SOIL SURVEY OF ONTARIO COUNTY, NEW YORK

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DESCRIPTION OF THE AREA.

Ontario County is located centrally in Western New York. It contains 656 square miles, or 419,840 acres of land surface, and about 22.5 square miles, or 14,400 acres of water surface.

The county is irregular in shape, though most of its boundaries are right lines. The main body of the county is bounded on the east

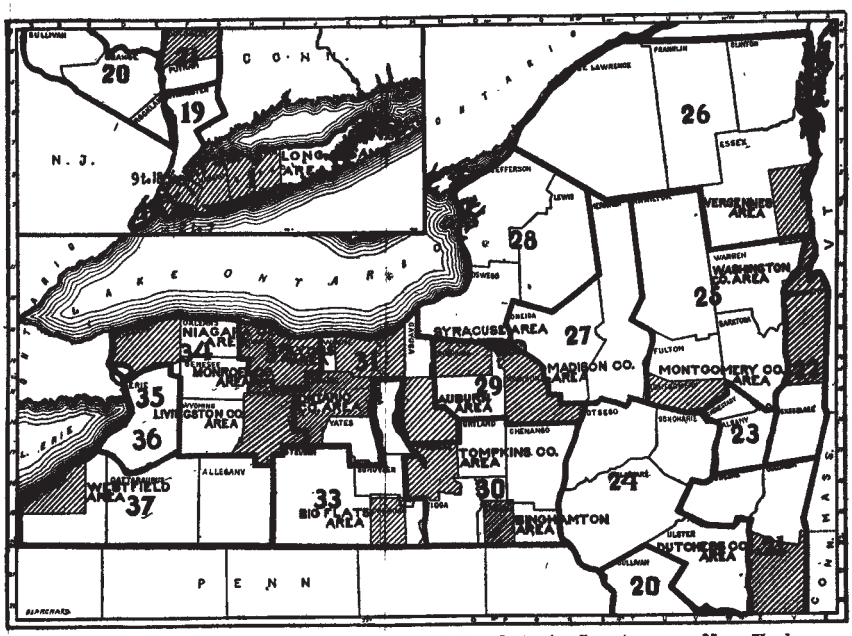

FIG. 2.—Sketch map showing location of the Ontario County area, New York.

by Seneca County and Lake Seneca. A southern projection of the western side is bounded on the east by Canandaigua Lake and Yates County. Yates and Steuben Counties and Springwater Township, of Livingston County, bound it on the south. Livingston and Monroe Counties and Hemlock Lake bound it on the west, and Monroe and Wayne Counties on the north.

The surface features of Ontario County are varied, the northern and southern portions being totally different in topography. The whole northern portion consists of a comparatively low-lying region, while the southern part consists of a high, hilly country.

The topography of the northern parts of Farmington, Manchester, and Phelps and northeastern Victor Townships, in the northern region, consists of many low rounded hills, known as drumlins, with intervening valleys and gravel plains. These drumlins are usually elongated, with the longer axis in a north and south direction. They vary in height above the valleys and plains from 5, 10, or 15 feet to about 100 feet, the valleys being from 400 to 600 feet above tide level, and 150 to 350 feet higher than Lake Ontario. In western Victor, northwestern East Bloomfield, and northern West Bloomfield Townships the topography is marked by a series of hills of an entirely different character than those of the drumlin type. These hills are of the glacial form known as kame moraines. They are irregular in outline, elevation, and character of the materials of which they are composed. In elevation they vary up to about 1,000 feet above sea. In this section and surrounding many of these hills are water-formed and wave-washed plains at various altitudes.

Throughout the remainder of the northern part of the county the physiographic forms are not striking or peculiar in character. This region is characterized by a rolling to slightly hilly upland, which becomes gradually more elevated toward the south. This upland region is made up of five parts, separated either by lake waters or northward-flowing streams. It is distinguished and separated from the kame-hill region only by the difference in topography. The drumlin-hill region is, however, separated from it by Black Brook, and from Manchester eastward by the Canandaigua Outlet. These two streams here flow in an old glacial stream channel, which also extends west and northwest to the northeastern corner of the county, dividing the kame-hill region into two separate parts.

In the region southwest of Canandaigua and south of East Bloomfield, and in another small section west of Honeoye, there occurs a series of hills lying between the low northern and high southern upland regions of the county. These hills are of the drumlin type in form, not unlike those along the northern edge of the county, though they occur at a considerably higher elevation, being banked against and upon the northern limits of the high-hill region at an altitude of from 900 to 1,700 feet above sea. These are the highest hills of the drumlin type within the State.

The southern portion of that part of the county lying west of Canandaigua Lake consists of a high-hill region greatly carved by preglacial erosive agencies. The hills of this region have for the most part rather flat tops and steeply sloping sides, the intervening

valleys being comparatively narrow. Four of these narrow valleys are in part occupied by long, narrow "finger lakes." Two of these finger lakes, Canadice and Honeoye, lie entirely within Ontario County, while the other two, Hemlock and Canandaigua, form wholly or in part natural boundary lines for the county. The larger of these lakes, Canandaigua, is the lowest in elevation, its surface being only 686 feet above sea level. The smallest, Canadice, is the highest, its surface being 1,092 feet above tidewater. The other two, Honeoye and Hemlock, are 800 and 896 feet above sea, respectively. Two similar valleys, whose northern ends are identified with Ontario County, occur to the east of those occupied by these lakes. One is occupied by Seneca Lake, at an elevation of 444 feet, and the other is occupied by a swamp along Flint Creek south of Gorham. The floor of the latter valley, which is a level swampy area, has an elevation of about 875 feet. Originally this swamp was undoubtedly a finger lake similar to but probably of less depth than most of the existing lakes in the other narrow valleys. Some of the valleys of this region have been more or less filled by glacial débris.

The range in elevation of the different parts of Ontario County is considerable, being about 1,850 feet. The highest point within the county, Gannett Hill, is located in the high-hill region just west of Bristol Springs. Its height above sea level is 2,256 feet. The lowest point, slightly above 400 feet, is in the northwestern corner of the county.

The drainage of Ontario County, with the exception of about one square mile, belongs to the Finger Lakes-Great Lakes-St. Lawrence system. The area excepted lies in the southeastern corner of Naples Township, and its waters finally reach the sea by way of the Chesapeake Bay.

The Finger Lakes-Great Lakes-St. Lawrence drainage system in Ontario County consists of three parts. The western portion of the county lies in the basins of Hemlock, Canadice, and Honeoye Lakes, and is drained by Honeoye Creek, the outlet of Honeoye Lake and a tributary of the Genesee River. A considerable portion of the central and southern parts of the county lie in the basin of Canandaigua Lake and is drained by its outlet, the Canandaigua Outlet. The eastern edge of the county lies in the basin of Seneca Lake and is drained by its outlet. The waters of all three of these drainage basins reach Lake Ontario and the St. Lawrence River, but by somewhat different routes.

The drainage of the entire northern edge of the county has no direct connection with the finger lakes. Neither has that of two interlake regions. However, the waters from these regions eventually reach Lake Ontario, as does that of the finger lakes.

Permanent settlements were made in 1787 in what is now Ontario County, and only two years later, January 27, 1789, a county organization was authorized by an act of the State legislature. The settlement had been so rapid that at the time of the erection of the county the population amounted to about 1,000, though it must be borne in mind that the territory inclosed within the county as it was then formed now consists of 14 counties, many of them much larger than Ontario County as it exists to-day. Prior to the erection of Ontario County, the territory embraced by it had successively been a part of Albany, Tryon, and Montgomery Counties.

The first Federal census, taken in 1790, a year after the county was organized, showed a population of 205 families—1,081 persons. Ten years later the census showed a population of 15,218, or a gain of some 1,500 per cent, even though Steuben County with a large area had been set off as a separate county in 1796. By 1810 the population of the county had increased to 42,032, though its area had been materially reduced by the formation of Genesee County. During the next decade, 1810 to 1820, no change in the area of the county was made, and its population increased to 88,267. However, in 1821 its size was reduced by the organization of both Livingston and Monroe Counties, and again in 1823 by the organization of Yates and Wayne Counties. By this last change in 1823 Ontario County assumed its present size and shape. The formation of these four counties from the territory of Ontario during the same census decade, however, had the effect of reducing its population in 1830 to less than half that of 1820, or to 40,167. In 1840 the population had increased to 46,020, and from that time to the present there have been no great changes, though from 1850 to 1870 it was considerably less. However, since then each census shows a larger population, with the exception of those of 1890 and 1892, when there was a slight decline. The present population (1910) is 52,286, or slightly less than it was in 1905.

However, a study of the census figures of the county shows that in recent years the increase in total population has been about equaled by the increase in population of the city of Geneva, to say nothing of the same ratio of increase in the population of some of the incorporated villages. This goes to show that the increase in population of Geneva and the incorporated villages has been at the expense of the rural districts, and that the agricultural population of the county has been slowly decreasing. A further analysis of the population statistics shows that certain townships whose soils are predominatingly of a certain character have decreased in population much more than other townships whose soils are predominatingly of a different character. Thus the changes in rural population in the different parts of the county bear a direct relation to the type and character of the soils and consequently to the prevailing system and character of agriculture.

The original settlers of the county were mainly from New England, though many came from Maryland, Virginia, Pennsylvania, and eastern New York, as well as some from England, Scotland, and Ireland. The present population, especially in the rural districts, is composed largely of descendants of the pioneers. There is, however, in the cities and villages a considerable foreign element, and many native-born Americans from other parts of the country.

The chief centers of population are the city of Geneva, with a population of 12,446, and Canandaigua, with a population of 7,217. Other villages, named in order of their size, are: Clifton Springs, Phelps, Naples, Shortsville, Victor, Manchester, Gorham, and East Bloomfield. All of these villages, except Naples and Gorham, are located in the northern part of the county.

Prior to 1825 all of the produce of the county had to be hauled by wagon to market. The completion that year of the Erie Canal just to the north of the county furnished a better and cheaper means of transportation, although for only a part of the year. After this no improvement in transportation facilities was made until 1841, when a railroad, now the Auburn branch of the New York Central system, was opened from Geneva to Rochester. The Pennsylvania Division and the Batavia and Canandaigua Branch of the New York Central lines and the Northern Central of the Pennsylvania system were built later. No trunk-line transportation was afforded until 1891, when the Lehigh Valley Railroad Co. completed their main line across the county from Buffalo to New York, and railroad facilities were not available in the southern part of the county until the Lehigh Valley finished its branch line from Geneva to Naples in 1894. In recent years additional service has been supplied by the Rochester and Eastern Electric Line between Rochester, Canandaigua, and Geneva.

Seneca Lake has connection with the Erie Canal at Geneva, and water transportation is available on both Seneca and Canandaigua Lakes during the season of navigation.

The county roads are in fair condition. Many of the main roads have been improved by macadamizing, and such work is being extended yearly in different parts of the county.

Ontario County is usually well supplied with easily accessible markets. Syracuse and Rochester are about equidistant to the east and west, while Buffalo is only a little farther away. There is direct communication with all three of these near-by markets. More distant markets for Ontario County products are New York, Boston, Philadelphia, Baltimore, Washington, and the coal-mining towns of eastern Pennsylvania, to which there is also means of direct transportation. Besides these outside markets the two centers of population of the county, Geneva and Canandaigua, are excellent local markets.

CLIMATE.

The climatic conditions prevailing over the region in which Ontario County is located are similar to those of all western New York. There is a wide range between the extremes in temperature of summer and winter. The normal monthly temperature at Shortsville ranges from 21.8° F. for February to 70.2° F. for July, a difference of 48.4° F. The annual normal is 47° F.

The precipitation has varied from 25.38 inches for the driest year to 32.92 inches for the wettest year. This precipitation is well distributed throughout the different seasons, being 6.57 inches in winter, 7.14 in spring, 10.81 in summer, and 6.74 in fall. Thus the greatest amount occurs during the growing season, and the least during the harvest and winter months. Heavy snowfalls occur during the winter, though occasionally it is light and an "open winter" occurs.

Monthly and annual temperature at Shortsville.

Month.	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	Mean.
	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.
January	26.8	25.2	22.9	25.2	18.7	18.8	31.6	24.6	25.0	28.2	24.7
February	23.2	16.7	21.4	28.3	17.0	18.3	24.9	19.1	21.0	28.6	21.8
March	24.2	31.3	38.7	42.1	30.4	32.3	26	37.8	34.8	30.2	32.8
April	46.8	45.7	46.0	45.2	40.2	43.2	45.2	39.2	44.2	43.8	44.0
May	57.2	55.6	55.0	59.4	59.0	55.8	55.6	50.2	58.6	54.8	56.1
June	67.2	67.0	62.2	61.6	66.1	64.6	66.4	63.2	67.1	65.8	65.5
July	71.6	74.0	69.6	69.0	68.2	70.4	69.1	69.4	71.1	68.4	70.2
August	73.6	69.0	65.6	64.2	66.4	67.1	71.5	66.6	67.2	67.9	68.0
September	65.8	62.7	62.7	63.2	60.1	62.1	66.2	63.4	65.8	61.5	63.4
October	58.8	51.1	50.8	51.8	47.8	51.8	49.8	46.8	53.2	47.1	51.5
November	40.5	33.7	46.4	35.7	36.7	36.6	37.2	37.7	40.4	45.0	38.4
December	28.7	26.8	25.2	23.1	22.5	31.3	25.8	31.2	29.4	25.2	27.3
Year	48.7	46.6	47.2	47.4	44.4	46.0	47.5	45.8	48.2	47.2	47.0

Monthly and annual precipitation at Shortsville.

Month.	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	Mean.
	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
January	2.75	1.31	1.40	2.12	4.21	1.85	1.16	2.15	1.32	1.82	2.01
February	3.02	1.31	1.35	1.89	2.11	1.16	0.58	0.67	1.39	2.34	2.60
March	4.39	1.26	1.98	3.83	1.82	1.31	.....	1.10	1.79	1.93	2.16
April	1.07	4.96	2.35	2.29	2.62	2.04	.....	2.63	2.59	2.61	2.31
May	1.67	3.56	2.66	0.29	3.50	2.15	4.11	2.30	3.34	3.15	2.67
June	1.18	2.65	4.36	5.19	2.95	6.18	4.87	2.49	3.96	2.32	3.82
July	3.42	4.62	6.20	2.59	5.57	4.14	4.08	2.64	5.24	3.45	4.20
August	2.05	5.60	1.86	5.29	1.79	2.88	2.93	0.99	2.14	2.39	2.79
September	1.74	2.35	1.66	1.77	4.09	0.77	3.00	3.40	0.79	2.06	2.16
October	3.14	1.11	2.22	3.37	1.80	3.83	4.59	4.07	2.13	1.58	2.74
November	4.38	1.87	1.05	1.18	0.40	1.10	2.14	2.88	1.19	0.77	1.84
December	0.90	2.44	3.10	1.20	2.06	2.19	2.33	2.16	0.68	0.96	1.96
Year	29.71	33.04	30.19	31.01	32.92	29.60	.....	27.48	26.56	25.38	31.26

Dates of first and last killing frosts at Shortsville.

Year.	Last in spring.	First in fall.	Year.	Last in spring.	First in fall.	Year.	Last in spring.	First in fall.
1900.....	May 11	Oct. 19	1904.....	Apr. 22	Oct. 7	1908.....	May 5	Oct. 20
1901.....	Apr. 20	Oct. 18	1905.....	May 2	Oct. 26	1909.....	May 2	Oct. 21
1902.....	May 4	Oct. 10	1906.....	May 11	Oct. 11			
1903.....	May 31	Oct. 27	1907.....	May 22	Oct. 21	Average...	May 7	Oct. 18

The average length of the growing season, the period between the last severe frost in spring and the first in fall, is 163 days, or from May 7 to October 18. The shortest growing season in the past 10 years was in 1903 and consisted of 148 days, being 15 days shorter than the average. The longest season occurred in 1901 and consisted of 181 days. The latest frost in spring occurred on May 31, 1903, while the earliest in fall was on October 7, 1904.

The above statements are based upon the records of observations made at Shortsville, which lies at an altitude of 740 feet above sea level. No records are available for any other point within the county, but there are doubtless variations due to difference in elevation, to proximity to bodies of water, and other variable local conditions.

AGRICULTURE.

From the first settlement the foremost industry of Ontario County has been agriculture. The early settlers were workers, not adventurers. They at once cleared the land and planted crops. From this beginning the agriculture steadily developed on a conservative and progressive basis. The present agriculture consists chiefly of the production of grain, potatoes, fruits, and nursery stock, with minor interests in the production of hay, hops, beans, cabbage, etc. Dairying and sheep raising are also carried on to some extent and form an important item in the annual income derived from the soil. Approximately 200,000 acres, or one-half the area of the county, was in cultivated fields or mowing lands in 1899. A little over one-half of this was occupied by small grain crops, and over one-third by forage crops, the remainder under cultivation being devoted to root and miscellaneous crops.

One of the first crops grown was wheat, and this has continued to be an important crop. By 1840, or 50 years after the harvesting of the first crop, the production of wheat amounted to 655,799 bushels, and 10 years later it was nearly a million bushels. In 1855, however, the advent of the wheat weevil caused the production to decline about 40 per cent, and in 1860 to nearly 50 per cent of the maximum. By 1870, however, the ravages of the weevil were ended and the produc-

tion had regained its former level, which it has since maintained, except for fluctuations due to seasonal variations. The production in 1899 amounted to 858,700 bushels on an acreage of 44,434 acres, or a yield of more than 19 bushels per acre.

Oats, potatoes, corn, and barley early became important crops. The census of 1840 places the production of oats at over a half million bushels. In 1850 the production declined about 100,000 bushels, but from that time to the present each census year shows a greater production than the preceding one, until the Twelfth Census, 1900, which places the production at 1,193,320 bushels, or slightly more than 36 bushels per acre for the area planted. Potato production in 1840 amounted to 395,844 bushels, but fell off in 1850 to less than a quarter of a million bushels. However, since then the total production has been much greater. In 1879 it amounted to 1,264,092 bushels, and the average acreage yield was 114 bushels. Ten years later, or in 1889, the production was only about half as much and the acreage yield also decreased by about 50 per cent, but in 1899 the aggregate yield was greater than ever, being 1,274,242 bushels, harvested from 15,307 acres, with the average yield per acre of about 88 bushels. Corn has always been one of the principal crops of the county. Its maximum production was reached in 1879, when 1,022,226 bushels were grown, yielding 45 bushels per acre. The production since that time has been slightly less than 750,000 bushels and the yield per acre has also been lower, being only 31½ bushels in 1899.

Barley began to be one of the principal crops of Ontario County soil early in the last century. Its yield in 1840 and 1900 was about equal, the former amounting to 384,615 bushels and the latter to 330,640 bushels. The largest crop of barley recorded was grown in 1889 and amounted to 676,476 bushels, with a yield per acre of 29 bushels. The acreage for 1899 was 11,789, much less than at the beginning of this decade. Buckwheat and rye each occupied an area of less than 2,000 acres in 1899. Hops were introduced some time prior to 1840, as the census of that year shows a production of 14,523 pounds. This crop, however, did not become of any considerable importance until 1860, the census then reporting 108,264 pounds. The development of the hop industry was rapid from that time on, and the height of the industry was reached in 1879, when 807,538 pounds were produced. Since that time hop raising has declined, the production in 1899 being 596,600 pounds. Interest in the growing of hops is still waning, though considerable quantities are produced in the vicinity of Bristol Center.

The utilization of the soils of the steep hillsides bordering Canandaigua Lake, particularly at the head of the lake in the vicinity of Naples, for the production of grapes has long been an important

industry. The first grape vine, an Isabella, set out at Naples, was brought from Dutchess County about 75 years ago. The importance of this industry is attested by the fact that the total value of the crop for the season of 1899 amounted to $136,829. This is no small sum, especially when it is considered that for the most part the crop is grown on soils and fields that are almost valueless for other farm purposes, except perhaps for a small amount of pasturage.

In the production of fruit Ontario County is prominent. The census for 1900 gives the number of fruit trees of bearing age as nearly 750,000, divided as follows: Apples, 419,483; peaches, 98,013; plums, 92,917; pears, 85,347; cherries, 25,259; and apricots, 8,646. These gave a yield of 1,036,621 bushels of fruit, valued at nearly $500,000. In addition to this, small fruits were produced to the value of nearly $100,000. The importance of Ontario County as a fruit-producing county is shown by the fact that for the year 1899 the total value of all fruits, tree, small, and vine, and the allied industry, nursery stock, amounted to $960,396, or approximately one-fifth of the income from all products of the soil.

Most of the early settlers brought some sheep and cattle with them, but, although in the aggregate many cattle are kept, the region has never been of importance as a dairy section. There were more cows kept during the first half century of the county's development than at any later period. Since 1840 the number has gradually diminished as other forms of farm industry have displaced dairying, the number of cattle during the last 25 years being less than half what it was in 1840. On the contrary, Ontario County has been one of the leading counties of the State in the number of sheep kept, and consequently in the production of wool. As early as 1840 there were 159,650 head of sheep, producing 365,553 pounds of wool. Although the number of sheep has since that time gradually decreased, the production of wool has become greater, showing that better wool-bearing strains of sheep are kept. The maximum production of wool, 676,547 pounds, was obtained in 1880. The number of sheep for the same year was only 102,944. Considerable portions of the townships of Bristol, South Bristol, Richmond, Canadice, and Naples are especially suited to this form of animal husbandry, and much more wool and mutton could be produced than is now produced.

Some idea of the present condition and development of the agriculture of the country is shown by the fact that the value of farm products not fed to live stock for the year 1899 amounted to $5,206,447, or a gross income of 22 per cent on the valuation of the land with improvements and buildings, implements, machinery, and live stock. If the cost of labor and fertilizers, which amounted to $919,200, is deducted from this income there is still an income of

18 per cent on the investment. This income amounts to $10.50 for every acre included in farms, and to $13.44 for every acre classed as improved.

Of the 417,280 acres of land within the county, 405,003 acres, or 97 per cent, is in farms (Twelfth Census, 1900). Of the area classed as farms, only 318,948 acres, or 78.8 per cent, was classed as improved. This improved farm land constitutes 76.4 per cent of the total area of the county, or approximately 3 acres out of every 4.

The adaptation of soils to crops has been quite widely recognized. Soils in the northern part of the county are well adapted to wheat, and this crop is still growing in competition with the western wheat-growing sections of the country. Formerly wheat was produced on the hill soils of the southern part of the county, but these soils not being well suited to the crop, it was abandoned after the opening up of the western lands. It is also recognized that certain soils, within the influence of the lakes, are well suited to the production of grapes, and that apples and other fruits are grown with much greater certainty of success in certain sections and on some types of soil than on others. In recent years the soils best adapted to alfalfa have been determined, and the practical uselessness of attempting the culture of this crop on any but these soils learned by experience.

It remains for the agricultural experimenter or the farmer to work out these questions of adaptation still further by adapting the soil not only to the class of products to which it is best suited, but also to those particular varieties of the several products which will give the greater returns for the labor and money expended. The need of this is especially pressing in the case of perennial crops, or those which require a number of years to mature. Suggestions along this line are made subsequently in this report.

While the farmers in general have recognized the limitations placed upon them by the soil and climatic condition of the region, there are many who pay little or no attention to this important matter, continuing to grow, often at a loss, on the soils which they may possess the crops which experience has long ago shown had better be omitted from the rotations on such types of soil under the conditions, economic or climatic, at present existing.

In line with the better recognition of the adaptation of soils to crops is the question of proper rotations. On many farms in the county crop rotation is practiced systematically and profitably. This is particularly true over that portion of the county outside of the high-hill section; in the high-hill section the reverse is true. The use of some soils for perennial crops, such as grapes, alfalfa, fruit trees, and nursery stock, interferes with the practice of any regular system of rotation on fields utilized for such agricultural products, but wherever practicable rotations should be used. In this work

the farmer must bear in mind that the question of the adaptation of soils to the different crops and even to the different varieties of crops limits the crops to be introduced and the length of the rotations on any particular soil. The drainage conditions, the markets, the transportation facilities, and the personality of the farmer are also factors which must be considered.

A general system of rotation now in use is as follows: Corn, beans, or potatoes, first year; oats or beans, second year; wheat with seeding to timothy and clover, third year; mixed clover and timothy, fourth year. Some farmers mow the fields two or three years and some use them for pasture for a year or more, but many plow down the clover sod directly for the cultivated crop, and permanent sods are rather the exception throughout the northern portion of the county, except along some of the streams and on fields which are difficult to use for the higher forms of agriculture.

Rotations for the various groups of soils occurring in Ontario County might be as suggested in the following paragraphs, though it must be remembered that these rotations are general and would not be suitable for all systems of farming. The specific rotation for each farm must be worked out by the individual to fit his soils and conditions and his system of farming.

The Volusia silt loam of the high-hill country in the southern part of the county is well adapted to late Irish potatoes. This crop may well be grown in connection with stock raising, including sheep and beef cattle. A considerable proportion of the area occupied by these soils is in forest and permanent pasture. The land under cultivation should be divided into three or four fields, and a rotation as follows established: First year, potatoes, with some succulent crop for sheep feed, such as rutabaga, turnips, cabbage or rape, and sowed corn for rough forage if stock feeding is to be practiced; second year, seeding to timothy and clover (alsike clover if difficulty is experienced in securing stands of the red clovers), with oats or oats and Canada field peas as a nurse crop. The peas are an excellent addition to the oats as a grain for feeding, the pea vines add to the value of the straw for feeding purposes and by their use another legume is added in the rotation; third year, clover and timothy; this scheme may be extended to a fourth-year rotation by leaving the sod for hay another year. A four-year rotation can also be made by growing buckwheat the first year, care being taken to return the straw to the field to be plowed under for the potato crop. This is desirable because it adds a second money crop to the rotation.

In the case of either the three or four course rotation, provision should be made for the removal of either the buckwheat or potato crop early enough to put in a cover crop, rye for turning under green or the setting aside of a season for green manuring.

For the Volusia loam and gravelly loam and the Caneadea gravelly loam, a three or four course rotation is desirable, and here the question of such a large percentage of permanent pasture does not enter. On these soils the three-year rotation may be: Corn and potatoes, one year; oats or oats and peas with seeding to clover and timothy, one year; and hay one year. This could be made into a four-year rotation by either giving up the entire field to corn the first year and to potatoes the second year, or by mowing or pasturing the sod one year longer. However, in no case should the fields remain in grass either for hay or for pasturage until the sod is worn out, as it is important to have a strong sod to turn under for the intertilled crops. The suggestions as to green manuring and cover crops given for the Volusia silt loam are also applicable to these soils.

For the Caneadea silt loam the same rotations are suggested, except that the intertilled crop should be corn either for ensilage or for grain, and wheat may or may not be introduced in the place of oats.

The Dunkirk soils vary widely in texture, and they may be divided into three classes in respect to crop rotations, those types of a heavy texture forming the first class, those of an intermediate texture the second, and those of a light texture the third.

For the first class or heavier soils of this series the rotation may be corn for ensilage or grain one year, oats one year, wheat with seeding to clover, alsike or red, and timothy one year, and hay one, two, or three years. This rotation could be shortened one year by omitting the oat crop. For the intermediate textured soils of the series the range of crop adaptation is wider, and more latitude in the choice of crops and rotations is possible. The rotation for these soils might be corn or potatoes, one year; beans, one year; oats, barley, or oats and peas, one year; wheat with seeding to red clover and timothy, mixed hay, one or two years. On farms having these soils if pasture is needed the second year in sod could be devoted to that purpose. This rotation could be shortened one year by omitting the beans, or lengthened by seeding to alfalfa and leaving that sod for several years. The lighter soils of the series are adapted to special crops, which often interferes with the establishment of a regular rotation, though the following is suited to these soils: Early potatoes or corn, one year; beans or special crops, one year; wheat or oats with seeding to red clover and timothy, one year; and hay, one year only.

The rotations for the miscellaneous soils of the county will vary according to the character of the soil, though those suggested for the different soils above will generally be suitable.

The agricultural practices employed throughout the northern part of the county are as a rule good. The small amount of stable manure is saved and returned to the soil. Clover sods are plowed down

rather than allowed to run out before breaking for the intertilled crops. Good care and cultivation is usually given the crops. Orchards are generally well pruned and cultivated, besides being sprayed for both fungus and insect pests. All this is reflected in good fields, fine orchards, well-kept farm buildings, adequate for the systems of farming in vogue, and a general air of prosperity.

In the high-hill region of the southern section of the county, however, the methods are not what they should be. In many cases attempts are made to grow crops for which the soil is not adapted, the systematic rotation of crops is not practiced, tillage methods are poor and inefficient, sods are left until they no longer produce, and fields are often left to grow up to briars, goldenrod, and other weeds. These conditions constitute the so-called " abandoned farms." That such conditions can be improved is shown by the fact that similar soils are producing fair crops when properly tilled and managed and where crops are grown to which the soils are adapted.

Farm labor conditions are fairly satisfactory, though the supply of efficient help is not equal to the demand. The scarcity of manufacturing establishments within the county works to the advantage of the farm employer, though much of the labor goes to the near-by cities, where steady employment is offered. Much labor is employed in the handling of the soils of the county. The last figures available (Twelfth Census) show that nearly $1,000,000 is expended annually for this purpose.

In 1900 there were 4,328 farms within the county, with an average size of 101½ acres. This gives one farm to each 11½ inhabitants. There was an increase of 1,156 farms in the 40 years preceding, and a decrease of 17½ acres in the average size of the farms, and a decrease in the ratio of population to the number of farms of 2⅛ Of the total number of farms in the county in 1900, 2,604, or 60.2 per cent, were operated by the owners; 461, or 10.6 per cent, by part owners; 36, or 0.8 per cent, by owners and tenants; and 946, or 21.9 per cent, by share tenants.

Farm-land values vary greatly in different parts of the county and with the differences in soils. In the northern section where the soils are prevailingly good and the methods and practices of the higher type, the average value is considerably greater than in the high-hill section of the county where the soil and other conditions are less favorable to agriculture. In the former section values vary from about $75 to $100 or more an acre; in the latter section much land can be purchased at $5 to $10 an acre. This range in acreage value for farm land bears a close relation to differences in soil, but is influenced also by topography, elevation, and access to shipping points and markets.

The following table, giving the valuation of farm land and buildings for each census year since 1850, shows the maximum valuation to have been in 1870:

Value of farm land with buildings in Ontario County, N. Y., 1850 to 1900.

Year.	Valuation.	Acreage value.	Year.	Valuation.	Acreage value.
1850	$15,066,953	$41.26	1880	$28,125,215	$47.31
1860	18,644,329	49.08	1890	24,382,000	63.51
1870	31,471,539	78.42	1900	20,661,050	51.01

The improvement of the agriculture of Ontario County requires the consideration of many things. The income may be increased by the further extension of the tilled area of the average farm. Much may also be gained by better drainage of some of the soils, by the planting of crops better adapted to the soils, and by better methods in tillage and fertilization.

The use of farm and commercial fertilizers needs careful study and experimentation. The use of lime is important. On some of the soils liming is absolutely essential for success in the production of legumes. On other soils, while the use of lime is not a necessity, its judicious use would be beneficial. As a rule, the soils needing lime are more or less deficient in humus. Such soils would be greatly benefited by the liberal use of organic manures, such as stable manure, the straw from the grain crops, and green crops plowed under. The restoration of organic matter will be assisted greatly by the keeping of more stock, thus avoiding the sale of forage.

SOILS.

The soils of Ontario County are diversified. They are derived from a great variety of materials, which have been changed to soils by various processes. They range in texture from heavy clays to light gravels and sands, and vary in color from deep browns and blacks to light grays and yellows. They vary in topography from nearly level plains to steep and rugged hills and in elevation from comparatively low altitudes to almost mountainous heights. They vary just as widely in their crop adaptation and in their agricultural condition.

These soils are divided according to the origin of materials and processes of formation into four groups—ice-laid, water-laid, residual, and cumulose. According to their color, topography, drainage, and character of materials, they are divided into six soil series and a group of miscellaneous soils. According to texture, they have been divided into 30 different soil types, each of which is shown by a distinct color on the accompanying map.

Nine of these types belong in the Dunkirk series, which is of considerable extent, covering a large part of the Ontario plain and

extending southward to meet the high-hill soils of the Allegheny Plateau. They also extend down the Mohawk Valley to the east and along Lake Erie forelands to the west. They are brown to reddish-brown in color and have been formed by lacustrine action upon glacial materials. With the exception of a small amount of limestone, the underlying rock formations have contributed but little material to the soils. In the section of the county occupied by these soils preglacial erosion has reduced the county to a plain of low relief, and owing to this and the character of the agencies acting in their formation the topography is comparatively smooth and there is little waste land. Many of the types are made up of outwash materials and have been formed by the action of flowing water. Others are clearly quiet-water deposits, and others evidently consist of the glacial till mantle reworked by water. Of the Dunkirk soils, the loam, fine sandy loam, clay, silty clay loam, fine sand, gravelly sandy loam, and gravelly loam, are the most extensive. The other types are of small areal extent.

The Volusia[1] soils occupy the high hill region of the southern part of the county. They are of wide extent, covering large areas in New York, Pennsylvania, and Ohio. They are light in color, grays, yellows, and browns being the predominant colors. Their range in texture in Ontario County is from a heavy silt loam to a shale loam with two types of intermediate texture, the loam and gravelly loam. Altogether these soils cover a considerable area in the county, the loam and silt loam being of quite wide extent.

In topography the Volusia soils are rugged and hilly, though locally their surface is such that all kinds of farm machinery can be used. They are derived from the feeble glaciation of the dissected Allegheny Plateau; feeble glaciation in that the mantle of till is thin and composed almost entirely of local materials derived from the underlying Devonian shales and sandstones. The weathering of these rocks in place has contributed partly to the soil formation, especially in case of the silt loam.

The narrow stream bottoms and basinlike depressions are occupied by recent alluvium. The soils derived from this material vary from a fine shale loam, where small, thin shale chips have been washed out from the country shale rock, to a silty clay loam. Between these two extremes is found the loam and silt loam types. These soils are gray and olive to dark in color and belong in the Genesee series, which occupies first bottoms throughout western New York, northern Pennsylvania, and a portion of northeastern Ohio.

Along the northern edge of the county occurs a group of soils closely related to the Dunkirk series—the Ontario series. They are brown to reddish brown in color and are derived entirely from the

[1] See Bulletin 60, Bureau of Soils, "A Preliminary Report on the Volusia Soils, their Problems and Management."

weathered and otherwise modified till of drumlins and moraines. The topography varies from rather flat elevated areas to steep eroded hillsides and elongated or oval-shaped drumlin hills. Four types are represented by this series—the gravelly loam, the gravelly sandy loam, the fine sandy loam, and the loam.

In the region surrounding Naples there occur two types of soil, a gravelly loam and a silt loam, which have been formed by deposition in a former high-level lake. These soils are of light-colored materials and of an entirely different character from the Dunkirk soils of similar formation. They are the Caneadea soils, which were formed at an earlier period than the Dunkirk soils.

A few small areas occupying depressions where there has been an accumulation of organic matter in the surface belong in the Clyde series, a series associated with the Dunkirk, but having poor natural drainage, which has been a factor in their formation. This series is of small extent. Two types, the fine sand and silt loam, were recognized and mapped.

Scattered over the county are several soil types which do not belong in any of the above series. These local types in their aggregate area are of considerable extent. One of these, the Livingston silty clay loam, is of residual material modified by glacio-lacustrine influences. Along the course of the Canandaigua Outlet are three local soil types—the Allis silt loam, the Farmington loam, and the Honeoye stony loam. Their occurrence is due to the removal of the glacial debris by glacial streams, and later weathering.

Muck represents an accumulation of the remains of plant life in low, poorly drained positions.

Below is given a table stating the actual and relative extent of each soil type, as shown in the accompanying soil map:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Ontario loam	88,384	21.0	Ontario gravelly loam	4,992	1.2
Volusia loam	51,008	12.1	Caneadea silt loam	3,968	.9
Volusia silt loam	34,496	8.2	Volusia gravelly loam	3,584	.9
Dunkirk silty clay loam	32,640	7.8	Genesee silty clay loam	3,328	.8
Ontario fine sandy loam	27,968	6.7	Honeoye stony loam	2,880	.7
Dunkirk gravelly loam	26,240	5.2	Genesee shale loam	2,304	.5
Genesee loam	24,192	5.8	Farmington loam	2,240	.5
Dunkirk clay	22,656	5.4	Genesee silt loam	2,240	.5
Dunkirk fine sand	17,856	4.2	Dunkirk sandy loam	2,048	.5
Volusia shale loam	17,088	4.1	Ontario gravelly sandy loam	1,664	.5
Dunkirk fine sandy loam	9,856	2.3	Dunkirk silt loam	1,216	.3
Muck	9,664	2.3	Clyde fine sand	1,152	.3
Dunkirk gravelly sandy loam	6,528	1.6	Allis silt loam	384	.1
Dunkirk loam	6,528	1.6	Clyde silt loam	192	.1
Caneadea gravelly loam	6,336	1.5			
Livingston silty clay loam	6,208	1.5	Total	419,840	

DUNKIRK GRAVELLY SANDY LOAM.

The soil of the Dunkirk gravelly sandy loam, to a depth of about 9 inches, is a light and loose sandy loam, having a light-brown to medium brown color. The subsoil, extending to depths greater than the 3-foot section, is of the same general character as the soil, though usually lighter in color and texture.

The sand content is variable, but generally of the intermediate grades. The content of fine rounded gravel is usually high. Taken altogether this soil type is extremely variable, as small beds of sand and gravel, and even areas of heavy material often occur within it. Cultivation is easy and safe under a wide range in moisture conditions.

No large areas of the Dunkirk gravelly sandy loam are found, though in the aggregate it covers a considerable extent of territory. It occurs scattered more or less throughout the entire northern and eastern portions of the county.

The type has a somewhat rough topography, which, together with its light and loose texture and structure, gives it efficient and at times excessive drainage.

In origin the Dunkirk gravelly sandy loam is derived from glacial materials left by the ice principally in the form of kame moraines, and subsequently more or less modified by wave action and the deposition of material from glacial lake waters.

The Dunkirk gravelly sandy loam is adapted to the production of early potatoes, beans, corn, clover, and alfalfa. Potatoes yield from 100 to 200 bushels, beans from 10 to 25 bushels, and corn from 50 to 75 bushels per acre. Newly seeded clover yields about a ton of excellent hay to the acre, and alfalfa gives three cuttings annually, varying from 1 ton to 1½ tons each, or 3 to 4½ tons an acre.

A considerable proportion of this type is too rough and uneven to be well suited for the production of intertilled crops. Such areas could well be planted to alfalfa, while those too rough and uneven for this purpose should be reforested. Cultivated fields of the type should be so managed and cropped as to increase the supply of organic matter, giving the soil greater power to conserve the moisture supply and also improving its tilth.

The condition of agriculture on the Dunkirk gravelly sandy loam is only fair. Improved areas are valued at $60 to $75 an acre, and the less improved areas at about $50 an acre.

DUNKIRK GRAVELLY LOAM.

The soil of the Dunkirk gravelly loam consists of a rich brown gravelly loam, with a depth of from 6 to 10 inches. The subsoil, to a depth of 36 inches, is a gravelly loam of the same character as the surface soil, though lighter brown in color and apparently lighter in

texture, as there is not the binding effect of much organic matter. Below this there is usually a deep subsoil of interbedded and stratified fine and coarse gravels and sands of various grades. This deep subsoil may or may not be found within the 3-foot soil section. Both soil and subsoil contain a varying but usually large percentage of medium to small rounded gravel and some cobbles. Much of this gravel content is of limestone, though a considerable proportion is of rocks occurring farther to the north and foreign to the locality. Owing to its open structure this soil is easily cultivated under a wide range of moisture conditions.

The Dunkirk gravelly loam is found most extensively developed through the drumlin region along the northern edge of the county. Here it occupies level to undulating plains or terraces having an elevation above sea level of 500 to 600 feet. In other parts of the county small areas of this soil occur which also have a terrace topography. The natural drainage of the type is for the most part good, and artificial drainage is needed only on level areas where the deep subsoil of gravels and sands is absent.

The Dunkirk gravelly loam has been formed largely from material extraneous to the county and brought in by the glacial ice, laid down, and subsequently modified by wave movements and deposition from glacial lakes or glacial streams.

The Dunkirk gravelly loam is one of the best corn soils of the county. It is also well adapted to potatoes, beans, cabbage, oats, wheat, alfalfa, and clover, as well as the grasses. Yields are generally good. They will range as follows: Corn, 75 to 125 bushels; potatoes, 100 to 250 bushels of excellent quality; beans, 12 to 25 bushels; cabbage, 10 to 18 tons; oats, 40 to 70 bushels; wheat, 20 to 35 bushels an acre. Alfalfa gives three cuttings, averaging 1½ tons each, or an average annual yield of 4½ tons an acre. Clover or clover and timothy of good sod will yield from 1 to 3 tons of excellent hay.

The condition of the farms of this soil is good. There is evidence of prosperity, as the farm buildings are adequate for the system of farming practiced and are generally well painted, and the surroundings are neat and well cared for. The price of land of this type averages about $75 an acre with improvements.

DUNKIRK SANDY LOAM.

The surface soil of the Dunkirk sandy loam consists of about 8 inches of loamy brown sand. The sand content is composed largely of rounded, medium-sized grains. The subsoil from 8 to 36 inches is a light-brown medium sand, somewhat lighter in texture than the surface. There are no stones present and practically no gravel, even of the finer grades. The type is easily cultivated and can be worked under quite a wide range of moisture conditions.

Only a small extent of this soil is found. It occurs mostly as stream and delta deposits west of Shortsville and southeast of Phelps. Other small areas are found elsewhere in the county, some of them in kame formations.

The Dunkirk sandy loam is best adapted to corn, potatoes, beans, clover, and alfalfa. Corn should yield from 40 to 75 bushels; potatoes, 100 to 250 bushels; beans, 10 to 20 bushels; and clover hay, 1 to 2 tons to the acre. Alfalfa should give an average of 3 to 4½ tons each season, three cuttings being secured.

The agricultural conditions of this type are only fair to good. Land values for the type range from $4 to $75 an acre.

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

Mechanical analyses of Dunkirk sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
25099	Soil	0.6	6.2	34.6	22.0	6.1	18.0	12.5
25100	Subsoil	.0	3.1	47.5	29.6	5.1	7.5	7.1

DUNKIRK FINE SAND.

The surface soil of the Dunkirk fine sand consists of a brown fine sand, varying in depth from 6 to 12 inches. Underneath this the subsoil to depths greater than 3 feet is a light-brown to yellow fine sand. There is no appreciable percentage of the coarser grades of sand and no gravel present in either the surface soil or subsoil. The whole section has a rather loose and open structure, which, with its light texture, admits of easy cultivation. In fact, in small local areas the texture and structure are such that when unprotected by a sod the surface material is readily moved by wind action.

The Dunkirk fine sand is developed largely as a delta deposit from glacial streams north of the city of Geneva, and as wave-washed plains and water-modified kame materials in western Victor Township. Other areas are scattered about through the northern portion of the county associated with the same series of soils.

The topography of the type consists of level to undulating plains and rough uneven hills. As a rule the natural drainage is good. In the hilly region it is rather excessive, while in some of the more level and lower-lying areas it is rather deficient. This soil type is derived from glacial materials assorted and deposited from flowing waters or of glacial materials modified by subsequent lacustrine agencies.

The original forest growth of the Dunkirk fine sand consisted of both pine and hardwoods. Some of the area occupied by it has a natural growth of brakes, ferns, and briers. Forested areas have an undergrowth of brush of various kinds.

The texture, structure, and drainage of the Dunkirk fine sand is such that it is an early, warm soil, and consequently well suited to early truck crops, such as early cabbage, radishes, lettuce, tomatoes, the vine crops, cantaloupes, cucumbers, strawberries, etc. Late potatoes are quite generally grown, though the soil is better suited for early potato production. An average yield of potatoes is about 200 bushels per acre. Cucumbers for pickling are grown, giving an average yield of some 600 bushels per acre. The type is particularly suited to this crop, as the vines can be forced to rapid growth and give fruits of excellent quality. Peaches, cherries, and berries of various kinds are also grown to a considerable extent. Oats, corn, and wheat are the staple crops. Oats yield 40 bushels; corn, 50 to 75 bushels; and wheat, 15 to 25 bushels per acre. Though not especially adapted to the grasses, clover and alfalfa do well on the Dunkirk fine sand, the former giving an average yield of from 1 to 2 tons, and the latter about 3 tons per acre annually.

In improving this soil more organic matter should be supplied, either by the application of barnyard manure or by use of green manuring crops. In this connection a clover sod should always be turned down before it runs out. Increasing the organic content would increase the power of the soil to conserve and deliver moisture to the growing crops.

The methods and agricultural conditions prevailing over areas of the Dunkirk fine sand are good, though susceptible to considerable improvement. Land values for farms of this soil range, according to cultivation, location, and improvements, from $40 to $75 an acre.

DUNKIRK FINE SANDY LOAM.

The Dunkirk fine sandy loam consists of a surface soil of brown to light-brown fine sandy loam about 8 or 10 inches deep. The subsoil is usually a light-brown or sometimes yellowish fine sandy loam, in places grading into a gravelly sandy loam, the gravel being small and rounded. Some water-worn gravel is also present in the soil in some localities. Though sometimes rather compact, the subsoil usually contains enough sand and gravel to give fine underdrainage. A good tilth can in most cases be secured and the type can be cultivated under quite a range of moisture conditions, as the soil seldom clods or puddles.

The type is confined to the northern part of the county and occurs principally in the valley of Canandaigua Outlet and in the vicinity of the Victor kames. Small areas are also found in West Bloomfield

Township. Outside of the region of the Victor kames the topography of the type is generally undulating to nearly level. In the kames of the Victor and Junius regions the surface is rougher and more irregular. In these situations some erosion has taken place on the hillsides, but for the most part the slope is not too steep for cultivation.

The Dunkirk fine sandy loam is derived from glacial material left by the ice sheet as till and kame moraine and subsequently modified by the wave action and deposition of glacial lakes.

The greater portion of the type has been cleared and is under cultivation, though some of the rougher hillsides of the kame phase are occupied by second-growth timber, largely oak. The more level and gently undulating areas of the type are excellent farming lands and produce high yields of the general farm crops. Such areas offer good opportunities for the development of some of the special crops. Corn yields from 50 to 150 bushels of ears per acre, together with several tons of fodder; oats produce from 30 to 60 bushels; and hay from 1 to 2½ tons. Alfalfa has yielded well where tried. Among the special crops potatoes yield 100 to 200 bushels, and are quite largely grown upon the more level areas in the Victor hills section of the county. Apples do well in favorable locations upon this soil type.

Well-tilled farms and good farm buildings evidence the prosperity of the farmers upon this soil type.

DUNKIRK LOAM.

The soil of the Dunkirk loam consists of a brown loam with a depth of about 10 inches. It is often quite sandy, approaching a fine sandy loam in texture, and is usually friable and easy to cultivate. Occasionally, however, the sand content is smaller and there is danger of clodding and puddling, if care is not exercised in cultivation. The subsoil is a loam, light brown to brown or yellowish in color. As a rule the subsoil is somewhat variable. Layers and lenses of heavy and light soil materials occur arranged in no regular order, though usually it becomes heavier with increase in depth, and as a whole the texture is a sticky loam.

Both soil and subsoil contain a varying percentage of rounded stones and gravel, together with some angular rock fragments. This stone content never interferes with tillage and is characterized by a predominance of limestone. The cultivation of the type is nearly always attended with good results.

The Dunkirk loam is an important agricultural type, but is of small extent, being principally confined to the valley of the Canandaigua Outlet in Manchester and Phelps Townships. It is characterized by gently undulating to nearly level surface. While the slope

is usually sufficient to give adequate surface drainage, the comparatively impervious character of the subsoil makes artificial drainage essential for the best results.

The material of which the Dunkirk loam is formed is largely of foreign origin, having been brought from the north through the agency of glacial ice. It is a rather heterogeneous material, as the ice moved over many different geological formations. The material derived from these formations was deposited by the ice upon its retreat. Following its deposition, however, it was covered by the waters of the melting ice and was more or less reworked. The final subsidence of these glacial waters exposed the materials to weathering, which has formed the type of soil as it now exists.

The original forest growth on this type consisted largely of black walnut and red oak, with some white pine. Bluegrass is the principal native grass at present.

The Dunkirk loam is one of the best types of the area for general farming purposes. It produces from 20 to 40 bushels of wheat and 40 to 60 bushels of oats per acre. The yield of corn runs as high as 100 or more bushels of ears per acre, with several tons of stover. Clover and clover and timothy give excellent yields, and when the land is well drained alfalfa is found to be well adapted to it. Cabbages yield from 10 to 20 tons per acre, and fruit, especially apples, does well where good drainage can be secured.

The farm improvements on Dunkirk loam rank among the best in the county, and land values are high, ranging from $60 to $100 an acre according to improvements.

DUNKIRK SILT LOAM.

The soil of the Dunkirk silt loam is a light-brown to gray silt loam about 6 inches deep. The subsoil, from 6 to 36 inches, consists of a heavy silt loam to clay loam or clay of a brown or yellowish-brown color. The surface is mellow when not too wet, but the subsoil is compact and has a dense, close structure. Though easy of cultivation with an optimum moisture content, it can not be cultivated satisfactorily if a slight excess of moisture is present. It then clods and bakes badly.

The Dunkirk silt loam is of small extent in the county, being found mainly in the northwestern part, with some small areas just north of South Bloomfield. The type has a level to rolling surface, and on account of its particular texture and structure is naturally poorly drained. It represents some of the finest of the sediments laid down in glacial lakes.

The Dunkirk silt loam is best used in the production of corn, oats, wheat, and hay.

DUNKIRK SILTY CLAY LOAM.

The surface soil of the Dunkirk silty clay loam consists of a brown to dark-brown heavy loam to silty clay loam, with a depth of about 8 inches. This is underlain by a subsoil of dense, plastic clay or silty clay, brown to reddish-brown in color. In a typical section the subsoil extends to depths of 3 feet or more, but there are areas where this material is less than 3 feet deep, the unassorted glacial till underlying it being found within 2 to 3 feet of the surface. The surface is quite free from stone and the clay subsoil almost entirely so. While a good tilth may be secured and maintained, it requires a large expenditure of labor to do so, especially if plowing is not done when there is a favorable moisture content. When too wet it clods and puddles and on drying bakes and sun cracks quite badly.

The Dunkirk silty clay loam occurs extensively in and around the city of Geneva, and north and northwest of Canandaigua. Smaller areas are found in the northwestern part of the county. In addition, there are numerous small areas throughout the northern half of the county.

The drainage of the Dunkirk silty clay loam is comparatively poor. The fine texture and close structure of both soil and subsoil prevent free internal circulation of water, and a nearly level surface retards the run-off. These features are somewhat modified by the stony glacial till composing the deeper subsoil. However, practically all of the area occupied by this soil type is in need of artificial drainage.

The topography of this soil is uniform. For the most part it consists of undulating plains, broken here and there by small stream courses. The method by which the materials were deposited explains this topography. The surface materials represent fine sediments laid down in the various bodies of impounded waters which existed during the different stages of the retreat of the glacial ice. They are quite largely foreign to the immediate locality.

The forest growth formerly found on the Dunkirk silty clay loam was the same as that which existed on the clay, and consisted chiefly of oaks. The Kentucky and Canadian bluegrass are indigenous to the soil and constitute the principal grass in the pasture sods.

The Dunkirk silty clay loam is an excellent soil for wheat, oats, alfalfa hay, pasture, some of the tree fruits, and fairly well suited to corn and beans. It is most generally used for general farming and dairying, for which it is very well adapted. Good sod lands of clover and timothy give from 1 to 2½ tons of hay of good quality. Wheat is extensively grown and gives yields varying from 20 to 35 bushels an acre. It is especially adapted to oat production, yielding from 40 to 75 bushels an acre. Where well drained, excellent

crops of corn are secured, yielding 8 to 15 tons of ensilage and 50 to 100 bushels of grain per acre. This soil seems to be a natural alfalfa soil and no serious difficulty is experienced with it where drainage is favorable. This always gives three crops, aggregating from 3 to 5 tons an acre. Certain varieties of apples also do well on properly drained areas. The type is also well suited to pears. Beans are grown to some extent and give fair yields. It is not a desirable soil for potatoes.

The conditions prevailing over the Dunkirk silty clay loam are, as a rule, only fair, and are capable of considerable improvement. The value of the type varies greatly according to location. In and near Geneva it is held at prices which have no relation to its agricultural value. Away from this influence a fair valuation is from $60 to $80 an acre with improvements.

The following table shows the results of mechanical analyses of samples of the soil and subsoil of the Dunkirk silty clay loam:

Mechanical analyses of Dunkirk silty clay loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
25105		0.1	0.8	1.0	7.8	11.7	57.7	20.8
25106		.0	.9	2.0	12.1	14.6	47.8	22.4

DUNKIRK CLAY.

The surface soil of the Dunkirk clay to a depth of about 7 inches consists of a brown to reddish-brown clay. The subsoil to 36 inches and more in depth is a dense, plastic, reddish-brown to light chocolate-colored clay. Below the surface a few inches the whole section is more dense and close in structure. Below the zone of cultivation there are horizontal bedding or stratification planes and vertical joint planes. The cultivation of this soil is difficult, and it can only be handled satisfactorily within a very narrow range of moisture content. If it is but a little too wet plowing forms large clods that can not be pulverized by any amount of later cultivation. If it is only a little too dry plowing forms clods just as difficult to reduce as those in the wet soil. The surface bakes and sun-cracks badly during drought. However, if the tillage operations are performed when the soil is in proper condition a satisfactory tilth can be secured.

The Dunkirk clay is most largely developed north and northeast of Canandaigua, north of East Bloomfield, and in the Honeoye Creek and Gates Creek valleys. Smaller areas are found in other sections of the county.

The Dunkirk clay has a comparatively uniform topography. It is level to gently rolling, often with steep bluffs along stream courses. It has an elevation varying from about 700 feet above see level north and northeast of Canandaigua to 800 to 900 feet in the Honeoye and Gates Creeks region. Although this soil represents lake-bed deposits, it now occupies comparatively high terraces or second bottoms. This topography has been developed by erosion. The natural drainage of this soil is poorer than that of any other soil of similar extent and position in the county. Owing to the fine texture and dense structure the internal movement of water is slow and with the nearly level topography there is comparatively little run-off. Evaporation is the chief factor in removing excess water. Drainage is poor, even near the steep bluffs along streams. Artificial drainage is therefore needed over the entire area of the Dunkirk clay. In installing this the drains should not be placed too far apart or too deep. While the underdrainage of this soil would be expensive, the tillage of such wet lands entails a much greater loss. Such drains properly laid are effective for many years, and the expense apportioned over this time amounts to only an insignificant sum for any one season, while drainage frequently makes all the difference between crop failure and crop success.

The Dunkirk clay has been formed by the weathering of the heaviest of the glacial-lake sediments of the whole region. These sediments were deposited in the deepest portions of the imponded waters held over this section of the State by the retreating glacier. They were derived from the glacial débris brought southward by the ice. Subsequent erosion has also played its part in the development of the type as it now exists. This type has a high lime content, especially in the subsoil.

The native forest growth of the Dunkirk clay was largely elm and white oak, with some beech and maple. Natural sods now consist principally of Canada and Kentucky bluegrass.

The Dunkirk clay is well adapted for pasture, hay, grain, and, where drainage is good, for alfalfa. It is not generally considered suitable for corn or potatoes, though the former is grown and often gives good yields. Good sods of clover and timothy give yields varying from 1 to 2 tons per acre; wheat, about 20 to 25 bushels; oats, 30 to 60 bushels; and corn 30 to 75 bushels. Cabbage is sometimes grown and yields from 7 to 14 tons per acre. A few farmers grow kidney beans, which yield from 10 to 20 bushels. Potatoes seldom yield more than 100 bushels per acre, with an average much less. A number of successful alfalfa fields are found on this soil type, giving three cuttings annually, which total from 3 to 4 tons per acre.

Agricultural conditions on the Dunkirk clay are only fair. Houses and other farm buildings are not genrally well cared for and the fields show lack of care. Better drainage is the first requisite in improving the type. This would enable better tillage. Then by the use of those crops adapted to a heavy soil, farming should become much more profitable.

The value of farms of the Dunkirk clay varies from $30 to $60 an acre.

The table below gives the results of mechanical analyses of samples of both soil and subsoil of the Dunkirk clay.

Mechanical analyses of Dunkirk clay.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
25103	Soil	0.0	1.1	1.2	2.6	2.1	55.5	37.5
25104	Subsoil	.0	.3	.3	1.0	1.3	49.0	48.0

The following sample contained more than one-half of 1 per cent calcium carbonate ($CaCO_3$): No. 25104, 8.34 per cent.

VOLUSIA GRAVELLY LOAM.

The soil of the Volusia gravelly loam consists of a light-brown loam to a depth of about 6 or 8 inches. It is more or less completely filled with gravel, both angular and rounded, which is in part local rock and in part foreign, the angular fragments being of local shale and fine-grained sandstone and the rounded stone for the most part of rock material foreign to the region. The subsoil is of a lighter and more yellow color and extends, usually, to depths greater than 3 feet. Like the surface soil, it is a light loam and carries a large percentage of gravel of various sizes and shapes and of mixed rock material. This soil is open and well drained and easy to cultivate. It is an early soil and can also be worked under a wide range of moisture conditions.

The Volusia gravelly loam is found only in the southern townships on the western side of the country. All areas of the type are comparatively small and irregular in shape and occurrence. The topography varies from gently rolling to hummocky and steep. Natural drainage conditions are good.

This soil type has been formed by the deposition of gravelly morains and local wash of light-colored materials of comparatively local origin. The native forest covering consisted largely of chestnut, white pine, and oak.

The Volusia gravelly loam is the lightest and earliest soil of this series. It is consequently better suited to corn and other crops which require a moderately long season for maturity. It is probably best suited to oats, potatoes, and hay, and, where the altitude is not too

great, to corn. Potatoes is one of the most profitable crops. They yield from 100 to 250 bushels per acre, with an average of about 150 bushels. Oats will yield from 30 to 40 bushels and hay from 1 to 2 tons per acre. Clover usually does well, though it is beginning to fail on farms where much cropping has been done.

This soil type is in need of more organic matter, which may be supplied by plowing under rye, or buckwheat, if stable manure is not to be had. It would also be of benefit to the soil to sow field peas with the oats and to establish a three-course rotation of potatoes, oats, and peas, with a seeding to clover and hay, mowing only one year.

The agricultural conditions prevailing over areas of the Volusia gravelly loam are only poor to fair. The value of farms of this soil ranges from $20 to $25 an acre with improvements.

VOLUSIA LOAM.

The surface soil of the Volusia loam consists of a dull-brown mellow loam to silty loam, with a depth of about 10 inches. The subsoil is composed of a compact gray loam of rather heavy texture. Both soil and subsoil contain a varying but usually large percentage of angular flat small and large fragments of argillaceous and arenaceous shale. There is also often a considerable quantity of rounded glacial stones and gravel present, as well as occasional large glacial bowlders. Areas which are not well farmed are lighter colored. In many places the stone content is excessive. But for this the whole type is easily tilled.

The Volusia loam occurs in rather extensive areas and in the aggregate forms one of the principal soils of the county. A large area is found east of Canandaigua Lake in Gorham Township. Extensive areas are also found next to the high hills west of Canandaigua and Honeoye Lakes, while scattered areas are found throughout the extreme southern and southwestern parts of the county. The topography is rolling to hilly, the type having an elevation ranging from about 900 to 2,000 feet above sea level. In the region occupied by the type southwest of Canandaigua there occur drumlin-shaped hills somewhat similar to the drumlins along the northern edge of the county, but of an entirely different character of soil material.

The natural surface drainage of this soil type is good, but internal drainage is only fair. Underdrainage of the greater part of the type is needed.

The Volusia loam is derived from the weathering of a mantle of glacial till of greater or less depth. The materials of which this till are composed are largely from the local country rock, moved by the ice only a short distance. There is, however, evidence of the admixture of some glacial material of more remote origin. This till mantle was deposited by the glacier as moraines.

The native forest growth, practically all of which has long ago been removed, was chiefly of oak, chestnut, and white pine. The present forests are second and third growth, principally of oak and chestnut. Much of the poorer and rougher portions of the type should be reforested, chestnut being probably the best tree for the purpose. Canada and Kentucky bluegrass are indigenous to this soil. The former predominates and the latter disappears entirely in poorer areas.

The Volusia loam is generally well farmed, especially in those areas of large extent occurring in Gorham, Canandaigua, Bristol, Richmond, and Canadice Townships. This soil is a potato soil. It is also adapted to the production of other general farm crops such as corn, where the altitude is not too great, oats, buckwheat, and hay. It is a good dairy farming, stock raising, and sheep raising type. In this kind of farming the type should be used for the production of the money crops and forage for winter feeding, its associate type, the silt loam, being used for grazing.

Probably the best money crop for the type is late Irish potatoes, which yield from 100 to 200 bushels per acre. Corn at the lower altitudes, either for the grain or ensilage, gives good results. The yields are from 50 to 100 bushels of ears, while from 8 to 15 tons of ensilage may be grown per acre. The type is much better adapted to oats than to wheat and gives yields varying from 25 to 50 bushels with a good seeding. Another money crop for which this soil is well suited and which can well be grown in any system of farming adapted to it is buckwheat. This crop will yield from 15 to 35 or 40 bushels and leaves the soil in excellent condition for other crops. Hay is an excellent crop for the Volusia loam. Seedings should be of timothy and red clover. If the crop is to be fed on the farm, this mixed hay or timothy and alsike clover are best, but if for sale timothy alone should be sown. Yields of hay range from 1 ton to 2½ tons per acre.

Dairy farming is quite generally practiced on the Volusia loam and is successful. This business and stock raising and the keeping of sheep could and should be materially increased. Where such systems of farming are now followed, the soil is in better condition and much better yields are secured. A good system of management for farms of this soil type would be some form of animal husbandry with late potatoes as the chief money crop and buckwheat as a secondary money crop.

The agricultural conditions in sections occupied by the Volusia loam are as a whole good. Much improvement could, however, be made. The indications are that there has been greater prosperity in the past than at present.

Land values vary with the location and improvements. Farms on back roads or in remote localities sell for $20 to $30 an acre, while those better situated are held at prices ranging from $40 to $60 an acre, according to the character of buildings and other improvements.

VOLUSIA SILT LOAM.

The surface soil of the Volusia silt loam consists of a pale yellow silt loam from 5 to 8 inches deep. The subsoil, to a depth of 36 inches, is a gray to light-yellow compact silt loam. This subsoil is sometimes mottled with brown, yellow, olive, and gray colors. Both soil and subsoil contain a variable but usually large quantity of stone, consisting largely of flat angular pieces of the country rock of shales and fine-grained sandstones. Where the stones are abundant or of a more sandy character, the soil is more friable and cultivation is attended with better results, though somewhat difficult in the more stony areas. On the other hand, where the stone content is less, the soil is more dense and compact and tillage is not so efficient, on account of the narrower range of moisture conditions under which it may safely be done.

Generally the soil material is greater than 3 feet in depth, though often the underlying rock formations are only thinly covered. The dense and compact structure prevents aeration and oxidation, and interferes with the movement of water. Consequently weathering is retarded.

The Volusia silt loam of Ontario County occurs only in the high hill portion of the southern part of the county, lying west of Canandaigua Lake. Here it is found capping the high hills occupying the highest elevations in the county. The most extensive areas are in Canadice, Richmond, Bristol, South Bristol, and Naples Townships. the areas occupy the dome-shaped hill tops of the region. They have the highest elevation in the county, varying from 1,000 to 1,200 feet to 2,256 feet above sea. The region in which this soil type occurs, with its wide range in elevation, is the roughest and most rugged in the county, though most areas of this soil are less rough than would be expected, lying as they do on the undissected parts of a high plateau. The fields are comparatively level and suited to the use of all kinds of farm machinery.

The type has good surface drainage, though many local areas of greater or less extent are very poorly drained, because of deficient internal drainage. The soil holds moisture tenaciously, and consequently underground moisture movements are slow, causing the entire soil section to be water-logged in many places. The soil is often in a puddled condition and when droughts occur it is in no condition to conserve moisture and crops suffer as much from a de-

ficiency as they previously did from an excess of water. Another feature of the natural drainage is the occurrence of springs on the hillsides, making local areas wet. Artificial drainage is therefore necessary over large areas of the type and would undoubtedly prove beneficial practically everywhere.

The Volusia silt loam has been formed by glacial action. The mantle of glacial till, or ground moraine, is generally shallow, though occasionally it extends to considerable depths. The materials of which it is composed are largely derived from the local rock, although there is an admixture of glacial material foreign to the immediate locality. In many areas the residual weathering of the underlying rock has contributed not a little to the soil section. This is particularly true of the subsoil of the less stony areas. Erosion has locally modified this glacial material and removed some portion of it.

A feature of this type is its apparent deficiency in organic matter. In those areas over which the poorer agricultural conditions obtain this important soil constituent is at a minimum. The systems of cropping have been such that the natural supply of organic matter has been slowly depleted. Until this condition is remedied no permanent improvement can be expected, even with the use of commercial fertilizers.

A considerable percentage of the area of the type is without doubt in an acid condition. When first cleared red clover and other leguminous crops were grown without difficulty, but in recent years they have failed to give satisfactory results. Redtop and other plants that thrive in acid soils do well. The land may easily be put in condition to grow clover by applying lime, which can be secured cheaply. This use of lime, 500 to 3,000 pounds to the acre, would correct the soil acidity.

When the region was settled the Volusia silt loam was cleared of a forest growth of chestnut, oak, white pine, beech, hard maple, and various other trees. There is at present but little, if any, of the virgin forest left, though many fields are occupied by an aftergrowth comprising, to a large extent, the same species. These forested areas are mostly confined to the rougher and less cutivable portions of the type.

Probably the crops to which the Volusia silt loam is best adapted are late Irish potatoes, oats, buckwheat, and timothy hay. The type is also well suited to dairying and stock and sheep raising. The main money crop should be potatoes. The quality of these is always good, and yields can be obtained which are comparatively larger than those of any other crops. Buckwheat should be the secondary crop, and to an extent timothy hay may be a third crop. The importance of this soil for these crops can not be too strongly emphasized.

Potatoes are extensively grown on this soil type elsewhere and yields are obtained ranging from 100 to 250 bushels per acre. Buckwheat should give a yield of 20 to 35 bushels per acre and leave the soil in a looser and better condition for succeeding crops. The oat crop is an important one, though wheat can not be successfully grown under present conditions. The former yields from 25 to 50 bushels per acre. Among the grasses timothy and redtop are the chief varieties. The yields vary widely, owing to the wide range in the age and condition of the sod. Over many fields the sod is so poor that it does not pay to mow. Newly seeded lands cut from 1 ton to 1½ tons per acre. This yield is far lower than it should be. Clover, as before stated, is rarely sown. If the soil were put into condition to grow this legume, the yields of hay could be materially increased and should average at least 1½ to 2 tons per acre. Canada bluegrass is common, while the Kentucky bluegrass is found where the soil is in better condition.

The farming methods and the condition of the farmers prevailing over nearly the entire area of the Volusia silt loam are poor. Buildings and fences are poor and loose systems of farming are prevalent. As a rule but little live stock is kept, and most of this is of an inferior grade. Many fields are unused, and many others are yielding only poor returns.

Animal husbandry of some form should be the foundation of all systems of farming for this soil. This, with the correction of the unfavorable drainage, chemical, and physical conditions of the soil, and the restoration of the organic content, coupled with good tillage, should and would be followed by better yields of those crops adapted to the soil.

The value of the Volusia silt loam is low. Many farms are for sale at prices varying from $5 to $25 or $30 an acre, according to the condition of the soil and its location with reference to shipping points. The lower priced farms are those where the poorer conditions prevail, and which usually lie at high altitudes and rather remote from shipping facilities over hilly roads. The higher priced ones have better improvements and are easier of access.

VOLUSIA SHALE LOAM.

The surface soil of the Volusia shale loam consists of from 4 to 6 inches of mottled brown light silty loam. There is nearly always present a variable but usually large percentage of flat, angular fragments of shale and fine-grained sandstone of local origin, with usually a small quantity of rounded stone and gravel of foreign glacial origin. The subsoil is a light-colored more or less compact loam of slightly heavier texture than the soil. The colors prevailing in the subsoil are gray, brown, and yellow. The subsoil contains a

high percentage of local rock material and less of foreign origin. The soil section is variable in depth, as the bedrock is nearly always found within 3 feet of the surface. Outcropping ledges of this rock occur in many places throughout the type. The physiographic position of this soil, together with its shallow depth, stony character, and the presence of the ledges make it difficult to cultivate.

The Volusia shale loam occurs only in the townships of Naples, Canadice, Richmond, South Bristol, and Bristol in the southern portion of that part of the county lying west of Canandaigua Lake, with one small area in Gorham Township along the east shore of Canandaigua Lake.

The Volusia shale loam occupies steep slopes and usually has excellent natural surface drainage, except where springs coming out along the bedding planes of the rock make some areas wet.

The material of which this soil type is composed is largely residual and colluvial from the underlying rock formations. All areas have been subject to glaciation, though comparatively little material foreign to the locality is present, there having been but little deposited by the glacial ice, or else it has been mostly removed by later erosive agencies. The country rock consists of comparatively soft shales and fine sandstones, the weathering of which has formed the largest part of the soil-forming material of the type.

The original forest growth was hemlock, white pine and various species of hardwoods. Practically none of the virgin forest remains, though a considerable proportion of the type is covered with a growth of timber, for the most part worthless, except for firewood. In the immediate vicinity of Naples and along Canandaigua Lake the Volusia shale loam is devoted to the production of grapes. It is well suited for this use as the tempering influence of the lake waters upon the climate usually prevents damage from frosts. The grapes grown are of excellent quality. Practically no other crop is secured from this type. It affords a scant amount of pasturage. Where the type is in vineyard the conditions of the farms are good, but most areas can be classed as wild land, either in forest or pastures.

The value of the Volusia shale loam depends upon its position with reference to lake influence, its development for the vineyard industry, and the value of the timber which it supports. Where developed as vineyard land it commands a high price, often several hundred dollars an acre.

GENESEE SHALE LOAM.

The soil of the Genesee shale loam, to a depth of about 8 inches, consists of a dark to light brown loam or silt loam more or less filled with small, thin shale fragments. These shale chips are irregular

in shape, flat, and of a grayish or olive color on the surface. Freshly broken they are generally black in color. The subsoil is a mottled heavy loam, more or less filled with shale fragments.

This soil type occurs in the valleys of the shale hill country and is of alluvial and colluvial origin. Its most frequent occurrence is as a delta formation, where streams come down from the hills. The largest areas are found along both sides of Mud Creek Valley north and south of Bristol Center. Drainage is usually good, owing to the open texture and structure of the soil.

The Genesee shale loam is adapted to the production of corn, oats, hay, and hops. Corn yields from 40 to 80 bushels; oats, 30 to 60 bushels; hay, from 1 to 3 tons; and hops, from 500 to 1,000 pounds per acre. In recent years alfalfa has been seeded on this soil and is doing well, giving annually three cuttings of from three-fourths of a ton to 1 ton each.

Crops and conditions on this soil type are good, though its remote location from shipping points and markets is a serious drawback. The selling price is not high, probably being around $30 to $50 an acre. It is usually held in conjunction with other soils.

GENESEE LOAM.

The soil of the Genesee loam consists of a gray to brown silty loam, from 6 to 12 inches deep, underlain to depths of 3 feet or more by a mottled gray, yellow, olive, and brown material of a silty loam texture. Lack of aeration and organic matter makes the subsoil appear heavier than the surface. Where adequately drained this type is mellow, friable, and easily tilled. No stones or gravel interfere with tillage.

The Genesee loam occurs in all parts of the county along the streams. It usually occupies first bottoms, though a few small areas occur in basinlike depressions of the upland. In either case areas of this soil type are liable to be inundated, and consequently natural drainage is rather poor.

This soil type is derived from the higher lying soils of the region, the wash from the hillsides being deposited by the streams upon their flood plains. The formation of the type is in process at the present time.

The native forest growth consists of various species of hardwoods of which elm and maple probably predominate.

The Genesee loam is peculiarly adapted for permanent pasture. The grasses start early in the spring, and a good supply of moisture keeps them green and succulent during the entire season. Where not subject to too frequent overflow the type is well suited to corn, cabbage, oats, wheat, and hay. The type is also well adapted to the

production of canning and truck crops, such as tomatoes, sugar corn, peas, string beans, etc. Yields are as follows: Corn, 50 to 100 bushels of ears; cabbage, 12 to 15 tons; oats, 40 to 60 bushels; wheat, 15 to 30 bushels; and hay, 1 to 3 tons per acre. Canning and truck crops also yield well.

The agricultural condition of the Genesee loam depends directly upon the drainage conditions. Where well drained the type is cleared and well cultivated, but where poorly drained it is usually in brush and timber. Values range according to the above conditions, from $25 to $75 an acre.

GENESEE SILT LOAM.

The Genesee silt loam consists of a silt loam surface soil, 10 to 12 inches in depth. In color it is brown or dark brown. The subsoil is a mottled light-brown silt loam. Often in the subsoil there is a noticeable percentage of very fine sand. Gravel and stone are lacking in both the soil and subsoil. The surface soil is usually well supplied with organic matter. The type is mellow and easily cultivated, though drainage conditions sometimes interfere with its utilization.

The Genesee silt loam is or limited extent. A long, narrow area is found along Mud Creek west of Bristol Center, and another in the southeastern corner of Canadice Township. It occupies a low, first bottom position, and consequently has a good and sometimes excessive supply of moisture. It owes its origin and formation to these features, as each overflow adds fine sediments to the surface.

The Genesee silt loam is adapted to hay and pasturage, corn, and canning crops. Good yields of corn and hay are usually secured, and also excellent pasturage.

Below are given the results of mechanical analyses of samples of both soil and subsoil of the Genesee silt loam:

Mechanical analyses of Genesee silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
25110	Soil	0.0	0.3	0.3	5.5	14.2	65.4	15.2
25111	Subsoil	.0	.0	.1	.4	.5	43.5	55.5

GENESEE SILTY CLAY LOAM.

The soil of the Genesee silty clay loam consists of about 6 to 10 inches of a heavy brown or grayish-brown silty clay loam. The subsoil is a plastic, heavy clay or silty clay, mottled brown, yellow, gray and olive, and extends usually to considerable depths. While this soil is rather heavy it is not difficult to till if properly drained,

though the range of moisture conditions favorable for its handling is narrow. The natural drainage is poor and underdrainage is necessary. This improvement has been made on some areas, and the first crop after drainage showed clearly the benefit derived.

The Genesee silty clay loam occurs, as does the Genesee loam, in first bottoms and in basinlike depressions in nearly all parts of the county. It always occupies a relatively low-lying position and as a rule receives the drainage from the surrounding soils. Occurring as it does in such close relation to other soils it owes its origin to the alluvial wash from higher-lying areas, and is of recent and even present formation.

The original forest growth consisted of elms, soft maple, and other deciduous trees and a luxuriant growth of swamp grasses. It is adapted, where adequately drained, to corn, oats, hay, and pasture, of which it gives excellent yields. Its value depends mainly upon the drainage conditions, which in many areas can be improved at a small cost.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Genesee silty clay loam:

Mechanical analyses of Genesee silty clay loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
25112	Soil	0.0	0.1	0.3	6.0	14.0	62.8	16.9
25113	Subsoil	.0	.2	.9	2.6	0.7	54.7	41.0

ONTARIO GRAVELLY LOAM.

The soil of the Ontario gravelly loam is a brown gravelly loam, ranging from 6 to 10 inches in depth, underlain by a subsoil of much the same character but lighter in color and extending to a depth of 36 inches. Both soil and subsoil contain a varying but usually large quantity of gravel, for the most part limestone, mixed with some of foreign origin brought in by the glaciers. The soil is usually easily cultivated, and the presence of the gravel renders it well drained where the surface run-off is sufficient.

The type is developed principally in the northern part of the county above an elevation of 600 feet. A few small scattered areas are found in the valleys occupied by Canandaigua and Honeoye Lakes.

The topography ranges from gently undulating in the northern part of the county to rolling and sometimes fairly steep along the walls of the valleys of the finger lakes. A small proportion of the type is also found occupying flat-topped terraces.

The type is derived through weathering of glacial till material, some of which may have been modified by subsequent lacustrine action.

Where the surface is roughest the type is somewhat restricted in its use for farming, but the larger proportion of it constitutes some of the best agricultural land of the county. The crops grown and the yields secured are about the same as on the Dunkirk gravelly loam. It is an especially valuable corn soil, producing from 75 to 125 bushels of ears per acre, and is also well adapted to potatoes, beans, cabbages, and fruit. Grass does well on the type, both clover and timothy and alfalfa.

The farmers on the type are prosperous, the buildings are good, and the farm practices are up to date. The price of land of this type is about the same as for the Dunkirk loam, averaging around $75 an ache with improvements.

ONTARIO GRAVELLY SANDY LOAM.

The soil of the Ontario gravelly sandy loam, to a depth of 10 inches, consists of a brown to yellowish-gray fine sandy loam to loam containing a large percentage of rounded and angular gravel and stones. The subsoil is of the same character as the soil, though lighter in color and often more gravelly. But for the high gravel content and rough surface of some areas the type is easy to cultivate.

The Ontario gravelly sandy loam is of small extent and found only in the northwestern corner of the county. It often has a rough, broken topography. The natural surface drainage is good. The type consists of glacial material left in the form of kame moraine, which has probably been subjected to little or no subsequent modification by glacial lakes. It differs from the subsoil of the Dunkirk gravelly loam not only in the mode of formation but also in the absence of the characteristic stratified underlying beds of gravel and soil.

The Ontario gravelly sandy loam where the topography is favorable for cultivation is suited to corn, oats, wheat, potatoes, clover, alfalfa, and timothy. With good care and attention these crops yield satisfactorily. There is, however, a considerable proportion of the type which is rather too steep and broken for the cultivated crops. Such areas should be reserved for forestry purposes.

ONTARIO FINE SANDY LOAM.

The Ontario fine sandy loam is one of the most important soils of the county, both in areal extent and in agricultural importance. The surface soil consists of a brown fine sandy loam with a depth of 8 to 10 inches. The subsoil is a light-brown to yellowish-brown fine

sandy loam, usually somewhat lighter than the surface soil in texture. This character of subsoil extends to about 36 inches, where the material becomes more compact and heavier in texture. Both soil and subsoil contain a varying but usually considerable percentage of angular and rounded stones and gravel, the type often tending toward a gravelly sandy loam. This soil can be easily worked under a considerable range of moisture conditions. Clodding is seldom troublesome, and a seed bed of excellent tilth can be prepared without an undue expenditure of time and labor.

The Ontario fine sandy loam occurs most extensively in Ontario County in the region around Halls Corners, Gorham, Stanley, Seneca Castle, and Orleans. It is the prevailing soil type in eastern Gorham, southwestern Phelps, and Seneca Townships. The areas have a gently rolling to undulating topography, seldom unfavorable to cultivation. In elevation they range from about 600 to 1,100 feet above sea level, though no abrupt changes in altitude occur.

The natural drainage of this soil is fair, though underdrainage is often of considerable benefit. Much land has been improved with tile drains, resulting in increases in the crops. The soil is capable of maintaining a favorable moisture content. The sandy subsoil, together with the more compact and heavy deep subsoil which prevents the rapid percolation of water to great depth, makes an excellent reservoir for the storage of moisture within the range of capillary action. This fact accounts, at least in a measure, for the excellent agricultural conditions prevailing over practically the entire area occupied by the type.

The Ontario fine sandy loam owes its origin to the weathering of sandy glacial till, which is probably mainly of local origin, but some of which has been moved considerable distances. The local material is for the most part from the Onondaga limestone which outcrops just south of the Canandaigua Outlet.

The original forest growth of oak and other hardwoods has long since been removed and the land given up to cultivation. Small tracts are still uncleared, however, furnishing firewood from a comparatively recent growth of forest trees, mostly hardwoods.

The Ontario fine sandy loam is adapted to a wide range of general farm crops and to a number of special crops. The growing of nursery stock on this soil has proved successful, the trees being thrifty, of good shape, and hardy. A considerable part of the nursery industry is conducted on the type.

Fruit growing, especially apples, is well suited to this soil type. Many large orchards of excellent appearance are found. These orchards consist largely of Baldwins, are well cared for, and give excellent yields. This industry is being extended, as it well may be.

The Ontario fine sandy loam is a natural alfalfa soil. Failure to grow it upon well-drained fields can be attributed to some factor other than the soil. Many excellent fields are found yielding from 3 to 5 tons an acre of hay from the three cuttings, with a fourth cutting possible in many seasons.

Of the general farm crops adapted to the Ontario fine sandy loam, wheat, oats, corn, potatoes, beans, and clover do especially well. The altitude is favorable to the maturing of corn crops, and the light texture and the structure of the soil are especially suited to its growth. Yields range from 100 to 150 bushels of ears of grain per acre and a good tonnage of stover. The soil is also particularly adapted to the growing of winter wheat. Large and satisfactory yields are obtained, varying from 25 to 40 bushels an acre. This soil has been utilized for wheat production from the time of its clearing and settlement and shows no diminution in yield. In fact, the yields in recent years have been larger than formerly. The development of wheat production in other sections of the country has had no effect on the growing of wheat upon this or equally good wheat soils here. Like wheat, oats do well on this type, giving a yield of from 50 to 70 bushels an acre. Potatoes also give excellent yields, ranging from 100 to 200 bushels an acre. Beans in the rotation yield from 20 to 30 and 35 bushels an acre. As is to be expected of a good alfalfa soil in this section of the country, this soil is well suited to red clover and the grasses. No difficulty is experienced in clover production, the yield of clover and mixed clover and timothy probably average 2 tons per acre for the first crop, and there is usually an aftergrowth of from three-fourths of a ton to 1 ton per acre, which is sometimes cut, but more often allowed to remain on the land. This, with the clover sod, is generally plowed down for the first crop in the course of the rotation.

Not much stock is kept on farms of the Ontario fine sandy loam and permanent pastures are rarely found. The stock kept consist of a cow or two, the work horses necessary for the farming operations, often a few sheep and a few hogs.

Farms over all parts of the region occupied by the Ontario fine sandy loam are in excellent condition. Methods which are adapted to the character of the soil and the system of farming are employed. Short-term rotations are practiced and clover sods are plowed under before they deteriorate. By this means and with the use of stable manure and commercial fertilizers the productiveness of the soil is maintained, and even increased.

The farm buildings are suitable for the system of farming practiced, and the houses and surroundings are generally neat and well cared for. There is every indication of a progressive agriculture and appearances of prosperity.

The value of farms on the Ontario fine sandy loam ranges from $60 to $100 an acre. It is likely, however, that little of the type is for sale at the lower figure, and many places with special improvements and a considerable proportion of bearing orchard would command a much better price than the higher figure.

ONTARIO LOAM.

The surface soil of the Ontario loam consists of a brown or light-brown light loam to fine sandy loam, having a depth of from 8 to 12 inches. In the areas of smoother topography the surface in many places has a reddish chocolate brown color. The subsoil is a brown to reddish-brown loam, usually noticeably heavier than the soil, but varying somewhat in texture from heavy to light. The entire soil section contains many angular and abraded stones and some gravel, more or less rounded and largely of limestone. In the drumlin region a phase of the type occurs in which the surface soil is absent. Often a long narrow strip occurs either along the crest of the hills or on steep slopes, from which the loosened soil material is removed by erosion as fast as it is formed by nature from the raw subsoil. Such areas are usually destitute of vegetation and appear as "gall spots." The surface soil has a favorable structure, which, together with its sandy nature, makes cultivation comparatively easy. The subsoil, or drumlin till, is decidedly more compact.[1]

The Ontario loam is one of the most important soil types of Ontario County, both in areal extent and agriculturally. It occurs in more or less broad areas in a belt of country extending across the county from Seneca Lake on the eastern side to the Livingston County boundary on the west. An important phase of it is also found in the drumlin region of the northern edge of the county, but the type is not found in the high-hill region of the southern part of the county, except along the west shore of Canandaigua Lake. Its largest area is in the townships of Geneva, Hopewell, Canandaigua, and East Bloomfield. It occurs in smaller areas in Seneca, Gorham, Phelps, South Bristol, Richmond, and West Bloomfield Townships, besides scattered areas in Victor, Farmington, Manchester, and Bristol Townships.

North of the Canandaigua Outlet the type occupies almost exclusively the rolling to rounded hills and ridges. These topographic forms are the drumlins, "little hills," of the region. The ordinary shape of these drumlins is an elongated oval, the length being three to five times the breadth. The northern ends are usually steep and abrupt, while the southern ends generally taper off gradually.

[1] Bulletin 111, N. Y. State Museum, Drumlins of Central Western New York, by H. L. Fairchild.

South of the Canandaigua Outlet, upon the foreland of the plateau country, where its greatest areal extent is found, the topography is for the most part smoother and cultivation is carried on without difficulty. Hills of a drumloid form occur, however, upon this plateau south of the Auburn Branch of the New York Central & Hudson River Railroad, between Canandaigua and Honeoye Lakes, but their contour is seldom so abrupt as in the drumlin district in Farmington, Manchester, and Phelps Townships.

Although the surface of the Ontario loam is rolling, virtually all of it is insufficiently drained for the best success in crop production. Underdrainage has been installed in many fields, always with a resulting improvement both in quantity and quality of the crops.

The Ontario loam has been formed by the weathering of the glacial till, whether left as drumlins or as the smoother ice-laid land forms. The surface soil of the drumlin phase of the type has, in many instances, been modified by water action, for water-laid drift may be expected on the surface of drumlins as an occasional product of superficial stream work.[1] However, the subsoil is generally of glacial till, as it is rare that water-laid material is found within the drumlin mass.

There has probably also been some modification at least of the surface portion of the soil in the gently rolling areas south of the Canandaigua Outlet, where it is possible that deposition of material has occurred when the area was covered by ancient glacial lakes. The character and thickness of such lacustrine depositions are not at the present time sufficiently prominent and characteristic, however, to admit of their unequivocal clasification as Dunkirk loam, and on account of their predominant till characteristics they are classed with the Ontario loam.

The soil is quite generally cleared and under cultivation, though small areas, particularly in the northern drumlin phase, are still in forest, which furnishes good fuel and a small amount of saw timber for farm use. The original forest growth consisted largely of white pine, black walnut, red oak, with a scattering of other species. Bluegrass, both Canada and Kentucky, grows naturally and forms the chief part of the sods of greater age.

The Ontario loam is probably the best wheat soil in the county and State. A large acreage of the type is devoted to this crop in systematic rotations and excellent yields are obtained. Minimum yields are seldom less than 20 bushels an acre, while the maximum may be as high as 40 or 45 bushels. The average is about 30 to 35 bushels.

[1] Loc. cit.

Beans are an excellent crop for this soil. They yield on the average about 15 to 20 bushels per acre, with a quantity of bean straw for sheep feeding. Oats are a good crop, giving yields varying from 40 to 70 bushels an acre. This soil is also an excellent corn soil, seldom yielding less than 50 bushels of ears to the acre and averaging about 75 bushels, with a miximum of 125 to 150 bushels. Besides the grain there are also several tons of rough forage. Ensilage corn nearly always gives a large tonnage per acre. Potatoes occupy an extensive acreage of this soil, especially west of Canandaigua and in the vicinity of East Bloomfield. They are late varieties, and yield from 100 to 200 bushels of tubers of good quality. Hay is nearly always an excellent crop on Ontario loam fields, the soil being especially adapted to the clover family. Good sods of clover, or clover and timothy mixed, cut from 2 to 3 tons of hay of fine quality, besides usually bearing an excellent aftergrowth, which is often plowed under to improve the soil for a succeeding intertilled crop. Where well drained it is admirably suited to alfalfa. It seems to be naturally adapted to this valuable legume, except in exposed positions in the drumlin phase of the type, where there is not sufficient covering of snow during the cold winter months. The length of season permits of three and sometimes four cuttings, which average from 1 ton to 1½ tons each, giving a total yield of 3 to 5 tons per acre annually. The acreage devoted to this crop is rapidly being extended. Cabbages are grown extensively, yielding from 10 to 20 tons per acre.

Many excellent apple orchards are found on the Ontario loam, and where properly cared for they give excellent yields of good fruit. This industry can safely be extended. Considerable nursery stock of all kinds is grown on this soil.

The agricultural conditions prevailing over that portion of the county occupied by the Ontario loam are far above the average for the State. As a rule the farm buildings are in good repair, commodious, and adapted to the systems of farm industry in vogue. The methods are among the best found in the whole section and quite generally adapted to the character of the soil. A more systematic rotation of crops is practiced on this type of soil than is generally the case, and the good crops and excellent conditions are a direct result.

The value of farms of the Ontario loam varies with location and the character of the farm buildings. Some farms more remote from towns or shipping points, and without buildings, sell for about $40 an acre; with buildings, for about $50 an acre. Better situated farms readily sell with improvements for $75 to $100 an acre.

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

Mechanical analyses of Ontario loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
25093.....	Soil.....	1.0	3.0	4.5	12.8	14.6	47.5	16.1
25094.....	Subsoil.....	1.1	4.0	5.4	14.5	19.0	39.6	16.3

The following sample contained more than one-half of 1 per cent calcium carbonate ($CaCO^2$): No. 25094, 5.84 per cent.

CANEADEA GRAVELLY LOAM.

The surface soil of the Caneadea gravelly loam consists of a golden-brown rather light gravelly loam, with a depth of about 7 or 8 inches. The subsoil like the soil is a gravelly loam, though often more sandy. The color is usually a little lighter, being more yellow than brown. The whole section is more or less filled with rounded and flat stones, coarse gravel being abundant. Ordinarily there is also present a considerable quantity of fine gravel. The interstitial soil material is usually rather light, containing a relatively high percentage of the various grades of sand. The character of this soil is such that the preparation of a seed bed and other tillage operations can be performed under a considerable range of moisture conditions, the high gravel content interfering in no way with such operations.

The Caneadea gravelly loam is found only in the extreme southern portion of Ontario County, where quite extensive areas occur. The topography is rolling and the natural drainage good, and owing to the open structure and coarse texture of the soil materials, even excessive in places. The elevation varies from about 800 to 1,500 feet above tide. The type has been formed by the deposition of glacial materials in high level glacial lakes and, instead of consisting of outwash from the glacial ice, seems to have been carried in by north-flowing streams.

The Caneadea gravelly loam is generally utilized in the production of general farm crops, though around Naples a good many vineyards are located upon it. Yields are largely dependent upon moisture conditions, as crops suffer severely from drought. Corn yields from 50 to 100 bushels of ears; oats, from 25 to 50 bushels; wheat, 15 to 20 bushels; potatoes, 100 to 200 bushels; and hay, from 1 to 2½ tons per acre. Alfalfa may be grown successfully by careful management.

The price of farms on the Caneadea gravelly loam ranges from $25 an acre in the more remote sections to many times as much for bearing vineyards or orchards.

CANEADEA SILT LOAM.

The soil of the Caneadea silt loam consists of 8 to 10 inches of drab to yellow silt loam. When dry and in areas having a low organic content the color is an ashy or dingy white. The subsoil consists of a drab to yellow heavy silt loam, often tending toward a clay loam in texture. Below plow depth the materials are stratified and usually consist of alternate layers of silt, clay, and very fine sand. In many places some stone and gravel occur. The surface soil is usually mellow and can be worked to a good tilth, though care should be exercised to plow when the moisture content is favorable, otherwise clods are formed.

The Caneadea silt loam occurs only in the extreme southern part of Ontario County. An extensive area is found in southern Naples Township and smaller areas in South Bristol Township. The topography is rolling. The elevation varies from about 900 to 1,300 feet above sea.

The formation of the Caneadea silt loam is due to wash from the glacial debris of the local shale hills, deposited in glacial lakes. The materials of which it is composed represent some of the finer of these lake sediments. Subsequent erosion and other weathering agencies have formed the type as it now occurs.

The original forest growth consisted of various species of oak, with some hickory and white pine. The natural sod is made up largely of the shallow rooted alsike and white clovers, and Canada bluegrass.

The Caneadea silt loam is an excellent soil ror permanent pasture, as it supports a luxuriant growth of the pasture clovers and bluegrass. Much of it should be used for this purpose, on account of its unfavorable topography for tillage and the danger of washing and gullying when without a protecting sod. It is a good soil for hay, grain, and some of the fruits. Timothy and clover hay yield from 1½ to 2½ tons per acre; wheat, 20 to 30 bushels; oats, 25 to 50 bushels; and corn, 30 to 80 bushels per acre. The soil is too heavy and dense for potatoes and beans.

The general agricultural conditions prevailing on this type are only fair. The land sells, with improvements, for $25 to $50 an acre.

CLYDE SILT LOAM.

The soil of the Clyde silt loam consists of a dark-gray to black silt loam, 6 or 8 inches deep, resting upon a subsoil of compact gray or ashy colored silt loam 36 inches or more in depth. Though compact in structure this soil material is mealy when dry and sticky when wet.

Only one area of the Clyde silt loam is mapped. This is located east of Halls Corners. It occupies a poorly drained basinlike

depression, and is wet and swampy. It is covered with a forest growth principally of soft maple, elm and other hardwoods. When drained and cleared it will be suitable for corn, cabbage, grain and hay.

CLYDE FINE SAND.

The surface soil of the Clyde fine sand is a dark-gray to black fine sand from 6 to 10 inches in depth, overlying a subsoil of gray fine sand, which extends to depths greater than 3 feet.

This soil is of small extent in Ontario County. Small areas occur in the eastern part of the county, where the type is associated with the Dunkirk soils. These areas always occupy relatively low positions in slight hollows or depressions or along stream courses. This position has been instrumental in maintaining swampy conditions and is responsible for the development of the soil type.

But little of the Clyde fine sand is under cultivation. Artificial drainage is essential in all areas of the type, and when this has been accomplished it will make a good soil for cabbage, sweet corn, onions, canning and truck crops.

HONEOYE STONY LOAM.

The Honeoye stony loam consists of a few inches to a foot or more of brown loam, filled with irregular shaped fragments of hard limestone, resting upon the bedrock or upon a mass of broken limestone. There is usually some glacial material at the surface, as is indicated by the presence of fragments of foreign rocks, but the cherty limestone is always characteristic of the type.

The Honeoye stony loam occurs in Ontario County in irregular detached areas extending in an east and west direction from Oaks Corners to a point directly north of Canandaigua. The type has a level to rolling topography and excellent drainage. Where the soil covering over the rocks is most shallow drainage is often excessive.

The formation of this type of soil is due to glacial action in breaking up the hard massive, crystalline Onondaga limestone. Much of the glacial material deposited was probably subsequently carried away by glacial stream action, and the soil formed by subsequent weathering of the residue of glacial material and the limestone rock. The original growth of timber consisted chiefly of oak and hickory.

The Honeoye stony loam is difficult to till, owing to the large stone content and is best adapted to pasture. On the deeper areas of the type, however, wheat, corn, clover, and alfalfa do well. If not injured by drought, to which the type is very susceptible, especially where shallow, the yield of corn is from 40 to 75 bushels, wheat from 20 to 30 bushels, clover from 1 to 2 tons, and alfalfa from 3 to 4 tons per acre. When once established alfalfa is especially suited to this soil.

The conditions prevailing over areas of the Honeoye stony loam are only fair. The land is not in demand and the price is low. It is usually held in connection with other soils.

FARMINGTON LOAM.

The Farmington loam consists of a light-brown mellow silt loam about 6 to 10 inches in depth, resting upon thin bedded shaley limestone. The shallow soil is more or less filled with flat angular fragments of the same soft limestone, the fences around the fields being built of these flat limestones. There is also usually a small percentage of rounded glacial gravel and stones. Cultivation is difficult because the depth of the soil is not great.

The Farmington loam is found only in detached, irregular shaped areas extending in an east and west line from northeast of Clifton Springs in Phelps Township, across Manchester Township, to a point north of Canandaigua in Farmington Township. Its topography is nearly level, and the drainage is good despite the closeness of the bedrock to the surface.

The formation of the Farmington loam is due to the action of glacial streams. It lies along the course of an old glacial stream channel, and it is likely that practically all glacial material originally deposited over this limestone was removed by the flowing waters. The glacial material left, together with material from the soft Bertie water lime, constitutes the soil material.

Notwithstanding the shallow character of the type, it is an excellent soil for potatoes, beans, corn, oats, and alfalfa. Potatoes give yields varying from 100 to 150 bushels; beans, 12 to 18 bushels; corn, 50 to 100 bushels; and oats, 25 to 50 bushels per acre. Clover and mixed hay do well and yield from 1½ to 2½ tons per acre. Alfalfa grows readily, the roots finding no serious difficulty in penetrating deep into the soft shaley limestone. It gives three cuttings annually, sometimes four, of from three-quarters ton to 1½ tons each.

The agricultural conditions prevailing over the region occupied by the Farmington loam are good.

LIVINGSTON SILTY CLAY LOAM.

The Livingston silty clay loam consists of a surface soil, about 10 inches in depth, having a brown to light-brown color and heavy loam or silty clay loam texture. The subsoil is a dense silty clay loam or clay of olive gray to mottled color. The loam surface soil makes cultivation less difficult than it otherwise would be, and although somewhat influenced by the heavier character of the subsoil a good tilth can be secured and later tillage is satisfactory, except as effected by drainage conditions.

One large area of the Livingston silty clay loam occurs southeast of Canandaigua. Other small areas are found on the Livingston County boundary on the western edge of the county.

The topography is nearly level to gently undulating. The natural drainage is inadequate and should be supplemented by artificial means. The heavy texture and dense, impervious structure of the subsoil hinders the free circulation of soil moisture, and renders the need for drainage very general on this type.

The origin of the material and processes of formation of the soil and subsoil of the Livingston silty clay loam are vastly different. The surface soil covering consists largely of glacial materials, possibly modified to some extent by lacustrine influences and is made up for the most part of material foreign to the underlying rock formation. The subsoil is, however, of local material from the bedrock itself. It has been formed by the weathering and disintegration of these Devonian shales; in other words, it is residual. Where undisturbed by cultivation or other influences the weathered product still shows the structure of the parent rock, and often no sharp line of separation between the two can be observed.

The forest growth of the Livingston silty clay loam consisted of hardwoods, mostly oaks and hickory, with some elm.

The best use of the Livingston silty clay loam is probably in the production of hay, spring grains, and pasture. Well-drained areas are also adapted to corn, wheat, beans, etc. Good yields are the rule on this soil. Corn yields 50 to 100 bushels; wheat, 25 bushels; oats, 50 bushels; beans, 15 bushels; and hay, 1½ to 2½ tons per acre.

The general conditions of the farms on the Livingston silty clay loam are fair to good. The value of farm land ranges from $50 to $100 an acre, according to improvements.

The following table gives the results of mechanical analyses of representative samples of soil and subsoil of the Livingston silty clay loam:

Mechanical analyses of Livingston silty clay loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
25116	Soil	1.6	4.1	4.8	12.1	7.9	50.3	19.2
25117	Subsoil	6.9	9.3	4.2	6.4	4.4	51.7	17.1

ALLIS SILT LOAM.

The surface soil of the Allis silt loam consists of 8 to 10 inches of light-brown to gray silt loam, containing some small rounded gravel and small soft shale fragments. The subsoil is a gray sticky loam to

clay loam. The structure of the surface soil is friable and open, and it can be easily worked and a good tilth secured, though that of the subsoil is dense and impervious.

The Allis silt loam is of small extent and occurs only along the Canandaigua Outlet north and northwest of Phelps. It has level to undulating topography, and the drainage, though retarded by the heavy texture and close structure of the subsoil, is fair.

The soil of the Allis silt loam is the result of a commingling of glacial material of foreign origin with residual material; the subsoil is purely residual from the gypseous shales of the Salina formation. This residual material varies in thickness, the original shales often being within 3 feet of the surface. The two can scarcely be separated, as the transition from one to the other is gradual, and, in fact, the shales themselves are soft and often but little heavier and more compact than the weathered product.

The Allis silt loam is adapted to the production of corn, oats, wheat, potatoes, and hay. Yields are good, and the condition of the farms on the type is generally satisfactory.

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

Mechanical analyses of Allis silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
25087	Soil	0.8	3.1	2.9	5.3	6.3	67.2	14.5
25088	Subsoil	.4	4.5	3.2	4.4	4.0	68.2	15.1

The following sample contained more than one-half of 1 per cent calcium carbonate ($CaCO_3$): No. 25088, 5 per cent.

MUCK.

The Muck of Ontario County is made up of a layer of more or less decayed organic matter varying from a few inches to several feet in thickness and of a dark-brown to deep jet color. At the surface it is well decomposed and in many places all evidence of organic structure have disappeared, but in the lower part of the section of the deeper areas decomposition has not progressed so far and the material is more fibrous and browner in color—Peat rather than Muck. The material underlying the organic soil, the deep subsoil, varies somewhat. Usually it consists of a plastic bluish or gray clay, though often under the shallower and smaller areas it is a sandy or stony material, similar, except in color, to that of the surrounding inorganic soil. Again, some areas are underlain by a gray or white deposit of carbonate of lime (marl). The character of the deep subsoil has but

little, if any, influence upon the character of the soil covering, though it does have an influence upon the question of drainage and moisture supply. The value of the soil itself depends more upon its depth and the state of the decomposition of the organic matter. In this respect a great deal depends upon whether the surface is peaty or well decomposed.

When drained, cleared, and cultivated the Muck works up to an especially good tilth, a seed bed of any depth can easily be prepared and all subsequent cultivation is readily accomplished.

The Muck is found in small and large areas scattered about in almost every township of Ontario County. The larger proportion of it, however, is undeveloped. All of the areas occupy relatively low topographic positions. They receive the drainage water from the surrounding higher-lying areas and naturally are poorly drained. Artificial drainage is absolutely essential to cultivation. Sometimes this is difficult and expensive to establish, though often it may be accomplished simply by aiding nature in clearing out and improving drainage channels already established. In either case the expense is justified by the enhancement in value that is certain to result. The comparatively low places in which the Muck is found and the consequent poorly drained and swampy natural conditions are responsible for its origin and formation. Following the period in which the whole region was covered by glacial ice these low areas with obstructed drainage became shallow ponds and lakes, and in them there sprung up a growth of water-loving vegetation. The growth, death, and partial decay of this vegetation, generation after generation, so filled the ponds and lakes that they became bogs or swamps, containing this organic soil. In some of them there were at first and at other intervals conditions favorable for the growth of Chara and perhaps other forms of plant life that secrete calcium salts. In these areas we find the deposit of marl, or carbonate of lime. The chemical peculiarities of this soil are its high organic content and the high lime content of the marl deposits.

In its natural undrained condition Muck is covered usually with a heavy forest growth of various species of deciduous trees, the predominating varieties being elm, soft maple, and black ash, though there are often areas of cedar and tamarack. Besides this there is a rank undergrowth of wild grasses, night shade, and other plants partial to a cold, wet soil. Some areas carry reeds, cat-tails, rushes, and sphagnum moss. All this plant life contributes each year to the formation of the soil.

Muck is a special-purpose soil, and its best utilization is in the production of celery, onions, head lettuce, spinnach, and root crops. Among the general farm crops, potatoes do best upon the Muck. Sweet corn also does well.

In Ontario County the chief crops grown in the reclaimed areas of Muck are celery, onions, and potatoes. The yield of celery varies from 1,000 to 2,000 dozen of first quality. Onions give a minimum of about 300 bushels, a maximum of about 1,200 bushels, and an average of from 500 to 700 bushels. The average yield of potatoes is about 250 bushels per acre, with a minimum of about 200 bushels and a maximum of 300 bushels. On one small area of Muck peppermint is grown. The English mint is grown, and of new mint, the first year down, a yield of 40 to 50 pounds of oil per acre is secured. A field of old mint, second year, gives a yield of about 30 pounds of oil per acre. Probably potatoes and onions are the best crops for the Muck in Ontario County.

In the production of these crops large quantities of commercial fertilizers and stable manure are used. In this region much phosphoric acid is used, about 1 ton per acre for celery or onions and 500 pounds per acre for potatoes. The application of stable manure usually consists of about 20 tons per acre.

The value of the Muck has a direct relation to the condition of drainage and improvement. Drained, cleared, and developed tracts sell for $200 an acre and are in a high state of cultivation, while undrained, uncleared, and undeveloped areas are held at a low price.

SUMMARY.

Ontario is one of the central counties of western New York. It has a land area of 656 square miles or 419,840 acres.

The topography varies from a low, rolling region in the north to a high hill region in the southern part. A difference in elevation of nearly 2,000 feet exists between these two physiographic regions.

Drainage, except for a very small area, is into Lake Ontario and the St. Lawrence River.

Ontario County has been settled for 123 years, and has had a county government for 121 years. The present population, 52,286, is near the maximum, though the urban population has recently increased at the expense of the rural population. There is a distinct relation between the soils and the changes in rural population.

The climate is typical of western New York. Rainfall is ample and usually well distributed throughout the year. Heavy snowfall is the rule.

Agriculture is the leading interest. It has had a steady development. Wheat has been an important crop from the early settlement to the present day. The production is nearly 1,000,000 bushels annually. Corn and oat production is now important, but these grains are largely fed on the farm.

Sheep husbandry has been a prominent part of the county's agriculture, and could well be made more so at present. Dairying and cattle raising have never occupied a very important place.

The growing of fruit, chiefly apples and grapes, and the production of nursery stock are among the leading industries.

Hops formerly were of considerable importance, but the cultivation of this crop is declining.

The value of the production of Ontario County soils, not fed on the farm, in 1899 amounted to nearly $5,250,000, or a little over one-fifth of the value of all farm land and improvements.

Farm labor is fairly satisfactory, though the supply is inadequate, largely because of steady employment offered in the near-by cities. About $1,000,000 is expended annually for farm labor.

Ninety-seven per cent of the area of the county is included in 4,328 farms of an average size of 101½ acres each. Of the farm area, 78.8 per cent, or three-fourths of the whole county, is classed as improved farm land. Farm-land values vary from $5 to $10 an acre for some of the high-hill soils to more than $100 an acre for the better farms in the northern part of the county.

The total valuation of farm land with all improvements in 1900 was $20,661,050, or $51.01 an acre.

Suggestions for the improvement of agriculture are better drainage, subsurface as well as surface; better and more complete utilization of all soils for crops suited to them; more systematic and more general practice of rotation, and more judicious fertilization.

The soils of Ontario County range in texture from light gravels and sands to heavy clay.

Thirty distinct soils, including Muck, are recognized. These fall into six series, in addition to which there are five miscellaneous types. The soils, according to origin of material and processes of formation, are divided into four groups; these are water-laid (lacustrine), glacial, residual, and cumulose.

The soil series represented are the Ontario, the Dunkirk, the Volusia, the Genesee, the Caneadea, and the Clyde.

The Ontario and Dunkirk soils are the most important soils of the county. The Ontario loam is the most extensive soil in the county. The Ontario fine sandy loam is also extensive. The soils of these series are excellent soils for apples, corn, potatoes, hay, alfalfa, wheat, oats, cabbage, beans, etc. Practically all of these soils are adapted to alfalfa.

Of the Volusia series, four types are found, the gravelly loam, the loam, the silt loam, and the shale loam. These soils occur on the high hills of the county, and cover one-fourth its area. The gravelly loam is the lightest in texture, and is adapted to corn, where the eleva-

tion is not too great, and to oats, potatoes, buckwheat, and hay. The loam is suited to the same crops as the gravelly loam. The silt loam is adapted to oats, potatoes, buckwheat, and timothy hay. Sheep raising should also be one of the principal industries. Much of the area of this soil type is in a poor and neglected condition, and farms are for sale at low prices. The shale loam of the steep hillsides of the southern part of the county is adapted to and devoted to grape production where favorably located with respect to climatic conditions.

The Genesee series is a group of first-bottom soils of comparatively small extent. Four types are mapped, the shale loam, loam, silt loam, and silty clay loam. These soils are suited to corn, oats, late truck crops, and hay.

The Caneadea soils are represented by only two types, the gravelly loam and silt loam. The lighter of these is adapted to corn, oats, alfalfa, clover, and potatoes; the heavier to wheat, oats, corn, and hay.

The Clyde series, fine sand and silt loam, are poorly drained. They are suited to truck crops where drainage is sufficient.

The Honeoye stony loam is thin and very stony. It is best used for pasture and forest.

The Farmington loam is similar to the Honeoye stony loam, except that the included stone fragments are flat and shaly instead of blocky and massive. It is a much better agricultural soil, and more easily cultivated than the Honeoye type.

The Livingston silty clay loam has a considerable extent. It is adapted to corn, oats, wheat, and hay.

The Allis silt loam is of small extent. It is devoted to corn, oats, wheat, potatoes, and hay.

Muck is mainly an accumulation of organic matter. It is excellently adapted, where drained, to celery, onions, spinach, and lettuce. In this county a considerable area of it is utilized in the production of potatoes.

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