SOIL SURVEY OF THE CONNECTICUT VALLEY.

By ELMER O. FIPPIN.

LOCATION AND BOUNDARIES OF THE AREA.

In the field season of 1899 a soil survey was made of a portion of the Connecticut Valley in Connecticut and Massachusetts, the results of which form a part of Report No. 64 of the Division of Soils. After the publication of this report an urgent request was made for the extension of the survey, and during the past field season practi-

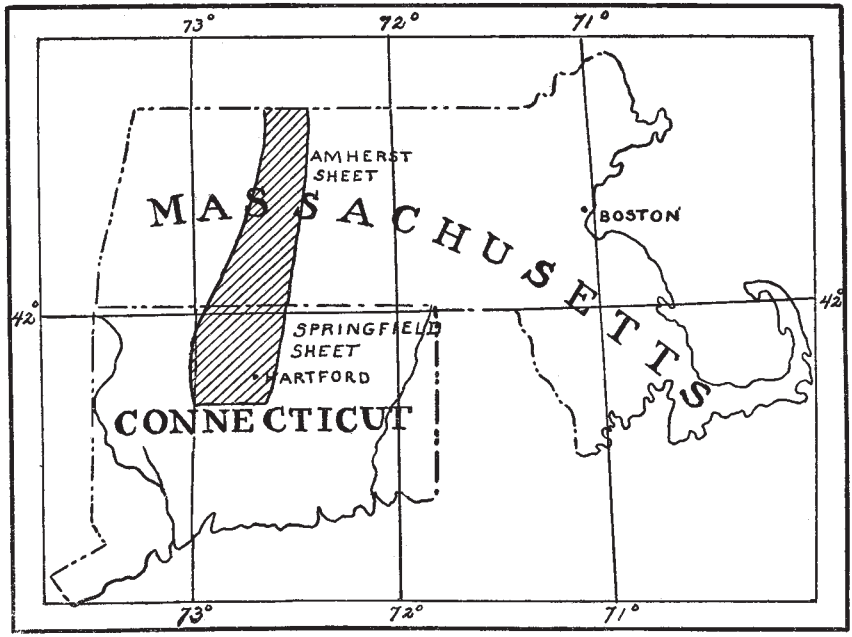

FIG. 1.—Sketch map showing location of Connecticut Valley area, Connecticut and Massachusetts.

cally all of the valley in Connecticut north of South Glastonbury and in Massachusetts was surveyed. Frequent reference will be made to the former report to enable a clearer understanding of the present investigations and to avoid repetition. The first survey "extends from South Glastonbury, Conn., * * * northward for a distance of about 41 miles to Bachelor Brook, in South Hadley, Mass., where the Mount Holyoke range of mountains completely separates it from

the extension of the valley from Northampton northward into Vermont." The area surveyed and mapped in 1899 comprises 388 square miles, or 248,470 acres, and has an average width of from 5 to 10 miles on each side of the Connecticut River.

The Connecticut Valley, as understood by geologists, is an elongated basin that extends through western Connecticut and Massachusetts, and, much diminished in size, forms the boundary between Vermont and New Hampshire. This valley is traversed by ridges and groups of hills which divide it into three, or more accurately into five, parts, of which the area described above, bordered on each side by a narrower valley, is the most southerly central one.

In this report we are concerned only with the valley from the latitude of New Britain and South Glastonbury, Conn., to the northern boundary of Massachusetts, i. e., from latitude 41° 40′ to 42° 44′. The area is 72.5 miles long, and the Connecticut River flows lengthwise through its central part. The width of the survey varies from 13.5 miles in the northern part to about 25 miles in the latitude of Hartford, Conn. But at the south the later survey is divided into two narrow areas, lying one on each side of the original survey, and having a combined width of 14 miles. Of these two strips the western one has a maximum width of 12 miles near its southern extremity. In the vicinity of Northampton the total width of the survey is 18 miles. These dimensions include a total area of about 926 square miles, or 592,640 acres, which taken with the previous survey make a total of 1,314 square miles, or 840,960 acres. The major part of the area is situated in the Connecticut Valley, but from Holyoke, Mass., northward it extends several miles upon the bordering uplands. In the southern half it is limited by the 500-foot contour; in the northern half by arbitrary lines.

HISTORY OF SETTLEMENT AND AGRICULTURAL DEVELOPMENT.

Some of the earliest permanent settlements in America were made in the Connecticut Valley, and several of the cities and villages have celebrated the two hundred and fiftieth anniversary of their foundation. This long history has been one of varied development. Naturally the hills and valleys have been thoroughly traversed by the successive settlers, and all available land was brought under plow decades ago. Not a vestige of the first native growth timber remains, and in many instances a series of crops of timber have been obtained from the same land. Among the growth of trees that now cover large areas may be seen the abundant proof that that same land has been cleared and cultivated for a series of years at some earlier time. These signs are more noticeable and numerous on the uplands than in the lowest part of the valley, because the land least favorably situated was

first abandoned when the economic conditions of the country became such that abandonment at some point was necessary. This abandonment is traceable to a combination of circumstances. The principal reason was the opening of new and fertile western lands, rather than the loss of fertility of the abandoned land.

The crops grown have always been corn, oats, rye, and possibly a little wheat at intervals, together with various grasses. Of necessity some truck crops were also produced. Mr. Dorsey, in his report on the earlier survey, has given a sketch of the growth of the tobacco industry since its beginning a century ago. This crop has long been important in the region, and interest in it has greatly revived within the last half dozen years.

CLIMATE.

The figures on precipitation and humidity stated in the 1899 report are applicable to the present survey, and the statements regarding temperature are equally accurate for our present purpose as far north as Northampton. For further information on these conditions there is included here the temperature and precipitation records for Amherst, Mass., and Storrs, Conn., but the latter station is situated a short distance east of the area surveyed.

The average temperature from May to September, from this data, is 64°, and the average precipitation for the same months is 3.86 inches.

Normal monthly and annual temperature and precipitation.

Month.	Amherst, Mass.		Storrs, Conn.		Month.	Amherst, Mass.		Storrs, Conn.	
	Temperature.	Precipitation.	Temperature.	Precipitation.		Temperature.	Precipitation.	Temperature.	Precipitation.
	° *F.*	*Inches.*	° *F.*	*Inches.*		° *F.*	*Inches.*	° *F.*	*Inches.*
January	23.6	3.46	21.9	3.98	August	68.2	4.27	67.6	3.83
February	24.9	3.28	24.2	3.97	September	60.2	3.53	60.9	3.45
March	32.7	3.48	32.7	4.04	October	49.0	3.75	49.5	4.07
April	45.4	3.03	45.0	2.84	November	38.3	3.85	38.9	4.44
May	57.0	3.83	55.6	3.88	December	27.3	3.51	29.7	3.34
June	66.2	3.74	64.9	2.53	Year	47.0	44.30	46.6	45.39
July	70.5	4.57	68.7	5.02					

PHYSIOGRAPHY AND GEOLOGY.

The area consists of two physiographic portions, the Connecticut Valley proper and the uplands. The valley has a slight southwesterly trend and widens from the north toward the south. At the northern boundary of Massachusetts its width is 2 miles, and the eastern border extends southward in a generally straight line, with the exception of a bend westward at Montague. The western border is less regular and

recedes by a series of three steps, each about 5 miles in extent. The first of these occurs a few miles above Greenfield, the second near Northampton, and the third at Westfield. The width is increased by these successive steps from 2 miles at Northfield to 16 miles at Northampton and 25 miles at Hartford.

Throughout the area the walls of the valley are steep and comparatively high, and notched at intervals by narrow gorges of inflowing streams. The generally even surface is broken by a number of long, narrow ridges and peaks that rise abruptly from the general level. The former have almost vertical sides on the west and north slopes. The most prominent of these ridges is the range containing the Talcott Mountains, Mount Tom, and Mount Holyoke. This reaches northward from New Britain to near Northampton, where it turns abruptly east across the valley, dividing it almost completely. Another important ridge is the Deerfield range, which begins at Sunderland in Sugarloaf Mountain and is prolonged beyond Greenfield to the village of Gill. In the town of Sunderland, east of the river, occurs the splendid peak of Mount Toby, which is separated from the upland by a contracted gorge and, for the second time, renders narrow the lowlying part of the valley. In addition to the prominences just mentioned many series and groups of lower and less rugged hills occur throughout the basin. These have gently and gracefully rounded surfaces and many of them are locally known as "hog backs." These hills are of the kind technically called by geologists "drumlins."

In addition to these features the Connecticut River and its tributaries are bordered by a succession of terraces generally continuous and frequently very distinct.

The region outside of the valley is very much broken and hilly, with comparatively rugged ridges and peaks and narrow, rocky ravines. In many places erosion has formed vertical walls, and, while some of the hilltops are comparatively flat, bare rock ledges are numerous.

The Connecticut River has several important tributaries that come down from the highlands through deep, narrow, picturesque gorges, of which Miller and Chicopee rivers are on the east and Falls, Green, Deerfield, Mill, Westfield, and Farmington rivers are on the west. The Deerfield, Westfield, and Farmington rivers, after reaching the valley, wind tortuously over its bottom for a considerable distance and then break through the trap ridges in very narrow gorges.

The elevation of the valley ranges from 100 or 200 feet at the south to 300 or 400 at the north, and the highest point of the Connecticut River in the area is 200 feet. The hills in the valley reach elevations of from 900 to 1,200 feet. The highlands have an elevation of from 500 to 1,200 feet, in one or two places reaching to 1,300 feet.

The unconsolidated materials of the valley have been divided by

Mr. Dorsey into glacial and sedimentary. This classification holds for all of the present area.

The rocks underlying the Connecticut Valley belong to Paleozoic and Mesozoic times. The basis of the highlands is a complex series of tilted gneisses, schists, and intrusive rocks now widely exposed. The underlying material of the valley is correlated with the Triassic period, and is of reddish color, due to the presence of large amounts of iron compounds. The region has long been one of intense geological activity, which has produced great faults. Through many of these which cut the Triassic formations masses of molten rock were intruded and now form the black trap rock of the Holyoke, Deerfield, and related ranges.

These series of rocks formed the surface of the country when the glacial ice covered all the region. Rocks of all kinds were ground into flour and deposited irregularly over hills and in depressions. On the highlands and higher hills of the valley this deposit is comparatively thin and inclined to be sandy. On the walls of the valley the drift is very thin, and over large areas practically absent. The variations in the pressure of the ice flow probably caused it to form the large rounded drumlins, which are very compact and do not show the effect of flowing water, except at their surface.

As the ice receded pools and lakes were formed over the land surface and the Connecticut Valley became a great lake. In these places sands and gravel accumulated, in the largest lakes also clay, and these materials form the present soil covering. These lake deposits have been eroded by the later drainage system and form the terraces already mentioned. The streams have further aided in soil formation by deposits that occupy the lowest parts of their valleys.

SOILS.

The soils of the area are of three general classes: First, those formed of glacial débris by direct glacial action, which constitute the drift or till; second, those formed by stream currents, which are chiefly gravel and coarse sands, and, third, those derived from the materials deposited in comparatively quiet lake waters. The latter are sands of various grades, silt, and clay.

The earlier survey recognized 11 types of soil. The present survey found all the established types and added three others, and a phase of certain of the upland soils, making 14 types in all. They range in character from clays and heavy stony loams through fine and coarse grades of sand to gravel. There are frequent areas of rock outcrop devoid of any soil covering.

The following table shows the areas of different soils, as well as the percentage of the entire area occupied by each soil type in the area covered by the surveys of 1899 and 1903:

Areas of different soils.

Soil.	Acres.			Per cent.
	1899.	1903.	Total.	
Holyoke stony loam	19,730	177,088	196,818	23.4
Triassic stony loam	37,180	71,936	109,116	13.0
Hartford sandy loam	54,920	40,384	95,304	11.3
Connecticut meadows	19,620	55,232	74,852	8.8
Windsor sand	29,960	42,048	72,008	8.6
Chicopee gravel loam	10,900	48,384	59,284	7.1
Enfield sandy loam	33,150	13,312	46,462	5.5
Manchester sandy loam	.....	44,160	44,160	5.3
Connecticut swamp	14,470	25,216	39,686	4.7
Norfolk coarse sandy loam	.....	27,904	27,904	3.3
Suffield clay	13,370	10,240	23,610	2.8
Elmwood loam	11,710	7,168	18,878	2.2
Podunk fine sandy loam	3,460	13,824	17,284	2.1
Bernardston loam	.....	16,064	16,064	1.9
Total	248,470	592,960	841,430	.....

TRIASSIC STONY LOAM.

The Triassic stony loam is a reddish to red-brown silty loam, with a depth of 14 inches, resting on a medium heavy sandy loam of reddish color 3 feet in depth. The material ranges from a sandy loam to a heavy silty loam which has a darker red color. Both soil and subsoil contain large numbers of angular bowlders of all sizes up to several feet in diameter, and the greater portion of these consist of the red and brown sandstones of the Triassic period.

This type occurs almost entirely in the southern half of the area below Northampton and is distributed in elongated bodies and groups of hills. It borders the Talcott Mountain Range and flanks the Mount Tom Range up to an elevation of 700 feet on the west side. Other areas occur in the towns of Granby, Conn., and Southwick and Southampton, Mass. On the east side it is regularly distributed as far north as the Chicopee River. North of Northampton the type is only found in a few small areas in the towns of Deerfield and Greenfield.

In the northern part of Farmington Valley and throughout the Westfield Valley the soil is very sandy and of only a very faint red color, and at depths of 30 inches a whitish, loose, coarse, sandy loam occurs. But this condition is not uniform and it alternates at short distances with the heavier loam phase. An area in Whiteloaf Mountain is a prominent example of this more sandy phase.

The surface of this type is hilly, with a steep slope where it comes in contact with the trap ridges; but the outline of the hills is usually gently rounded, particularly on the east side of the survey.

The type is associated with the Triassic formation, from which nearly all its material has been derived through glacial action. In a few places ledges of this rock are extensively exposed at the surface, and these are indicated on the map by symbols. The prevailing red color is due to the presence of compounds of iron.

The greater part of this type is cultivated to grass and grain crops, of which the yield is moderately large. The returns are small on the sandy portions. Very little tobacco is grown on this soil, and that, as the earlier report states, is of heavy body and dark color.

It is best adapted to the growth of grains and small fruits and is well adapted to pasture lands.

The following table shows the texture of the fine earth of representative samples of the Triassic stony loam:

Mechanical analyses of Triassic stony loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
9105	2 miles W. of North Somers.	Heavy silty loam, 0 to 15 inches.	1.77	3.00	6.54	5.02	14.24	29.70	32.56	8.84
9103	½ mile E. of Manchester.	Red silty loam, 0 to 14 inches.	.39	3.62	8.06	8.02	19.74	23.60	27.28	9.58
9106	Subsoil of 9105.....	Red sandy loam, 15 to 36 inches.	.35	3.06	6.32	5.28	17.18	30.68	29.48	7.34
9104	Subsoil of 9103.....	Red heavy loam, 14 to 36 inches.	.24	4.54	8.62	7.98	21.80	21.60	24.34	11.00

HOLYOKE STONY LOAM.

The soil of the Holyoke stony loam is a dark yellow or brown silty loam, from 7 to 12 inches deep. The subsoil ranges from a moderately heavy yellow sandy loam to a heavy loam, with the sandier phase most abundant. The type is very stony throughout and contains pebbles and bowlders of angular shape and varying in size from less than an inch to several feet in diameter. In places these almost cover the surface.

Its distribution is chiefly in the northern half of the area, but it also occurs in the vicinity of Farmington and in the town of Southwick.

The surface, which reaches the highest elevations of the valley and highlands, is very rugged and broken by gorges and peaks. Many bare rock ledges occur, and in places these form vertical walls of great height. In the lower portions of the valley lenticular hills, or drumlins, are common.

Like the last type, this one is of glacial origin and the material is derived from a variety of metamorphic, diabase, and crystalline rocks. The thickness of the deposit varies from nothing to more than 100 feet. The heaviest, or loam, phase occurs in the lower parts of the valley and is also prominent on the western highlands north of Northampton. In many areas the bowlders and ledges are so abundant and the slopes so steep that they are valueless for cultivation, and it seems advisable to indicate these on the map by symbol. These areas are of very large extent and form the type of all the principal mountain ranges and peaks. The soil in general is of moderate fertility. The sandiest portions yield small crops, but the loam phase, where it is cultivable, returns good yields of all the grain and grass crops, besides being well suited to grazing. Some tobacco is grown, the yields, with generous applications of fertilizer, ranging from 1,800 to 2,000 pounds per acre, but it is rather heavy bodied, dark colored, and of poor quality.

Dairying is the most prominent industry on the type. Fruits of all kinds suited to the region thrive and a considerable quantity of apples is produced. The number of apple orchards can well be increased and grapes and other kinds of fruit added, as the soil is capable of producing all of these to advantage. The chief drawback in growing peaches in the northern part of the area is the prevailing low winter temperature. While some peaches are produced, further experimentation is necessary to demonstrate the feasibility of carrying on their cultivation on a commercial scale.

The following table shows the texture of the fine earth portion of samples of the Holyoke stony loam:

Mechanical analyses of Holyoke stony loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
9079	4 miles SW. of Westfield.	Yellow loam, 0 to 12 inches.	1.93	2.50	6.30	4.04	11.70	23.92	46.78	4.56
9081	1 mile N. of North Wilbraham.	Dark yellow loam, 0 to 12 inches.	2.60	2.06	5.12	4.90	18.18	24.10	37.60	7.90
9080	Subsoil of 9079.....	Yellow loam, 12 to 36 inches.	.78	6.80	12.72	9.00	21.56	19.70	23.84	6.18
9082	Subsoil of 9081.....	Heavy sandy loam, 12 to 36 inches.	.64	1.66	4.70	4.96	21.02	24.86	36.20	6.32

BERNARDSTON LOAM.

The Bernardston loam is a light clay or loam of dark color, 10 inches in depth, underlain by 14 inches of a dark and often yellowish loam. This rests usually on a dark slaty blue clay loam of very compact nature. The soil and the subsoil, especially the latter, abound in slaty fragments, and the greater part of the large bowlders which it contains are fibrous, contorted slate.

The type occurs in one body at the northern limit of the survey, chiefly in the town of Bernardston. The surface is very hilly and broken, as in all highlands of which it is a part, and outcrops of the underlying argillaceous rocks are very extensive. The cultivable areas, which are formed largely of drumlinoid hills, lie in irregular isolated patches. The native timber is predominantly hard wood, sugar maple being the most common tree, but in the more stony areas, where the soil is shallow, chestnut, pine, and hemlock are most numerous.

The materials forming this type have been derived from argillite rock through glacial action, which explains the abundance of fragments of this rock in the soil and subsoil. The cultivable parts of the type have all been cleared and produce excellent crops of corn, oats, rye, and grass. This soil is productive, and remains so for a long time. It is the best grass and grazing land in the area surveyed, and is very largely utilized for dairy purposes. It quickly responds to careful treatment, and its productiveness may be greatly increased.

The following table contains mechanical analyses of samples of fine earth of the soil and subsoil of the Bernardston loam:

Mechanical analyses of Bernardston loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
9062	1½ miles NE. of Leyden.	Dark gray loam, 0 to 12 inches.	2.81	4.98	5.74	3.32	15.06	24.14	34.88	11.88
9064	2 miles NW. of Bernardston.	Dark brown loam, 0 to 12 inches.	2.90	7.52	8.86	4.60	13.42	17.24	33.20	14.76
9063	Subsoil of 9062.....	Heavy loam, 12 to 36 inches.	.32	3.68	5.30	3.22	14.84	22.58	36.86	13.42
9065	Subsoil of 9064.....	.....do	.65	6.84	7.82	5.26	12.84	14.76	35.46	16.96

ROCK OUTCROP.

The areas in which rock symbols occur on the map include parts of all the three types described above, and in one or two instances

parts of other types, and they represent soil conditions where the rocks are too abundant and the slope too great to permit cultivation. In many places on the crest of ridges and peaks they stand for almost bare ledges. Since the glacial ice overran all of the region, it left its fine débris wherever there was a depression, and this accounts for the small patches of an acre or more of cultivable land in the midst of these very stony areas, and as a rule there is at least a thin covering of soil over all the region.

On the western highlands, in the northern part of the area, a large part of the area of this soil has been cleared and furnishes good early pasturage; but the greater part is occupied by woodlands of second-growth chestnut, maple, Swiss pine, hemlock, oak, and other species. Its best use is for forestry purposes, and it affords to the practical forester an opportunity for interesting study.

CHICOPEE GRAVEL LOAM.

The Chicopee gravel loam consists of from 4 to 8 inches of a yellowish or grayish sandy loam, underlain by beds of coarse, loose gravel, composed of small pebbles and sand and rounded cobblestone bowlders. The gravel is usually of a grayish or whitish color, but may be stained somewhat by iron compounds. The type occurs chiefly in the larger valleys along important lateral streams. The largest areas are found in the towns of Westfield, Ludlow, Amherst, and Bernardston. The surface is either a sloping plain or has a more irregular surface, rendered so by bars and kettle holes. It was formed from the deposits of swiftly flowing streams, and represents deltas built up around their mouths at the time of the glacial lakes.

Corn, rye, and buckwheat are the leading crops, but this type of soil is only cultivated to a small extent. The low productiveness of the soil, combined with the loose, porous nature of the subsoil, will probably always prevent its extensive cultivation.

The following table gives mechanical analyses of fine earth of this type of soil:

Mechanical analyses of Chicopee gravel loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
9067	3 miles NW. of Greenfield.	Sandy and gravelly loam, 0 to 12 inches	0.89	11.74	25.74	14.04	20.06	9.94	12.92	5.52
9068	1 mile W. of Westfield.	Gravelly loam, 0 to 12 inches.	1.53	7.50	17.86	8.86	15.98	15.92	23.44	9.70
9066	¼ mile NE. of Bernardston.	Brown sandy loam, 0 to 10 inches.	3.80	11.54	14.54	5.28	10.20	15.56	32.04	10.78

NORFOLK COARSE SANDY LOAM.

The Norfolk coarse sandy loam is a dark sandy loam 8 inches deep resting on a stratum of heavy red or yellow sandy loam 10 to 22 inches thick. Beneath this material occur deposits of coarse sand and gravel, which in the southern part of the survey around Newington show distinct cross-bedding.

The type is a valley formation and occurs most extensively in the lower half of the area. It has a level or gently sloping surface composed of ridges and low hills. The largest area is southwest of Hartford, and this, together with areas in the Rockville Valley, shows distinctly its relation to the Triassic formation by the dark-red color of the soils and by the fragments and bowlders of the red sandstone scattered plentifully through it. The type was formed as a lake deposit. The coarse basal material was laid down in swift currents, and later the fine loam of the top soil was deposited in comparatively quiet water. In the Farmington Valley and around the Congamuck Ponds the materials are essentially the same as in the Chicopee gravel loam, with a deep yellow sandy loam covering. On the farm of the Hatch Experiment Station, at Amherst, Mass., the surface loam has a large proportion of fine sand.

The type is generally one of considerable productiveness, especially so around Newington. Here it produces good crops of corn, small grain, and grass. Fruit is grown also on this part of the type. Farther north, on the west side of the survey, it produces tobacco of fairly good quality, the yield ranging from 1,700 to 2,000 pounds per acre. Most of this crop is produced in open fields, but at Granby, Conn., some shaded Sumatra is grown. As in all the tobacco produced on the heavier soils, the leaf tends to be heavy and of dark color, qualities which do not commend it to the trade and which reduce the profit of its cultivation.

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

Mechanical analyses of Norfolk coarse sandy loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
9089	1 mile E. of Manchester.	Heavy yellow sandy loam, 0 to 20 inches.	0.55	7.52	12.64	7.32	12.48	18.68	33.20	8.06
9087	2 miles NW. of Simsbury.	Heavy yellow sandy loam, 0 to 22 inches.	.68	13.34	23.68	4.38	7.90	11.68	30.04	8.72
9090	Subsoil of 9089....	Coarse sand and gravel, 20 to 36 inches.	.22	5.84	44.30	30.38	12.24	1.92	2.50	2.08
9088	Subsoil of 9087....	Coarse sand and gravel, 22 to 36 inches.	.33	19.08	43.90	12.56	8.80	5.14	6.98	3.20

MANCHESTER SANDY LOAM.

The Manchester sandy loam consists of a reddish or dark-yellow, medium-grade, sandy and gravelly loam, from 8 to 18 inches deep, underlain by loamy sand and gravel. Frequently large bowlders are embedded in this material.

Its occurrence is limited almost entirely to the eastern part of the survey, where it is found in the valley and in depressions on the hills. The largest bodies are around Glastonbury and Manchester, as far north as Somers, Conn. Around Greenfield, Northfield, and east of Amherst, Mass., the type consists of coarser grades of sand and gravel.

The surface of the Manchester sandy loam is rolling. It is generally composed of low ridges and knolls, although in a few places the type forms low, flat terraces. It originated from a combination of glacial lake and stream deposits, and the material is exceedingly irregular in character and thickness. Material from the red Triassic formation forms the type in the Manchester region.

The soil is naturally fertile, but the porous nature of the subsoil makes it easily subject to drought. A large proportion of the type is not cultivated, but where in use it produces good crops of grain, fruit, and early truck. In the vicinity of Manchester considerable tobacco is grown, and this is of good quality. The yield is from 1,600 to 1,800 pounds per acre. Yields of 75 bushels of corn per acre are recorded. It is an especially good soil for peaches, and other fruits succeed well. Careful treatment is required to secure the best results.

The following table shows the result of mechanical analyses of samples of fine earth of soil and subsoil of this type:

Mechanical analyses of Manchester sandy loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
9101	1¼ miles E. of South Manchester.	Yellow sandy loam, 0 to 16 inches.	0.79	5.04	14.06	17.08	40.66	12.16	6.96	3.70
9099	3 miles N. of Greenfield.	Brown sandy loam, 0 to 12 inches.	2.21	6.32	14.20	11.46	27.92	18.78	14.06	7.26
9102	Subsoil of 9101	Red sandy loam, 16 to 36 inches.	.30	5.20	19.08	20.36	32.42	13.62	7.44	1.56
9100	Subsoil of 9099	Dark sandy loam, 12 to 28 inches.	.81	8.80	16.78	11.36	26.32	18.52	11.58	5.92

WINDSOR SAND.

The Windsor sand consists of from 6 to 10 inches of a light-yellow or brown coarse sand, resting on a yellowish coarse sand and fine gravel, slightly loamy. This material grades at a depth of 16 inches into a very loose gray coarse sand and gravel which extends to depths of 30 or 40 feet over large areas.

This type occupies wide areas in the earlier survey, as it does in the present one, where it forms broad gently rolling plains in the towns of Westfield, Southampton, and Montague, Mass. It is also found in smaller areas, in which the surface is more hilly, scattered widely throughout the valley. Mr. Dorsey has considered it to be a shallow lake deposit, and this explanation of its origin seems to be applicable to the areas in the present survey.

The type is divisible into two phases, of which the light, loose, phase forming gently rolling plains is the most extensive. The small areas, located along streams and found associated with heavier types are more a sandy loam than a sand and much more productive. In the Farmington Valley and around Congamuck Ponds the coarse sand and gravel subsoil generally has also a covering of a yellow loam that is sometimes 12 or 15 inches in depth. Several large tobacco shades are located on soil of this character at Granby, Conn. The heavier soil covering makes the soil much stronger, while the nearness of the water table and retentive deep subsoil adds to its fertility.

Very little of the plain phase of the type is at present under cultivation, but is covered by a stunted growth of pine. The soil is so

loose and lacking in fertility that profitable cultivation can only be carried on at considerable expense for fertilization.

A large part of the heavier phase is under cultivation and produces fairly good crops. It is an excellent early truck soil. Tobacco is grown on this soil in a number of places with good results, for the leaf is thin and elastic and the general quality is good. The yield in the open fields is about 1,600 pounds and under cloth about 1,000 pounds per acre. This soil is easily affected by dry weather.

In the following table is shown the texture of typical samples of fine earth of soil and subsoil of the Windsor sand:

Mechanical analyses of Windsor sand.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
9107	½ mile W. of Lake Pleasant.	Coarse sandy loam, 0 to 9 inches.	0.86	9.64	35.32	19.14	16.40	7.24	7.26	4.82
9109	3 miles E. of Southampton.	Dark sand, 0 to 9 inches.	.82	9.24	35.54	20.68	18.54	4.48	6.00	5.42
9111	1½ miles S. of Granby.	Yellow loam, 0 to 15 inches.	.88	8.76	19.40	9.26	16.44	12.06	25.92	8.00
9108	Subsoil of 9107....	Yellow gravel, 9 to 36 inches.	.63	10.80	32.06	20.44	20.02	7.72	5.32	3.32
9112	Subsoil of 9111....	Sand and gravel, 15 to 36 inches.	.31	14.52	25.26	11.30	20.52	8.80	15.40	4.12
9110	Subsoil of 9109....	Yellow coarse sand, 9 to 36 inches.	.52	17.06	41.10	17.84	12.52	2.80	4.34	4.14

HARTFORD SANDY LOAM.

The Hartford sandy loam, to a depth of 12 inches, consists of a dark-brown sandy loam. This material is underlain to a depth of 3 feet or more by red or yellow sand or light sandy loam. Medium and fine grades of sand predominate, and the amount of coarse sand and fine gravel does not exceed 5 per cent.

The type is not as extensively developed in the present survey as in the earlier one, but occurs generally in small bodies throughout the western and northern part. The largest bodies are in the town of Westfield and between the villages of Hatfield and Deerfield. It forms terraces and plains some distance back from the larger streams, and has a gently rolling and sometimes billowy surface. This last characteristic is due to action of the winds in producing dunes, and is most extensive west of Avon, Conn., and below Westfield, and in the town of Whately, Mass.

Like the Windsor sand, from which it is distinguished by the much finer grade of the sand, the Hartford sandy loam consists of two phases, one of which is very light, loose, and porous, and not cultivated to any extent, and the other is a medium sandy loam, with a comparatively shallow subsoil—from 3 to 5 feet—and advantageously situated with reference to water supply. The first phase comprises the largest areas, which were mentioned above as having the rolling, billowy surface, and in these places the material extends to depths of 20 or 30 feet. The second phase forms smaller bodies, and is mostly under cultivation. In the Farmington Valley, in the towns of Simsbury and East Granby, it has a covering of from 6 to 12 inches of a heavy yellow loam, similar to that which overlies the Windsor sand in that region. This renders it very productive.

The type is used extensively in the production of truck crops and tobacco. The heavier phase appears to be the best tobacco soil of the area, especially for the shaded crop. In open fields tobacco yields from 1,600 to 1,800 pounds of a very desirable leaf, and the yield under shade ranges from 1,000 to 1,200 pounds. The leaf is of good quality, light color, elastic, and of fair body, and in general commands the highest prices.

Of such soil there are considerable areas that are still available for the production of the crops mentioned, especially in the Hatfield to Whately area.

Mechanical analyses of samples of the soil and subsoil are given below:

Mechanical analyses of Hartford sandy loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
9077	1 mile SE. of Sunderland.	Dark sandy loam, 0 to 12 inches.	2.15	0.20	0.82	1.84	53.14	28.52	11.04	3.64
9075	3 miles SW. of Westfield.	Sandy loam, 0 to 15 inches.	2.38	2.90	13.52	13.16	27.88	13.42	22.76	6.08
9078	Subsoil of 9077....	Loose sandy loam, 12 to 36 inches.	.25	.08	.66	1.28	58.92	29.94	7.14	1.44
9076	Subsoil of 9075....	Yellow medium sand, 15 to 36 inches.	.55	3.40	12.80	12.64	32.18	18.44	17.98	2.28

PODUNK FINE SANDY LOAM.

The Podunk fine sandy loam consists of 12 inches of friable, dark-brown fine sandy loam, underlain with a yellow or brownish fine sandy loam.

It forms low, level terraces, and occurs most extensively around Westfield and west of North Amherst. It is also distributed along the Connecticut River in small bodies from Northampton to the northern limit of the survey. The surface is level or gently rolling, with low ridges or sand dunes in a few places. The dunes are most prominent between North Hadley and Sunderland.

The material composing this soil originated by deposition in deeper lake waters, but it has been largely reworked and redeposited by later stream action, and much of it lies within the flood plain of the rivers along which it occurs. The type is entirely under cultivation and produces good crops of corn, late truck, cucumbers for pickling, and tobacco. The area in the latter crop is large, and the yields range from 1,700 to 1,900 pounds in the open fields. In quality it is slightly heavy, coarse, and of dark color, and hence does not bring the highest prices. It is not as good a tobacco soil as the heavier phases of either the Hartford sandy loam or the Windsor sand, but the deficiency in quality is offset by the larger yield. For the shade-grown crop it is also regarded as slightly too heavy, producing a leaf a grade less perfect than the lighter soils just mentioned. It is a very desirable medium and late truck soil.

In the following table the texture of representative samples of soil and subsoil is shown:

Mechanical analyses of Podunk fine sandy loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
9095	3 miles SE. of Sunderland.	Fine sandy loam, 0 to 12 inches.	2.35	0.22	1.50	2.78	25.62	38.94	26.80	4.14
9091	½ mile S. of Deerfield.	Silty and sandy loam, 0 to 10 inches.	2.21	.22	.74	.56	14.74	44.14	34.44	4.98
9093	1 mile E. of Westfield.	Fine sandy loam, 0 to 15 inches.	1.89	.04	.40	.36	13.40	47.34	31.48	6.80
9092	Subsoil of 9091.....	Brown fine sand, 10 to 36 inches.	.52	.00	.14	.28	23.02	49.30	24.74	2.34
9096	Subsoil of 9095.....	Fine sandy loam, 12 to 36 inches.	.38	.20	1.40	2.70	28.62	43.02	21.20	2.86
9094	Subsoil of 9093.....	Fine sandy loam, 15 to 36 inches.	.51	.06	.74	.80	17.32	51.40	25.98	3.64

CONNECTICUT MEADOWS.

The surface 12 inches of the soil of the Connecticut meadows consists of a dark silt loam. This is underlain by a heavier dark-grayish

to yellow or brown silt loam. The soil and subsoil frequently contain a considerable quantity of very fine sand, and the areas are sometimes traversed by small ridges of material of the character of Podunk fine sandy loam, but in general the type is a grade heavier than the last described type. The underlying material, of the same general character as the surface 3 feet, extends to a depth of 20 and even 50 feet.

This type occurs as low, level terraces distributed along the large streams. The largest bodies lie along the Connecticut River at Northampton, from which point they reach northward to Sunderland. Other large bodies occur along the Farmington River in Connecticut, and in Massachusetts in the Deerfield Valley and the vicinity of Northfield.

The surface is level or gently rolling, and frequently traversed by abandoned stream courses. It generally has a small slope from its highest point near the stream to a lower level at the foot of the scarp with the next higher terrace.

A large part of the area of this type is subject to overflow, but the bodies between South Deerfield and Deerfield and west of North Amherst, with some other smaller ones, are exceptions.

The material consists of the finest grades of sand and silt that have been reworked and deposited by the streams along which it occurs. In the process of reworking and deposition large amounts of organic matter have been incorporated with the sand and silt.

For general farm crops this is the most important and valuable soil formation within the area of the present survey. Along the Connecticut River it is occasionally valued at $250 an acre and rents for $30 per annum.

Excellent crops of corn, small grains, late truck, onions, and cucumbers for pickling are produced. It is very desirable for onion growing, which is a very important industry on the type between Hatfield and Sunderland, and the yields average 500 bushels, though 800 and even 1,000 may be obtained by the best of care and liberal fertilization.

While a large amount of tobacco is grown in the open, it is of low grade, because of the strong, dark, coarse character of the leaf; but the large yields of from 1,800 to 2,000 pounds offset these objections to some extent. The best grade of leaf can not be produced in this latitude on such heavy soil.

The following table gives the mechanical analyses of soils and subsoils of this type:

Mechanical analyses of Connecticut meadows.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
9071	½ mile W. of Northfield.	Dark silty loam, 0 to 10 inches.	2.12	0.12	1.22	1.36	3.44	14.16	72.64	6.56
9073	½ mile W. of Sunderland.	Dark silty loam, 0 to 9 inches.	2.09	.60	1.78	1.48	4.80	8.24	75.14	7.30
9069	1 mile SE. of Northampton.	Dark silty loam, 0 to 15 inches.	1.45	.06	.48	.30	1.12	6.52	78.94	12.42
9074	Subsoil of 9073.....	Heavy silty loam, 9 to 36 inches.	.93	.16	.30	.12	2.10	12.14	81.36	2.88
9072	Subsoil of 9071.....	Yellow silty loam, 10 to 36 inches.	.69	.00	.14	.08	1.06	12.82	82.04	3.24
9070	Subsoil of 9069.....	Heavy silty loam, 15 to 36 inches.	.41	.06	.08	.08	.34	6.30	83.40	9.64

SUFFIELD CLAY.

The Suffield clay consists of from 4 to 8 inches of heavy dark-drab clay loam resting on a heavy, tenacious gray-drab clay, which extends to a depth of 20 and in some instances 75 feet. The material shows distinct lamination throughout and the layers are from a sixteenth to a half inch in thickness.

It is an unimportant agricultural soil of small extent, and occurs in the towns of Southampton and Greenfield and in small bodies in Deerfield. In these places it forms terraces with very steep scarps and has a gently rolling surface. It is of deep lake origin, and while appearing very heavy and tenacious it is largely composed of silt, probably of the finer grades. The formation is extensively used in the manufacture of brick, for which purpose it is necessary to add considerable sand.

The type is cold and wet and is difficult to cultivate. The subsoil is very resistant to the development of plant roots, and all crops make meager growth. It is best utilized in the production of grass and would probably be improved for this purpose by a judicious and gradual deepening and loosening of the soil. This will enable the plant roots to penetrate deeper and give them a better moisture and food supply.

In the following table are shown the results of mechanical analyses of samples of soil and subsoil of the Suffield clay:

Mechanical analyses of Suffield clay.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
9097	2½ miles SE. of Amherst.	Stiff clay, 0 to 12 inches.	1.65	0.88	2.50	2.70	21.20	18.50	30.46	23.38
9098	Subsoil of 9097.....	Stiff clay, 12 to 36 inches.	1.08	.22	1.06	1.36	9.02	8.32	35.36	44.66

ENFIELD SANDY LOAM.

The Enfield sandy loam consists of medium-grade dark sandy loam 8 inches deep, underlain by from 16 to 22 inches of a medium-grade sand, which in turn rests on glacial till. It differs from the same type mapped in the earlier survey in that the underlying stony loam is not always derived from the Triassic sandstone.

The areas are small and irregular, and occur in east Granby and Somers, Conn., Southwick, Westfield, and Northampton, Mass., and in a few other scattered places. At Bloomfield and Tariffville, Conn., the sand is largely of fine grades.

The surface is rolling. In general the type originated from the overlapping of the sandy lake deposits with the glacial till, but in a few instances, notably in the town of Amherst, it is the result of wind-blown sand deposited on hillsides.

This soil is not important agriculturally in the areas surveyed in 1903. About half of it is under cultivation, and some tobacco of fair quality is produced in yields ranging to 1,800 pounds per acre. It is a fairly good truck and grain soil, but not very satisfactory for the production of grass.

ELMWOOD LOAM.

The Elmwood loam is essentially of the same character as that described in the 1899 report and consists of 8 inches of a dark sandy loam, under which is a layer, from 12 to 28 inches thick, of a rather compact sand that rests on heavy, impervious drab clay.

It occurs associated with the Suffield clay and has the same general surface features. It is formed by the lapping of the sandy formations over the Suffield clay.

The impervious underlying clay renders the type wet and poorly drained, and consequently rather cold. A result of this is the slight formation of iron hardpan in the subsoil. Underdrainage is very beneficial. The crops grown are corn, small grains, and grass, and moderate yields are obtained.

CONNECTICUT SWAMP.

The characteristic feature of the Connecticut swamp is its wet, swampy, and poorly drained condition, and this condition occurs in connection with all the types that have been described above. It is not confined either to high or to low levels, but exists in small bodies throughout the area.

At Newgate Prison, Conn., Congamuck Ponds, East Farms, and Wapping, Mass., deep deposits of muck have accumulated. The more elevated areas of the type can be drained and are very productive. These would make very good celery, onion, and cabbage lands.

AGRICULTURAL METHODS.

Rotation of crops is not generally practiced. With the average general farmer the grain crops and grass are alternated to suit the demands of the season, and clover is frequently seeded, but often fails because of unfavorable weather conditions. Tobacco and the truck crops in general usually succeed themselves on the same ground year after year. The soils are plowed from 6 to 8 inches deep and subsequent cultivation is usually shallow. The implements are run deepest when the plants are small and the root system not extensively developed, and very shallow at the last of the season, when the roots are near the surface across the row.

Fertilizers are used extensively thoughout the valley. The quantity applied per acre ranges for the various crops from 200 to 500 pounds for the grains to 1½ tons for tobacco. The fertilizers consist of a great variety of chemical, vegetable, and animal materials and are usually applied in the form of complete mixtures. In the case of tobacco and special truck crops it is generally distributed in two or three portions at different stages in the development of the plant, with the first and heaviest application just before the crop is planted.

AGRICULTURAL CONDITIONS.

Within a distance of from 1 to 3 miles of the Connecticut River, and in narrower strips adjacent to the larger of the other streams, the area is thoroughly and intensively cultivated. The soils here are largely sandy loams of medium and fine grades and silts, and lend themselves readily to tillage. The farms are of small size and well improved, and the men who cultivate this land usually own it and are

fairly prosperous. The size of farms in this part of the area ranges from 10 to 50 acres, with a mean of perhaps 30 acres. The remainder of the valley land may be grouped in a second division in which the farms are larger, averaging from 80 to 100 acres, and cultivation is less thorough. In this division there are large areas of light, rolling plains land that is uncultivated. Much of the soil is coarse and loose, and supports a small growth of timber. At some time in the past practically all of it has been under cultivation, and there are considerable areas that are worthy of attention under present conditions. On the better soils grain farming and dairying is the principal industry, and some truck and tobacco are grown. The farmers are fairly prosperous and have substantial farm buildings and machinery.

A third class of lands constitutes the highlands outside of the valley proper and the tops of some of the highest hills within it. In this class the timbered land occupies probably 80 or 90 per cent of the surface and the farms, which are scattered and isolated, have a small area of cultivated land, though the average holding is considerably larger than in either of the first two divisions. It is here that so many abandoned farms occur, with neglected and decaying buildings, sometimes originally quite substantial structures. This is not due to a sterile soil, but to a combination of economic conditions, the distance from railroad facilities, and the very stony character of the soil. The production of grain and dairying are the leading industries, and in some places apples form an important product.

The land in the hilly area is valued at from $3 to $15 an acre, depending upon the location, condition of buildings, amount of cultivable land, and character of the timber. In the valley the fertile, level, fine loam soils along the Connecticut River from Northampton to Sunderland are valued at from $175 to $250 an acre. Farther north the same land commands somewhat less, and the remainder of the valley land is worth at present from $20 to $50 an acre.

Not much of the land in the meadows is cultivated by tenants, although among truck farmers the practice sometimes is to rent their land. This high-priced land commands an annual rental of from $20 to $30 an acre.

Throughout the area there is taking place a noticeable movement of foreigners into the agricultural regions, and many of these are obtaining possession of farms in the more remote districts. They are increasing in number and buying nearer and nearer the centers of population. It seems probable that this element, composed chiefly of Poles and Italians, will ultimately bring about a change in the agricultural conditions of the area by again bringing under cultivation much of the abandoned land.

The farm labor is chiefly Polish, and commands wages of from $1.25 to $1.50 a day for ordinary work.

On the uplands and hills where stony soils prevail dairying receives much attention. The dairy herds are small and of mixed breeds. Ensilage is extensively used. The product consists of milk for city use, cream for the market, which is separated and graded in some instances in central factories, and butter. A number of creameries are located in the area surveyed, and most of these are operated on the cooperative plan. The cream, which is separated on the farm both by gravity and in centrifugal machines, is collected daily by wagons. It is carried in wooden casks of 20-gallon capacity. Only the churning is done at the central factory.

The grain crops are not especially important and are largely fed on the farms where produced. General trucking is carried on throughout the valley on the sandy loams and silt loams that occur adjacent to the large streams. The production is sufficient to supply the large home demand and to provide a small surplus for shipment to outside markets. There is an abundance of good soil available for this purpose, the location of which may be learned by consulting the accompanying maps. Some specialization has occurred within this industry, two important products being onions, and cucumbers for pickling. Hundreds of acres of onions are grown on the Connecticut Meadows between Hatfield and Sunderland. This heavy silt loam seems better adapted than any of the other soils to their production, and the average yields obtained are from 500 to 700 bushels per acre. The seed is sown in early spring on land that has been fertilized with nearly a ton of some "complete" fertilizer mixture. The Podunk fine sandy loam does not give nearly as good results, either in quantity or quality.

Around Northfield several hundred acres of cucumbers are grown for a salting factory in that village. For this crop either the fine sandy loam or the silt loam of the meadows is good, but on the whole the former is the better.

The crop of greatest value in the aggregate produced in the area is tobacco. The most reliable unofficial estimate available places the acreage of this crop, within the 1,325 square miles of the two surveys in the season of 1903, at about 15,000 acres. This figure includes practically all of the tobacco grown in the region. The average acreage per farm is about 15 acres, but there is a range of from 1 to 105 acres.

The earlier report devoted considerable space to the discussion of the status of the tobacco business in the region at that time, but there has been a large development along new lines since that date.

The general distribution of the acreage of tobacco in the original survey has been stated in the 1899 report. In the present survey the crop is most extensively grown in the vicinity of Avon and Granby on the west side, and of Ellington on the east side, of the main valley in

Connecticut. In Massachusetts the largest areas of the crop are in the towns of Westfield, Hadley, Hatfield, and Whately. Small fields are scattered throughout the valley part of the survey, and especially on the Connecticut Meadows.

The leaf produced is a wrapper type, and three varieties are grown—the old Connecticut "seed leaf," which now occupies only a small acreage, the Havana, and the Sumatra, which last was introduced in the Connecticut Valley in 1900. The bulk of the crop is grown in the open field, but in 1900 the form of cloth tent in use in Florida was introduced into the Connecticut Valley, and during the present season was used on a total area of between 700 and 800 acres.

The yield per acre in the open field ranges on the different types of soil from 1,500 to 2,000 pounds, and under tent from 1,100 to 1,400 pounds. Originally only Sumatra seed was grown under tent, but during the last two seasons Havana has also been tried with success.

Fertilizers are always heavily applied—1½ tons per acre, and under tent this amount is greatly increased to insure a strong, rapid, and regular growth. The bulk method of fermentation has been introduced, and seems destined to supersede the old system of case fermentation, where there is practically no way to control the process of curing. The new method gives far more satisfactory results.

The tobacco industry is growing, and is now more substantial than ever before. The curing barns are mainly new and well built, and some of very large size have recently been constructed. There is still plenty of soil suitable for the extension of the industry.

Transportation facilities are entirely by rail above Hartford, Conn., and the area is well served. Only a part of the highlands is remote from shipping stations. A number of railroads traverse the region in various directions and have direct terminals in all the large Eastern cities. Electric car lines reach all of the important towns, and these do some freight and express business.

All the largest cities of western Massachusetts and a number of important ones in Connecticut are located in the valley. Beginning at the north the larger ones are Greenfield, Northampton, Holyoke, Westfield, Springfield, Hartford, and Rockville. In addition, a great number of villages and towns of importance form an almost unbroken succession throughout the valley. The region is the center of population of the western two-thirds of the States traversed. This large number of cities and villages within the area afford a very good home market for all kinds of agricultural products, while the railroads place the large cities of the coast within easy reach.

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