growing onions, potatoes, cabbage, and other vegetables. If only partially drained, it would make fairly good pasture land.

The table following gives the results of mechanical analyses of samples of the soil and subsoil of the Whitman loam.

Mechanical analyses of Whitman loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
130227.....	Soil.....	5.4	7.3	5.2	13.3	16.0	37.6	14.8
130228.....	Subsoil.....	9.1	11.5	7.7	19.8	13.6	30.9	6.9

WHITMAN SANDY LOAM.

The surface 6 to 8 inches of the Whitman sandy loam consist of a dark-gray to black sandy loam with a high content of organic matter. The subsoil is a mottled, yellowish-gray sandy loam, grading at a depth of 2 to 2½ feet into a lighter sandy loam or loamy sand. Some stone is found in both soil and subsoil and numerous fragments of granite ranging up to 3 feet or more in diameter are strewn over the surface.

The Whitman sandy loam is a type of small extent, associated with the Gloucester sandy loam. It occupies low, flat areas and slight depressions in a poorly drained condition. Water stands within 3 feet of the surface in all areas and some are badly waterlogged. Some of the larger areas mapped occur near North Plympton and South Halifax and between Middleboro and Bridgewater. Other areas are found in Lakeville, Rochester, Marion, and Mattapoisset Towns.

As would be inferred from the occurrence of the type, it is derived from glacial till, and owes its differentiation from the Gloucester sandy loam to poor drainage extending over a long period of time. With good drainage established, the soil would become gradually browner in color and more friable and would lose much of its present acid properties, which are inimical to most cultivated crops.

Practically all of the original forest, consisting of oak, pine, and maple, has been removed and birch is now the principal growth.

None of the type is under cultivation. It is naturally too wet to produce satisfactory crops, but when adequate drainage has been established it should give good yields of corn, oats, and hay and make good pasture lands. Cabbage, onions, and Irish potatoes also should do well.

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

Mechanical analyses of Whitman sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
130229.....	Soil.....	5.0	2.3	11.8	32.5	9.4	22.6	6.3
130230.....	Subsoil.....	4.2	11.2	12.2	35.2	10.1	21.8	5.2

CARVER GRAVELLY SANDY LOAM.

The Carver gravelly sandy loam varies considerably in both soil and subsoil as well as in topographic features. Generally the soil to a depth of 6 to 10 inches consists of a light gravelly loam to gravelly sandy loam, brown the entire depth if under cultivation or gray in the surface 2 to 4 inches and brown beneath if timbered. Most of the gravel is less than 3 inches in diameter, but in places there are varying quantities of cobblestones strewn over the surface and mingled with the soil material. The typical subsoil consists of a yellowish-brown light gravelly loam to sandy loam, extending to a depth of 12 to 18 inches and beneath this, to a depth of several feet, of interstratified coarse sand and gravel. In places the subsoil is little else than gravel and cobblestones, while in others representing the lighter phases of the type there is no intermediate stratum of sandy loam and the soil is underlain directly by a mass of fine gravel and coarse sand. The type is practically free of stone except near Hingham, where a large number of large granite bosses appear above the surface.

The Carver gravelly sandy loam occurs in all sections of the county, but to the greatest extent within 8 miles of the coast between East Weymouth and the Barnstable County line. Some of the largest areas mapped are found at and to the south and west of Plymouth and in Hingham Towns. The more important areas farther inland occur in Kingston, Middleboro, and Lakeville Towns.

The surface features range from nearly level to irregular rolling, hillocky, and ridgy. The areas near Hingham vary from the typical kettle and kame topography to more gently undulating and nearly level. At Plymouth the topography is very rough, consisting of an intricate system of steep sided ridges and hillocks divided by numerous pot holes and drainage depressions. In the areas to the south and west of Plymouth the type extends from the irregular rolling moraines to extensive plains indented by steep-sided depressions. The other areas scattered here and there occur for the most part as low irregular ridges, rounded hills, and as some of the steeper slopes around ponds. All areas are naturally well drained.

The type is derived from stratified drift, occurring as kames, eskers, outwash plains, and terraces, and includes portions of the moraines. The areas near Hingham and in the central and western parts of the county are typical, while those in Plymouth Town are mostly of the light phase.

The original forest growth consisted principally of white pine on a large portion of the type, the remainder having a mixed growth of white pine and hardwood trees. Clumps of the white pine still remain in places, but in the large areas to the south and east of Plymouth scrubby oak bushes and pitch pine constitute the main

growth. Some of the very gravelly areas that have been cleared and since abandoned for farming purposes are gradually being reforested with cedar.

The type is rather too droughty for the general crops of the region and very little of it is farmed. The levellest loamy areas if properly handled will give fair yields of corn and hay, being also adapted to potatoes, vegetables, strawberries, raspberries, and blackberries. In the line of fruits, apples, peaches, pears, and grapes can be grown very successfully. However, a very large proportion of the type should be reforested with white pine.

CARVER COARSE SANDY LOAM.

The soil of the Carver coarse sandy loam, to a depth of 6 to 10 inches, consists of a gray or brown, coarse light sandy loam to coarse loamy sand, carrying a considerable quantity of very fine gravel and in places some larger pebbles from one-half to 1 inch in diameter. Where the soil is under cultivation it usually has a brownish color to the immediate surface, but in most timbered areas it is gray to a depth of 2 to 4 inches and brown beneath. Extending below the soil to a depth of 18 to 24 inches is a light-brown or orange-colored less coherent coarse sandy loam or loamy coarse sand, and this is underlain by a brownish-gray sand or a mixture of coarse sand and gravel.

This is the most extensive type of the Carver series. Large bodies of it occur south and southeast of Plymouth and farther west in lower and adjoining towns. Large areas also are found near Middleboro and Duxbury, west of Long Pond and in Halifax, Pembroke, and Marshfield Towns.

The surface ranges from nearly level to undulating and irregular rolling, and hilly. In its most extensive development it occupies plains which when viewed panoramically appear nearly level, but at closer range are found to consist of an intricate system of ridges rising to the same height and divided by numerous holes and irregular depressions anywhere from 10 to 50 feet deep. Here and there it extends to rounded hills and rolling morainic topography, while in other places it occupies level to gently undulating stretches. On account of the open structure of the soil and the great depth of the underlying gravelly material the type is naturally well drained by percolation, except in many of the depressions, the bottoms of which are below the general water table. Many of the larger depressions are occupied by ponds and in numerous others, kept wet the year round, are found accumulations of muck.

The Carver coarse sandy loam is derived from stratified drift, consisting for the most part of sand and gravel from granite and gneiss. Generally it is most loamy in the gently undulating areas

and along the crests of flat-topped ridges, and sandiest as well as stoniest on the steep slopes and where it occupies a very irregular hummocky topography.

Pitch pine and scrub oak form the principal forest growth on the large bodies of the type south and southeast of Plymouth where the topography is roughest. These areas, no doubt, once supported a fair growth of white pine, but all of this was removed long ago. The oak growth following the pine is peculiarly scrubby on account of being frequently killed to the ground by forest fires. For the same reason very little leaf mold has accumulated, and the soil necessarily is deficient in humus, being light gray and ashy in places. The leveler areas supported a good growth of white pine or of oak and pine mixed, but only clumps of these trees are now found.

Cultivation of this type is confined to a comparatively small acreage, and this mostly to the leveler phase, as it occurs in Duxbury Town and through the central and western parts of the county. With good treatment it gives fair yields of corn and rye. It is too droughty for grass and does not make good pasture land. In the line of general farming rye is the most promising crop. Potatoes, apples, pears, grapes, and a variety of vegetables do well. The rougher areas are best suited to forestry, unless they can be utilized in growing grapes and other fruits for the market.

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

Mechanical analyses of Carver coarse sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
130223.....	Soil.....	10.7	24.3	13.4	18.7	9.5	17.8	5.5
130224.....	Subsoil.....	12.1	26.1	11.7	17.4	9.8	18.0	4.8

CARVER SANDY LOAM.

The soil of the Carver sandy loam to a depth of 5 to 9 inches is a brown, medium-textured sandy loam underlain by a lighter brown sandy loam. This grades lighter and less coherent downward and at a depth of 12 to 18 inches gives way to a yellowish-gray or grayish-yellow coarse sand or sandy loam, which may continue uniform to a depth of 3 feet or alternate with thin layers of gravel. In some areas a sprinkling of gravel ranging up to an inch or so in diameter occurs on the surface and through the soil, while in others very little gravel is to be found except in the deeper subsoil. Generally wherever the type is forested the surface 2 to 4 inches of the soil is gray or dark gray. This when mixed with the underlying material, as has been done in the cultivated areas, gives the characteristic brown soil.

The Carver sandy loam occurs in all sections of the county, except the very sandy region lying between Plymouth and Wareham. Some of the largest areas form an irregular belt extending in a southwesterly direction from Marshfield Hills to Bridgewater. Other important areas are found east of Plymouth, and in the following towns: Hingham, Hanover, Hanson, West Bridgewater, Middleboro, Lakeville, Rochester, and Wareham.

The type occupies level to gently undulating topography, occurring as upland plains and as terrace or bench lands and filled in valley areas. It is naturally well drained, although not excessively leachy or droughty.

The Carver sandy loam is derived from stratified drift, mostly of granitic material. In small areas, particularly a few west of Duxbury with scattering stones over the surface, it may be from a very sandy phase of the till which gives rise to the Gloucester sandy loam, but in most places the line of separation between the two types is sharply defined. Where the Gloucester sandy loam is typically stony and rolling the Carver sandy loam is just as strikingly level and free of stone, also being considerably lighter in texture.

The characteristic tree growth on this type now is oak and other hardwoods or a mixture of these with scattering white pines. At one time very likely white pine constituted the principal growth on nearly all areas, but about all this has been removed for lumber.

About one-fourth of the type has been cleared for cultivation. Corn and grass are the principal crops, but a number of others are grown in a small way, including potatoes and a variety of vegetables. Where it is not too remote from the railroad, its best uses are for potatoes, berries, and other truck crops. Corn yields from 20 to 50 bushels, oats about the same, and hay from one-half to 1 ton per acre. Rye is a promising crop not now grown to any extent.

Below are given the results of mechanical analyses of samples of the soil and subsoil of the Carver sandy loam.

Mechanical analyses of Carver sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
130221.....	Soil.....	4.2	16.9	11.5	24.1	11.6	20.6	10.2
130222.....	Subsoil.....	6.5	22.1	15.0	20.6	10.2	19.2	6.0

CARVER FINE SANDY LOAM.

The Carver fine sandy loam consists of 6 to 10 inches of a brown or gray and brown fine sandy loam, underlain by a yellow medium to fine slightly sticky sand. In places the subsoil is uniform in texture to a depth of 3 feet or more, but more generally it grades lighter

downward into a brownish loose medium or coarse sand at a depth of 18 to 30 inches. The differences in the color of the soil depend upon whether it is under cultivation or not or well or inadequately drained. If cleared and cultivated it usually is brown, whereas if timbered it may be light to dark gray in the surface 2 to 4 inches and brown underneath.

This type is confined very largely to Wareham and Marion Towns in the southern part of the county. Other areas occur in Mattapoisett, Rochester, Carver, Lakeville, Middleboro, Halifax, Plympton, Bridgewater, and Hingham Towns.

The surface features are level to gently undulating with small areas here and there slightly depressed and inadequately drained.

The Carver fine sandy loam is derived from the finer phases of the stratified drift, occurring as filled in valley lands and extensive outwash plains.

The original tree growth consisted principally of white pine and oak. The small proportion of the type cleared is more highly prized for farming purposes than either the Carver coarse sandy loam or the Carver sandy loam occurring in the same vicinity. On account of its fine texture and level surface features it is a good retainer of moisture and can easily be kept in a productive state. Corn and hay are the principal crops, the yields ranging from 25 to 60 bushels of the former and one-half to 1 ton of the latter per acre. Potatoes, strawberries, raspberries, blackberries, and vegetables are grown in a limited way and all of them do well. The best use of the type is trucking.

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

Mechanical analyses of Carver fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
130201.....	Soil.....	1.6	6.6	7.7	47.9	26.4	6.6	3.3
130202.....	Subsoil.....	1.1	4.0	4.8	47.6	33.6	6.6	2.3

PLYMOUTH STONY SANDY LOAM.

The soil of the Plymouth stony sandy loam, to a depth of 6 to 10 inches, consists of a medium-textured sandy loam, usually gray in surface 2 to 4 inches and brown beneath. The subsoil begins as a light-brown, medium to rather coarse textured sandy loam and grades lighter downward into a brownish or yellowish-gray coarse sandy loam or a bed of coarse sand and fine gravel at an average depth of about 18 inches. Some angular fragments and large masses of granite are scattered over the surface and embedded in the soil mass

and in places there is a small quantity of rounded gravel in the soil and much greater quantities in the deep subsoil.

The Plymouth stony sandy loam is a hilly to rough mountainous type occupying the rougher morainic areas to the southeast and west of Plymouth and near Marshfield Center and some rounded hills or drumlins, such as Captains Hill and a few others in the southern part of the county. The largest and perhaps the most typical area occupies the high morainic ridge known as Manomet Hill, east of Plymouth. This ridge rises rather gradually from the west, but the east slope is very steep and broken and much more stony than the general run of the type. The areas west of Plymouth have a very irregular surface consisting of numerous high, steep-sided ridges and hills. The configuration is such as to give perfect drainage, except along the lower slopes and in the depressions, where there may be considerable seepage.

The type is derived from morainic material either stratified or unstratified. In the road cut across Manomet Hill the subsoil material shows very distinct areas of stratification and consists very largely of sands of the different grades and fine gravel. It is possible though that in many places in the same ridge no signs of stratification are to be found. What is true here is also true of the other areas of the type. The surface in general is so rough that any minor differences in the origin of the material do not have an important influence upon the soil from an agricultural point of view.

The original forest growth consists principally of white pine and oak with scattering hardwood trees of other species, including chestnut. Areas where the original forests have been removed for lumber or killed by fires now support a scrubby growth of oak bushes or a mixture of these and pitch pine.

Scarcely any of the type is under cultivation and it is valued almost entirely for the timber it supports. Very little of this is suitable for lumber, though it makes good firewood. Some areas probably could be used profitably for pasture. The best use, however, is for forestry.

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

Mechanical analyses of Plymouth stony sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
130231.....	Soil.....	5.7	16.6	10.3	22.1	16.0	22.5	6.3
130232.....	Subsoil.....	13.3	20.3	12.0	26.4	11.0	9.9	6.9

MUCK.

Muck, or what is known locally as "bog land," consists of accumulations of organic remains in a more or less advanced stage of decomposition and usually mixed with varying quantities of mineral matter. Such accumulations range from a few inches to several feet in depth, although only the areas where the mucky material is 9 inches or more in depth are mapped as Muck, the others being classed as Meadow. In typical areas the soil is composed of a soft smooth textured vegetable mold with a small admixture of sand and finer mineral matter and dark brown to black in color. Varying from this, in places the soil approaches the more fibrous texture of Peat, and of a black mucky sand in some of the marginal and other shallow areas. The material underlying the surface soil ranges from a gray, medium to coarse compact sand to a gray or drab sandy loam.

Muck is a very important type of soil in Plymouth County, both in point of extent and agriculturally. It is generally distributed over the entire county, but occurs to the greatest extent through the belt of deep sandy soils between Plymouth and Wareham and westward to near Middleboro. It occurs along most of the streams in strips of varying widths and in numerous isolated depressions from one-fourth acre to 100 acres or more in extent. All areas are naturally wet and swampy and some were parts of ponds only a few years ago. Numerous areas of less than 5 acres in extent exist in the area but are not shown in the soil map.

The formation of the Muck is usually brought about by the growth and decay of such plant forms as some of the mosses, grasses, and the sedges in the presence of water. This material accumulates year after year, and as mineral matter is added to the originally purely vegetable remains, through the agency of dust blown in by the winds and sediments deposited by flood waters, beds of partially decomposed organic material are gradually transformed from the Peat to what is classified by the bureau as Muck. Upon the deeper accumulations the growth of some shrubs and trees, of such kinds as alder, water birch, tamarack, cedar, etc., gradually encroach on the lakes and ponds from the shores, though the shallower Muck and Peat deposits may form around and in the presence of the trees. Additions to the organic deposits are also, of course, made through the death and decay of occasional trees, fallen branches, leaves, and roots, though in general the tree growth contributes comparatively little to the material.

In the manner above described many of the lakes and ponds of this area have been and are being gradually filled in with these deposits.

All uncleared areas are heavily forested but the growth varies in different areas. Along the streams and in many of the isolated

depressions the principal growth is birch, maple, and small swamp oak, with an undergrowth of coarse grasses and shrubs. Other areas support a dense growth of white cedar or a mixture of cedar with birch and maple.

Muck is used extensively for growing cranberries, a very profitable crop. With good drainage it also is well adapted to celery, onions, lettuce, and some other crops, but nothing has been done along this line. Its desirability for cranberries depends primarily upon two factors, the ease with which water can be gotten on it for flooding purposes and the accessibility of sand to put over the surface. So the industry is confined very largely to the sandy sections of the county from Marshfield south to Wareham and east to the Barnstable County line. There is yet room for a great extension of the industry on land just as suitable for the purpose as that already developed. Areas that can not be easily flooded or where sand is not near enough at hand to justify their development for cranberries can be drained and used profitably for the special crops mentioned above, as well as for corn and grass.

Areas of Muck considered adapted to cranberry culture range in value from \$10 to \$50 an acre, the average being less than \$25 an acre. This is for the land in the rough or forested state. It is said to cost from \$100 to \$600 an acre to clear it, provide the necessary drainage and get the crop well started, and when in a good cranberry sod it is valued as high as \$1,000 an acre.

MEADOW.

Meadow is a term applied to strips of low-lying lands, occurring along the streams and in some of the smaller drainage depressions, which are subject to frequent overflows and otherwise kept in a more or less waterlogged condition. All of the fresh-water streams of the county are bordered by wet to swampy lands, but a large proportion of these are classed as Muck. In the Meadow lands the soil is quite variable locally, as well as in a more general way, depending upon the nature of the uplands with which it is associated and the size of the streams along which it occurs. Along the Taunton River, where it occurs most extensively, the soil to a depth of 6 to 9 inches is a dark-gray to black mucky sandy loam or fine sandy loam, underlain by a gray coarser and more compact sandy loam subsoil. In the other areas through the Gloucester loam and sandy loam belts, the soil varies from dark-gray to black fine loam to sandy loam, with a depth of 6 to 9 inches, underlain by a gray to drab sandy loam subsoil, while along the streams through the deep sandy uplands the soil is a mucky sandy loam or sand and the subsoil a gray coarse sand and gravel.

A glance at the accompanying soil map will show that the areas of Meadow are inextensive, being confined very largely to the western

part of the county, where the conditions are not as favorable for the accumulation of Muck as in the more sandy lands to the east.

The native vegetation consists of birch, swamp maple, alder, and a variety of other water-loving trees, and shrubs and coarse grasses. A small percentage of the Meadow is cleared for pasture and a few small areas that have been partially drained are devoted to the production of hay. Most areas are susceptible of thorough drainage, and can thus be converted into good land for corn, grass, and a number of special crops, including celery, lettuce, and onions.

The cost of draining should not prove prohibitive.

TIDAL MARSH.

The low, treeless tidal plains along the coast and fringing the tidal streams some distance inland constitute the Tidal marsh. The soil to a depth of 12 to 36 inches or more consists of a dark-gray to black mucky material, with numerous partially decomposed roots through it, or a mucky sand usually quite compact at the surface. The subsoil varies considerably, but in most places is a dark-gray to drab sand of medium to fine texture, sometimes containing lenses of clay. When first exposed to the air the mucky material smells strongly of hydrogen sulphide.

The largest areas of Tidal marsh occur near Cohasset and at the mouths of North, South, and Green Harbor Rivers between Scituate and Duxbury. All areas are subject to frequent tidal overflow and the larger ones especially are cut by a network of tortuous tidal streams.

The Tidal marsh supports a salt water loving vegetation, consisting for the most part of coarse grasses and rushes. Local areas highly impregnated with soluble salts have no growth except salt grass. Along the streams it was not possible to make any close separation between Tidal marsh and Muck. Both being mucky, the separation had to be based largely upon the vegetation they supported, the Muck as a rule not extending much beyond the timbered areas.

Farming on the Tidal marsh is confined to the cutting of the wild grasses for hay. The hay is coarse and does not rank high as a feed, but cattle do fairly well on it and it makes good bedding. By diking and pumping off the drainage waters the marsh lands could be converted into good agricultural lands. At first they would be too salty for most crops, but the excess of soluble salts would be washed out by the rains in the course of a few years.

COASTAL BEACH.

The Coastal beach includes the recently formed gravelly and sandy strips along the ocean front which have no agricultural value. The material varies from a mass of gravel in some areas and especially

along the tide-swept portion of the beaches to gray and brownish sands of the different grades heaped into dunes and constantly blown about by the winds. The more important areas include most of Nantasket, Humarock, Rexhame, Duxbury, Manomet, and Long Beaches and Saquish Neck.

While the Coastal beach lands have no value for farming some of them and especially Rexhame and the other beaches all the way around to Hull command high prices as sites for summer homes.

SUMMARY.

Plymouth County lies in the southeastern part of the State, between Boston and Buzzards Bays, and contains 446,720 acres, or 698 square miles. The total population in 1910 was 144,337 against 113,985 in 1900. Plymouth, in the eastern part, is the county seat. Its population is 12,141. Brockton, with a population of 56,878, is the largest place and an important industrial center. Within a radius of 8 miles of Brockton are several other important industrial towns and between Plymouth and Hingham along the south shore are several villages and numerous resorts.

The surface features for the most part are level to gently rolling and over a large part of the county the elevation ranges between 80 and 140 feet above sea level. The roughest areas, occurring east and south of Plymouth and quite an extensive region extending through to Buzzards Bay is very sparsely settled. The best development is along the coast north of Plymouth and through the northern, central, and western portions of the county.

The county has an extensive system of public roads, a large number of which are macadamized and several oiled. The railroad facilities are excellent. Besides the steam roads, nearly all of the cities and villages are connected by electric roads.

The climate is marked by long, cold winters, with a heavy snowfall, and short, cool summers, with occasional hot, sultry periods. On account of the pleasant climate during the summer months thousands flock to the resorts along the coast.

Agriculture was the principal industry in the county until about 1875. Since then it has become more and more subordinate to manufacturing.

The movement to the West and demand for labor created by the numerous mills and factories that sprang up caused a scarcity of labor on the farm. As a result some farms were abandoned outright and many others were badly neglected.

Production of practically all crops continued to decline until about 1900. Since then there has been a decided change for the better and lands have almost doubled in value.

Hay, potatoes, miscellaneous vegetables, and cranberries are the leading crops. Dairy farming is an important industry and some

attention is given to raising hogs and cattle. Poultry is another important interest. The county offers good opportunities in several lines of farming. Hogs and cattle can be raised profitably. Dairying can be gone into much more extensively with profit as can also the growing of vegetables, strawberries, raspberries, and blackberries. Good apples can be grown on almost any of the well-drained uplands. The tendency now is in the direction of small farms and a greater diversification.

Sixteen types of soil are mapped. These are grouped in four series and the miscellaneous types, Rough stony land, Meadow, Muck, Tidal marsh, and Coastal beach.

The Gloucester series is by far the most extensive and important agriculturally. It includes the level to gently rolling uplands derived from glacial till and with more or less stone strewn over the surface and through the soil mass. The Carver includes outwash plains, filled-in valleys, and kames, the material being mostly sand with little or no stone on the surface, but the deeper subsoil especially consisting very largely of waterworn gravel. The Plymouth series occupies rough morainic topography where the deeper subsoil is from preglacial material.

The Gloucester loam is an extensive type, light, friable, gently rolling, and naturally well drained. It is forested and strewn with stone, but about all of the stone has been removed from the cleared areas. It is the best upland soil in the county, and is used for general farm crops, principally grass for hay. Corn, oats, and several other crops are grown in a more limited way. It is also used extensively for trucking, and many dairy farms are found on it. Apples, pears, cherries, and many of the smaller fruits do well.

The Gloucester sandy loam is an extensive type used principally for hay and pasture. Some corn, oats, and other general crops are grown. Yields are about as good as on the Gloucester loam. It is used to some extent for trucking.

The Gloucester stony sandy loam is about the same in texture as the Gloucester sandy loam but much more stony. Very little of it is under cultivation. It is best adapted to pasture.

The Gloucester stony loam is a very stony type of small area. It is not cultivated but used to some extent for pasture. It is best suited for forestry and pasture.

The Rough stony land includes rough, stony areas that are not suitable for cultivation. It is best adapted to forestry. Some areas would make good pasture.

The Whitman loam is an inextensive type confined to poorly drained areas, principally within the Gloucester loam. It is not cultivated and has very little value in its present condition. If drained it probably could be used profitably for corn, oats, grass, and some truck crops.

The Whitman sandy loam is a poorly drained type of small extent, associated with the Gloucester sandy loam. It has scarcely any value in its present condition, but if drained it would be adapted to the same crops as the Whitman loam.

The Carver gravelly sandy loam is an extensive type occupying irregular areas of hilly to gently undulating topography. It is rather droughty on account of the deep underlying sand and gravel. The levellest loamy areas, if properly handled, will give fair yields of corn, hay, potatoes, and berry crops. Grapes probably would do well. The roughest areas, now supporting a scrubby growth of pitch pine and oak, should be reforested with white pine.

The Carver coarse sandy loam is an extensive type occurring principally to the east of Plymouth. It is coarse, open, and droughty, with a level to undulating and irregular surface, and well drained. Only a small acreage is farmed. With good treatment it gives fair yields of corn and rye. It is too droughty for grass and does not make good pastures. Potatoes, apples, pears, grapes, and a variety of vegetables would do well on the best areas.

The Carver sandy loam is a good soil with scarcely any stone and not much gravel at the surface. It is level and naturally well drained. The principal crops are hay and corn. Potatoes, berry crops, and a variety of vegetables do well. Its best use is for potatoes, vegetables, and berries.

The Carver fine sandy loam is a light sandy type, nearly level in topography, and fairly well drained. It is used to some extent for general farming and truck. It may be best used for truck growing.

The Plymouth stony sandy loam is a rough, stony type. It is not farmed and is suited for little except forestry.

Coastal beach areas are inextensive and have no agricultural value.

Muck is an extensive type, and over 2,000 acres of it are now in cranberry bogs. Areas not suitable for cranberry culture can be drained and used profitably for tame grasses and some special crops, such as celery, lettuce, and onions.

Meadow is not used except for pasture. If drained it would be adapted to celery, heavy truck, corn, and grass.

Tidal marsh includes the tidal overflow lands along the coast. It is not cultivated, but quite a large acreage is mowed each year. The hay obtained is coarse but is relished by stock. It makes good bedding. By diking and draining the tidal lands could be brought under cultivation and converted into valuable land.

[PUBLIC RESOLUTION--No. 9.]

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

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

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

Approved, March 14, 1904.

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

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