SOIL SURVEY OF MONROE COUNTY, NEW YORK.

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DESCRIPTION OF THE AREA.

Monroe County is located about the middle of the southern shore of Lake Ontario, that lake forming its northern boundary. Wayne County bounds it on the east, Ontario County on the southeast, Livingston County on the south, Genesee County on the southwest, and

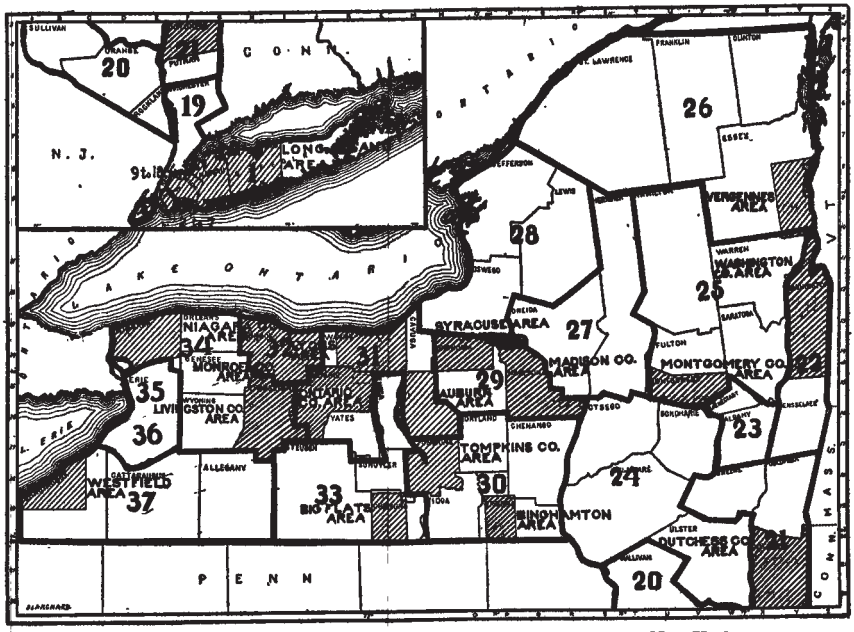

FIG. 1.—Sketch map showing location of the Monroe County area, New York.

Orleans County on the west. All of the land boundaries are right lines. The water boundaries—Lake Ontario and, for a short distance, the Genesee River—are irregular.

The extreme dimension of the county, both north and south and east and west, is approximately 30 miles, the total area being 674 square miles, or 431,360 acres.

The county lies at a comparatively low altitude and shows little range in elevation. The lowest country is along the shores of Lake Ontario, Irondequoit Bay, and the lower course of the Genesee River, where the elevation is 246 feet above sea level. The highest land in the county is on Baker Hill, on the Ontario County line in southern Perinton Township. It is 928 feet above sea level, or 682 feet above the surface of the lake.

The northern portion of the county consists of a moderately level plain, broken only by the gorge of the lower Genesee and the indentation occupied by Irondequoit Bay. Along portions of the lake shore and Irondequoit Bay the plain abruptly drops to the level of the water, in bluffs of unconsolidated material, varying from a few feet to 30 or 40 feet in height. In other portions it approaches the lake in gentle slopes, which are usually separated from the lake itself by low sand beaches. The gorge of the Genesee River from Rochester to its mouth is characterized by rock cliffs and bluffs similar to those described, in some places attaining a height of about 200 feet.

A characteristic physiographic feature marking the southern boundary of the northern plain of the county is the gravelly ridge representing the shore line of the former glacial Lake Iroquois and having an elevation above the rest of the plain of from a few feet to some 20 or 25 feet. This ridge extends from east to west across the county at a distance from Lake Ontario varying from a little over 2 miles to about 9 miles. It is, however, divided into three parts by the indentation of Irondequoit Bay and by the Genesee gorge.

The southern part of the county has an undulating to rolling topography. It is smoothest, as a whole, along its northern portion, becoming rougher southward. In the east-west belt, including Rochester and extending south to a line drawn through Churchville, Buckbee Corner, Henrietta, Fairport, East Penfield, and Roseland, the topography is a gently undulating plain. South of this belt the topography is rougher. Even in this region, however, there are but few areas that are too steep for all ordinary farm operations.

Standing on this southern plain, there are two areas of rather conspicuously high country. One is a belt of kames, consisting of a long, narrow ridge lying east and west, passing through the southern part of Rochester. The other is another kame-hill region in the southeastern part of the county in Perinton and Mendon Townships, known as the Victor and Mendon kame hills, respectively. The former are the highest and roughest, the highest point in the county occurring here.

Across the northern belt the Genesee River has cut a deep, narrow gorge. Across the southern belt on the other hand the river is flanked by flats, the breadth varying with the character of the adjacent

country. In general, they are narrower to the south and broader to the north, spreading out into a broad area in Chili and Brighton Townships.

The drainage of Monroe County belongs entirely to the Great Lakes-St. Lawrence system. The principal stream, the Genesee River, forms the boundary of the county for a distance of 6 or 7 miles. Its course across the county is north and northeast. It empties into Lake Ontario at Charlotte, after traversing the county for about 30 miles. From the southern boundary of the county to the city of Rochester its course is through the valley region previously described, and over a portion of this part of its course it describes a series of meanders, with ox-bow bends and loops, the valley alluvium lending itself easily to the erosive action of the river currents, which have cut a rather deep channel in the soft material at the ordinary stages of flow. Sometimes, however, the stream is unable to carry all of the flood waters delivered from above; the overflow of the flats ensues. From Rochester northward to its mouth it flows over several falls and in a deep gorge. The total fall of the Genesee within Monroe County, most of which occurs within the city of Rochester, is about 275 feet, giving considerable water power, some of which is utilized. Water is also taken from the Genesee at Rochester for the Erie Canal. The principal tributaries of the Genesee in Monroe County are Honeoye Creek, Allen Creek, and Black Creek, the last two entering it from the west and the first from the east.

The lake shore immediately west of the Genesee is indented by numerous ponds and bays, inclosed by the lowland plain and by sand beaches. A few round ponds, some without outlet streams, occur in the kames of Mendon and Perinton Townships.

Probably the first of the Caucasian race to visit what is now Monroe County were the Jesuits from the early French colonies of the St. Lawrence Valley, who came to convert the Seneca Tribe of the Iroquois Indians to Christianity. The whole "Genesee country" was visited by these missionaries, who probably gave the Indian occupants the apple, as many of these fruit trees were found in the region by the pioneer settlers. At the time of the Revolutionary War the whole region was a wilderness. However, immediately after the close of that conflict settlements were made farther up the valley, in what is now Livingston County. Soldiers of Sullivan's command, who had visited the region during the war, with others, were attracted to the region, and came in, took up the land, and began the cultivation of the soil. All of the earliest settlements were made to the south of Monroe County, along the route of travel from the Mohawk Valley and eastern part of the State to Fort Niagara. The first permanent settlements within the county were made about 1789,

though these settlers found " Indian " Allan in the vicinity of Scottsville at that time with growing crops of wheat and corn.

Most of the lands of Monroe County were included in the " Phelps and Gorham purchase," which was consummated in 1789. The lands included in this purchase were exploited by New Englanders. Some of the lands of the county were, however, bought and exploited a little later by Robert Morris, of Philadelphia, the great financier of the Revolution. The New England States, eastern New York, Pennsylvania, and Maryland furnished most of the pioneer settlers of the region. Sawmills and gristmills were erected at an early date, and the active pursuits of farming were taken up from the first.

Monroe County was organized and set apart from Ontario County by an act of the State legislature February 23, 1821, taking its name from James Monroe, then President of the United States. No change has been made in the form or area of the county since its organization.

The population of the county a year prior to its organization, 1820, was 26,855. During the next decade the population nearly doubled. After 1830, however, its growth was not so rapid, as it was 40 years in again doubling its population, this being in 1860, 100,648. In the 32 years from 1860 to 1892 the population again doubled, being 200,059. Since that time there has been a steady and large growth, the census of the present year (1910) showing a total population of 283,212. This large increase in population has not been due to the agricultural development of the county, but to the growth of Rochester, the third city in size in the State, the present rural and village population being only about equal to the total population of the county 70 years ago.

Many of the descendants of the early pioneers still reside in the county, some of them owning the lands settled and occupied by the earlier generations of the same family. A large percentage of the population has, of course, migrated hither from the surrounding region, from other States and cities, and from foreign countries. This latter source has furnished a relatively large proportion of the city population.

Seventy per cent of the county's population is contained in Rochester, the metropolis of the county and region. Incorporated villages, in order of their size, are Brockport, Fairport, Charlotte, Pittsford, Honeoye Falls, Webster, Hilton, Spencerport, and Churchville. The combined population of these amounts to 14,227. Thus it is seen that the population in the unincorporated villages and the open country is 50,860, or only about 18 per cent of the total.

For over 30 years after the permanent settlement of the county access to the outside world was difficult and transportation slow. It was accomplished by ox team or on horseback over roads that

were scarcely more than trails through the wilderness. Some transportation was carried on during this time by boats to Canadian points. This condition was somewhat relieved in 1822, when the Erie Canal was opened eastward, the first cargo, a boatload of flour from Monroe County wheat, leaving Rochester for Little Falls, N. Y., October 29 of that year. The completion of the canal from Lake Erie to the Hudson River, three years later, greatly improved transportation conditions. Though slow in operation, it gave an outlet to the older settlements for the surplus products of the soil. Another canal, the Genesee, was built at a little later date along the Genesee River from Rochester to Mount Morris and Dansville, and still later to Olean, connecting with the Allegheny River. This, however, did not materially increase the markets for the Monroe County farmers, and as it proved unprofitable was soon abandoned. The Erie Canal is now being enlarged and made a barge canal.

Transportation by rail was not available until some 10 years after the completion of the Erie Canal. Steam trains were inaugurated on what is now the main line of the New York Central & Hudson River Railroad in 1837. Four years later Rochester was connected with Auburn by a railroad, now the Auburn division of the New York Central. Connection with points in Livingston County was made by railroad in 1854. In 1878 the Buffalo, Rochester & Pittsburg Railroad was completed, and five years later the present branch of the Pennsylvania Railroad was built on the right of way of the abandoned Genesee Canal. Other steam roads now belonging to the New York Central Lines and the Lehigh Valley have been built across the county. Twelve different railroads now enter the city of Rochester and three more cross the county south of the city.

In recent years electric lines, the Rochester & Eastern and the Rochester, Syracuse & Eastern of the New York State Railways—the former connecting Rochester with Canandaigua and Geneva and the latter connecting Rochester with Syracuse and intermediate points—and the Buffalo, Lockport & Rochester Railway, connecting Rochester with Buffalo and intermediate points in Niagara, Orleans, and Monroe Counties, have been built and are in operation. The railroad connecting Rochester with Avon, Geneseo, and Mount Morris, a branch of the Erie, also gives electric passenger service. Besides the foregoing transportation facilities, traffic is carried on by boat from Charlotte to other Lake Ontario ports.

The county highways are only good to poor, except where they have been improved by macadamizing in the last few years. Quite a considerable mileage of the roads has been so improved and more is being done each year.

Rochester is the home market, and large quantities of farm produce of the county are consumed there, especially truck crops, fruit, potatoes, and dairy products. The markets of Buffalo on the west are not far distant and are easily accessible. The markets of Pittsburgh and of the iron, oil, and coal towns of western Pennsylvania are reached by direct railways, as are the anthracite coal towns and manufacturing towns and cities of eastern Pennsylvania. The industrial towns and cities of eastern New York and of the New England States are also markets for Monroe County, and are reached by direct railroad connections. Much of the Monroe County fruit, especially apples, is shipped across the Atlantic and finds markets in London, Liverpool, Glasgow, Paris, and other European cities.

CLIMATE.

The climatic conditions of Monroe County do not differ from those of other counties similarly located. The mean annual temperature is about 47° F. At Rochester the maximum temperature recorded is 99° F; the minimum temperature recorded is —12°.

Lake Ontario measurably influences the climate of the lake-shore section. As stated by Turner, the temperature of the lake waters of Ontario are from 10 to 15 degrees warmer in winter and cooler in summer than the air over the adjacent land. The meteorological station at Rochester is about 6 miles from the lake shore on the Genesee River, at an elevation of 500 feet above sea level and 253 feet above the lake.

The mean annual precipitation is 34.5 inches. Of this amount 9 inches occurs during the winter months, 8.5 inches during the spring, 9.1 inches during June, July, and August, and 7.9 inches during the fall months. The annual precipitation is about 6.5 inches less in the southern part than in the northern part of the county.

The mean annual snowfall for the year amounts to about 88.4 inches, and the heaviest snow occurs during the month of January. The prevailing wind is westerly.

The average length of the growing season between the last killing frost in the spring and the first in fall, taking the county as a whole, is 160 days. The growing season is some 25 days shorter in the southern part of the county than along the lake. At Rochester the average dates for the last killing frost in spring and first in fall is April 29 and October 17, respectively, giving a growing season of 171 days. The longest growing season reported is 191 days at Rochester in 1909.

The following tables, compiled from the Weather Bureau records at Rochester, show the normal monthly, seasonal, and annual tem-

perature and precipitation, also the dates of the last killing frost in spring and the first in the fall for this station:

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

Month.	Temperature.			Precipitation.			
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year.	Total amount for the wettest year.	Snow, average depth.
	°F.	°F.	°F.	Inches.	Inches.	Inches.	Inches.
December	29	70	−11	2.9	1.6	4.6	17.0
January	24	69	−12	3.2	1.3	3.3	22.6
February	24	65	−12	2.9	4.8	1.5	20.8
Winter	26			9.0	7.7	9.4	60.4
March	31	79	− 7	3.1	0.9	7.0	14.5
April	45	93	11	2.4	2.5	4.7	5.0
May	57	93	28	3.0	1.2	3.5	T.
Spring	44			8.5	4.6	15.2	19.5
June	66	95	36	3.1	1.5	1.9	0.0
July	71	99	45	3.1	1.9	5.4	0.0
August	69	97	43	2.9	1.6	3.0	0.0
Summer	69			9.1	5.0	10.3	0.0
September	63	98	34	2.3	0.9	3.0	0.0
October	51	87	19	2.8	1.3	8.7	0.2
November	39	73	1	2.8	0.8	3.2	0.3
Fall	51			7.9	3.0	14.9	8.5
Year	47	99	−12	34.5	20.3	49.8	88.4

Dates of first and last killing frosts.

Year.	Rochester.		Year.	Rochester.	
	Last in spring.	First in fall.		Last in spring.	First in fall.
1902	May 11	Oct. 10	1907	May 12	Oct. 21
1903	May 2	Oct. 25	1908	Apr. 21	Oct. 13
1904	Apr. 22	Oct. 7	1909	Apr. 11	Oct. 19
1905	Apr. 22	Oct. 26	1910	.....	.....
1906	May 11	Oct. 13	Average	Apr. 29	Oct. 17

AGRICULTURE.

For many years following the settlement of Monroe County agriculture was the chief occupation of the people, but the growth of the city of Rochester has divided their interests between agriculture and manufacturing and trade. These latter industries long ago

assumed the lead and are now of prime importance, although agriculture has a prominent place in the business interests of the county.

Long before the coming of white people as settlers to this region the Indian inhabitants used the soil in various places for the growing of fruit, corn, beans, and vegetables. Denonville, a French explorer, who visited the region in July, 1687, a century before its settlement, found several fields of corn growing in the southern part of the county. Sullivan's expedition to this region in 1779 was for the purpose of destroying the crops and stores of the Indians, who were allied with the British. This expedition did not reach Monroe County, although large quantities of growing corn, vegetables, fruit trees, and stores of corn were destroyed farther up the Genesee Valley, in Livingston County.

The early settlers came to the region for the express purpose of making homes in the wilderness and at once cleared land and began the cultivation of the soil. Wheat from the first was the chief crop. As early as the year 1789, 20 acres of wheat was grown by "Indian" Allan near Scottsville. A year later the same settler sowed 100 acres of wheat besides some corn. For many years the marketing of wheat and flour from the flour mills at Rochester was done with difficulty. The best and most accessible markets were the Canadian settlements, on account of the existence of cheap lake transportation. However, some wheat and flour was marketed in the eastern part of the State and in Philadelphia and Baltimore. The advent of transportation by the Erie Canal gave a great impetus to wheat production, which in 1849 became nearly a million and a half bushels. Following this there was a considerable period in which the ravages of the wheat weevil caused the county production to decline greatly. By 1869, however, this pest had practically disappeared, and the production of wheat was again in excess of 1,000,000 bushels. The statement has been made that the production of wheat in the West and the local development of fruit farming has caused a decline in wheat production in this region. A study of the statistics of wheat production in this county, however, proves this statement to be in error, for the production for the year 1899, as reported, was 1,208,950 bushels, ranking first in the State. The development of other systems of farming, especially fruit production, has, however, brought about a change in the relative importance of wheat production. An important fact in connection with the production of wheat is the average yield per acre. In 1854 this was 15 bushels. In 1899 the average yield had increased to 21 bushels per acre, and it is believed that the average yield for 1910 is still greater.

Before the improvement of the transportation facilities to outside markets the crops grown by the settlers were such as would serve for family use. Hemp and flax were grown to provide clothing.

Tanneries were built to furnish leather. Distilleries consumed much of the crops. Asheries made "black salts" from the ashes derived in clearing the land of timber, as there was no market for lumber. Tobacco was later introduced, and at one time the production reached nearly a half million pounds. All of these local industries and crops have now disappeared, except as the manufacturing of leather goods, the distillation of liquors, and the manufacturing of beer, ale, and malt have been developed at Rochester for the local as well as the distant markets.

Most of the early settlers brought with them a few cattle, sheep, and swine from their eastern homes when they migrated hither, though much of the meat foods were secured from the game of the region, which was abundant. During the first half of the period following the settlement of this county there was a considerable development of the cattle industry, but with the larger development of other forms of farm industry in the last 50 years, and the continuance of wheat production, the number of cattle has decreased, the total number in 1900 being about 7,000 less than in 1860. Likewise, and to a much greater extent, the number of sheep has declined, there being only 32,357 head in 1900, or about 70,000 less than 40 years earlier. However, the total value of live stock in 1900 was approximately equal to that of 1860, due undoubtedly to improvement of breeds and to the large number of work stock (horses) required for farming operations.

The production of hops at one time assumed considerable importance, the yield in 1869 amounting to 337,394 pounds. This crop has now practically disappeared from the county, as 10 years ago only a little over 5,000 pounds were produced.

Barley has been grown on quite an extensive scale, the production reaching a maximum of 560,528 bushels in 1879, from an area of 22,925 acres. Since that time there has been a marked decline in production and acreage, the former falling off more than half and the latter about two-thirds in the subsequent 20 years.

Oats have long been a crop of leading importance, the production exceeding 1,000,000 bushels each census year for the last 50 years. Corn also is a crop of considerable importance, though somewhat less grown since the greater development of the fruit industry than formerly. Other cereal crops, such as rye and buckwheat, have never been of extensive acreage or production. The production of beans has been and is now of considerable magnitude.

Monroe County has long been one of the leading potato-producing counties of the country. As early as 1859 the production of this tuber crop amounted to over a million and a quarter bushels. In only two census years (1865 State and 1870 Federal) has the production reported been less than 1.000,000 bushels. The production

reported for the year 1899 lacks only a little of being 2,000,000 bushels, the county then ranking second in the State and fifth in the United States in potato production.

The production of hay and other forage crops has never been of great importance, owing to the development of other and special crops. It has only kept pace with the number of live stock, which has increased in later years as work stock. The production for 1899 was somewhat less than 1,000,000 tons, which amount it has never exceeded.

The growing of vegetables, which include the various truck crops, has become of much importance, owing to the large increase in population of Rochester, the value of these for 1899 being more than a half million dollars.

The production of fruit was begun in this region by the Indians. Some of the early settlers brought apple seeds from their old homes in the east. An orchard was planted at Scottsville west of the river as early as 1799. Other orchards were set from time to time, so that by 1860 the value of the fruit produced in the county amounted to $367,643. The production has increased greatly since that time, as many orchards were set out from 1864 to 1878, and it will still further increase, as the past 10 or 12 years has been a period of extensive planting. The value of the fruit produced in 1899 was $768,927, the county ranking third in the State. At that time there were 789,409 apple trees of bearing age, giving a total yield of 1,436,039 bushels, the county ranking second in both the State and the United States. Peach trees stood next in number, there being 247,069 trees, which produced 94,300 bushels. Pears were third with a yield of 43,440 bushels from 121,686 trees; and cherries fourth with 20,888 trees and a yield of 20,400 bushels. In addition to this production of orchard fruit, there was a yield of small fruits to the value of $127,973, making the total value of fruits alone $896,900.

Along with the development of the fruit industry an increase has taken place in the growing of nursery stock. Reports from the New York State Department of Agriculture for 1909 place the acreage devoted to this industry at 1,697, and the total number of trees, both fruit and ornamental, and shrubs, at 13,400,061, of which a little more than one-half are fruit trees.

The agriculture of Monroe County at the present time consists of fruit and grain farming, nursery stock production, truck growing, and general and dairy farming. Of the 431,360 acres in the county, 381,941, or 88.5 per cent, is in farms. Eighty-nine per cent of this farm land is classed as improved. Of this improved land, 124,859 acres were given to cereal crops in 1899. Wheat had the largest acreage of any of these crops, as well as the largest acreage of any single crop in the county. This amounted to 57,278 acres, which

gave an average yield of 21 bushels per acre. Of the cereals, oats were second in extent with 34,834 acres, and an average yield of 36½ bushels per acre. Corn ranked third, with an average yield of 29 bushels from 22,091 acres. Barley was grown on 7,841 acres and gave a yield of nearly 28 bushels per acre; 2,522 acres were devoted to rye, which yielded on an average 17½ bushels. Forage crops occupied 63,073 acres. Of these hay was the most important, with an acreage of 55,082 and an average yield of a little more than 1 ton per acre. Clover was grown on 4,705 acres, with a total yield of 5,526 tons, or about 1⅛ tons per acre.

Tuber crops, of which Irish potatoes occupied 21,851 acres, were next in acreage extent, the potatoes yielding an average of 89 bushels per acre. Pulse crops, beans and peas, had an acreage of 16,816, of which the beans occupied 16,639 acres, with a yield of approximately 10 bushels per acre. Miscellaneous vegetables occupied 7,635 acres. This leaves 103,445 acres, or somewhat less than one-third of the improved land for pasture and orchards.

Monroe County ranked second in the State in 1899 in the value of agricultural products not fed to live stock. This amounted to $6.454,975, or $14,277 per square mile, or $18.99 for each acre of improved land in the county, and represents an average income of $1,096 for each farm, and a gross income of 16 per cent on the value of live stock, implements, buildings, and land.

The adaptation of soils to the production of certain crops has been generally recognized by the farmers. While the major part of the county can be farmed as general or grain farms, there are certain soils that are better adapted to special crops. The fine sand and lighter phases of the fine sandy loams are best adapted to truck crops and early potatoes, to the growing of nursery stock and the production of certain fruits, such as peaches, cherries, blackberries, raspberries, and other bush fruits. Grape culture where carried on upon this kind of soil, especially near the lake, is very successful. Another special crop soil is Muck, which is invariably used for those crops best adapted to it, such as truck crops, potatoes, onions, etc. The Clyde soils, which in a way are closely related to the Muck, are most productive only when such special crops are grown.

The heavy clays and clay loams are most productive as grain and grass farms and are generally utilized for this purpose, though an exception is found near Honeoye Falls, where a heavy clay has been thoroughly underdrained and is used for the growing of nursery stock.

The loams, fine sandy loams, and silt loams form the greater proportion of the general and grain farms, while the fine sandy loam is the best potato soil.

The fruit industry in the northern half of the county shows in a marked way the value of selecting crops for different kinds of soils. Here apples and pears are invariably planted on the loams, silt loams, and heavier phases of the fine sandy loams, while peaches and cherries are planted on the lightest phases of the loams, silt loams, fine sandy loam, fine sand, and gravelly loam. Although apples, pears, and quinces will grow and produce well on a heavy soil, these soils should be well drained.

Alfalfa is quite generally grown and can be grown successfully on most soils of the county if they are well drained and limed.

A special crop lately introduced is the commercial growing of flower seeds for seedsmen, and a great many acres are devoted each year to this industry.

Crop rotation, though generally practiced, is not as systematic as it should be. The greater number of the Monroe County soils are easily tilled and lend themselves to short-term rotations. Where long-term rotations are used they generally consist of spring grains, as oats or beans, followed by wheat and grass, sod for one or two years, with pasture for one or more years.

The following crop rotations are outlined for the different soils and systems of farming found in this county:

For the Dunkirk loam (heavier phase) or silt loam, beans followed by wheat or grass (clover and timothy), with sod two or three years; or corn one year, followed by oats, then sown to wheat and seeded to grass, with sod one or two years. On the lighter soils, as light Dunkirk loam and fine sandy loam, potatoes followed by oats or beans, then wheat seeded to timothy and clover, sod one or two years (followed by either corn or potatoes, oats, wheat, and grass with sod). On clays and silty clay loams, corn followed by oats, wheat, and grass seeding of clover and timothy, sod two or more years.

Where orchards are planted and cultivated a crop should be grown each year that can be plowed under, in order to keep up the supply of organic matter in the soil. This green manure crop need not interfere with the tillage of the orchard, since a crop such as buckwheat, crimson clover, oats, or rye can be sown late in the summer and turned under in late fall or early spring.

Alfalfa, whenever stock or dairy farming is carried on, should have a prominent place. It not only improves the soil, but produces a feed high in protein.

The light sands should be so farmed as to return the greatest possible amount of organic matter to the soil, either as cover crop or green manures plowed under, or by the application of barnyard manure.

It is difficult to plan a system of rotation for the Genesee soils because of their nearness to streams and rivers and the frequency of

their flooding. Canning crops or corn may be followed by oats with seeding to clover and timothy, meadow for two or three years followed by pasture.

These suggestions for rotations are only general and will not suit all farms. Each farmer must work out a system of crop rotation for his individual farm or farms, having in mind those crops best suited to his particular soils and conditions, the main money crop, and fertilizer to be used. The varieties of each crop should include those that best suit his kind of farming, soils, and conditions, markets and transportation facilities.

The farming methods and practices are quite well suited to the present conditions. That portion of the county within immediate influence of the lake is largely devoted to fruit growing. The light sands near Rochester as well as the cultivated Muck areas are used extensively for truck gardening, while the more remote sections are used to produce such crops as will withstand some delay in marketing.

In 1900 there were 5,889 farms in the county, having an average acreage of 64.9 acres each. Of these farms, 63.5 per cent were operated by the owners.

A study of the value of farm lands shows the continuous development of the agriculture of the county. The census of 1900 gives the value of the farm land with improvements, except buildings, as $23,724,770, or $62.12 per acre. The valuation with buildings is $35,322,250, or $92.48 per acre. Monroe County is exceeded only by Erie County in the total value of farm lands, improvements, implements, and live stock—the total investment in agriculture.

The labor situation is somewhat complicated. Rochester absorbs large quantities of labor, and as most of the forms of farm industry need help only at certain times of the year, it is often difficult to obtain competent men. There is much labor required in the aggregate, however, as during the season of 1899 some $1,091,660, or one-sixth of the gross income, was expended for that purpose.

The betterment of agriculture in Monroe County hinges on many things. Drainage is undoubtedly the most essential factor in the improvement of the soils, because of its fundamental character. Many of the soils, owing to their physiographic positions and mode of formation, are too wet for cultivation, while others already under cultivation are not producing what they should because of insufficient drainage. Thousands of dollars are lost annually because of this deficiency in tilled fields, while hundreds of acres are untilled and uncropped for the same reason.

Better methods of tillage and management of the soil are also suggested, especially in the matter of plowing and preparing the seed bed. After drainage and careful preparation of the seed bed the

most important matter is the selection of varieties of crops to which the soil is well adapted, the rational use of fertilizers, and the maintenance of organic matter in the soil. More attention to these matters will certainly result in greater profits to the farmer and a great increase in the value of the agricultural output of the county.

SOILS.

Besides those areas classed as Dunesand, which includes some Beach sand, and Marsh, 25 types of soils are mapped in Monroe County. These are grouped in five important series. In addition to these series, there are a number of miscellaneous soils of small areal extent.

The materials of which the soils of Monroe County are composed have been derived from extraneous material brought to the region by glacial ice, from the weathering and disintegration of some of the country rock, and from the accumulation of organic matter under swampy conditions.

The formation of the materials which make up these 25 soils has been effected by six processes: (1) Deposition from glacial ice; (2) deposition in glacial lakes; (3) residual decay of the country rock; (4) deposition by streams, ancient and modern; (5) the accumulation of partially decayed organic matter; and (6) the accumulation of wind-blown material. Of these methods of formation, the first two have given by far the greater number of the soil types of the county. The soils formed by these processes are placed in the Dunkirk, Ontario, Lockport, and Clyde series. Dunesand, which includes some Beach sand, is of recent deposition. The former has been deposited by the wind; the latter by wave action. Those soils formed mainly from residual material are the Allis clay, Honeoye stony loam, and in certain locations the subsoils of the Lockport series. Muck and Warners loam are the only cumulose soils in the area. The former is composed of the decayed organic material and is formed under swampy conditions, while the latter has in addition to this an accumulation of inorganic matter (marl).

The rock formations most important in contributing to the soils are, from north to south, first, the Medina formation, which consists of shales and sandstones usually of Indian red but sometimes of gray color. These rocks are closely related to the soils mapped as Lockport stony loam, Lockport fine sandy loam, and the Hamlin silt loam. In the stony loam is found the closest relationship to this formation, since the lower part of a section of the Lockport stony loam is residual from the underlying shale and sandstone. The Hamlin silt loam found along the stream courses which extend through the Lockport soils is also characterized by the Indian red color of the underlying formation.

South of the Ridge Road is found the Niagara group of rocks, of which the Lockport limestone appears to have had the greatest influence upon the soils of that region. The influence of this rock formation is most marked in Sweden and Ogden Townships. It is a fossiliferous, rather thick bedded magnesian limestone, outcroppings of which are found at various points in the county.

The next important consolidated formation affecting the soils is the Salina. The light olive-colored shales of this group outcropping in southern Riga Township form upon weathering the soil material of the Allis clay.

The Bertie waterlime (the last stage of the Salina group) is another important division and is closely associated with the Onondaga limestone of the Devonian group. The Onondaga is a massive and somewhat crystalline limestone, which upon weathering breaks down into irregular fragments and is the principal source of the soil material of the Honeoye stony loam, found in the southern part of Wheatland, Rush, and Mendon Townships.

The Dunkirk soils, as stated, are derived from water-laid deposits of glacial age. They range from gravels and sands to clay—the heaviest deposit of the county. They are usually of brown, gray, or yellowish color. There are eight types in this series. Of the silty clay loam, a light phase has been recognized and shown on the map by hachures. Of these eight types the fine sand, silty clay loam, and silt loam predominate. This series occurs in a broad belt across the northern portion of the county and a narrower and less continuous belt across the southern portion, with smaller areas occurring in all parts of the county.

Closely associated with the Dunkirk soils is a series which was formed in much the same manner, but under swampy conditions—the Clyde soils. On account of the high content of organic matter these soils are much darker in color than the Dunkirk soils. Poor drainage conditions favored the growth of plants, and the preservation of their remains, which in turn affected the color of the soil. Of this series two types have been mapped, the fine sandy loam and loam. These soils are quite tertile, but for the most part are much in need of drainage.

The Lockport series includes two types—stony loam and fine sandy loam. These are found only north of the Ridge Road, and for the most part are level and generally in need of drainage. They are brown or Indian red in color and relatively shallow. The lower portion of the soil section is usually residual from the underlying Medina shales and sandstones.

The Ontario series, of which there are four types, is of glacial formation. These soils are associated with the Dunkirk soils and resemble them somewhat, although differing in many respects, chief of

which is the topography and the lack of general stratification of the material. The types recognized are the fine sandy loam, the loam, and the silt loam.

Those soils included in the Genesee series are a fine sandy loam, loam, silt loam, and silty clay loam. They are formed from the alluvial deposits brought in at times of floods and are first bottom soils. After the Dunkirk and Ontario soils, the Genesee soils are of greatest value agriculturally.

Of the miscellaneous soil types Dunesand, which includes some Beachsand, is nonagricultural. Marsh, under present conditions, is nonagricultural, but if drained would be fertile. Warners loam is largely nonagricultural because of its swampy condition and the shallowness of the surface material. Hamlin silt loam, a local type of alluvial origin, is for the most part suited for pasture. Allis clay, a residual soil, is largely in pasture, owing to its shallow soil and poorly drained condition. Honeoye stony loam, a soil composed largely of residual material from the Onondaga limestone, occurs mainly in the southern part of the county. Essentially the same soil is formed from the Niagara formation through the central part. This soil is shallow and generally unsuited for cultivation on account of the high content of rock fragments.

Below is a table giving the acreage and per cent of each of the soil types recognized in the accompanying map of Monroe County.

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Ontario loam	89,536	20.8	Ontario gravelly sandy loam	4,416	1.0
Ontario fine sandy loam	69,760	16.2	Honeoye stony loam	4,416	1.0
Dunkirk silt loam	54,080	12.5	Muck	4,160	1.0
Dunkirk fine sand	49,536	11.5	Lockport fine sandy loam	4,096	.9
Dunkirk silty clay loam	16,576	5.2	Marsh	3,648	.8
Light phase	6,016		Dunkirk loam	3,136	.7
Dunkirk fine sandy loam	19,264	4.5	Genesee loam	2,624	.6
Ontario silt loam	18,688	4.3	Genesee fine sandy loam	2,176	.5
Dunkirk gravelly loam	15,744	3.7	Warners loam	1,728	.4
Genesee silt loam	14,528	3.4	Dunesand (includes some Beach sand)	1,536	.4
Lockport stony loam	1,600	2.9	Allis clay	704	.2
Heavy phase	10,944		Dunkirk gravelly sand	704	.2
Dunkirk gravelly sandy loam	10,688	2.5	Genesee silty clay loam	640	.1
Clyde loam	6,912	1.8			
Light phase	768		Total	431,360	.....
Clyde fine sandy loam	6,592	1.5			
Hamlin silt loam	6,144	1.4			

DUNKIRK GRAVELLY SAND.

The soil of the Dunkirk gravelly sand is a yellow to brown gravelly sand 5 or 6 inches deep. The sand is of a fine to medium texture, while the gravel varies from fine to coarse and is waterworn. The

subsoil from 6 to 36 inches is of the same material as the soil, and is usually light yellow to yellowish brown in color. This soil type varies in its content of sand and gravel. Sometimes the surface soil is free of gravel and the proportion in the subsoil is excessive. In other areas the reverse is true. Stratification is rarely shown within a 3-foot section, although deeper cuts show cross bedding.

The area of Dunkirk gravelly sand is restricted, the type being confined entirely to the vicinity of Mendon Pond.

The natural drainage is good because of the loose, open structure, which permits of free movement of water.

Agriculturally this soil is of little value. The topography is such that cultivation is difficult. Where cultivation can be carried on to advantage, potatoes, oats, corn, and hay are the principal crops. By careful management early truck crops and small fruits could be grown to advantage on this soil because of the open structure and thorough drainage. Whenever cultivated there should be a systematic rotation of crops, which would add to the organic content of the soil. The application of barnyard manure is necessary for the best results.

The value of Dunkirk gravelly sand ranges from $25 to $50 an acre.

DUNKIRK GRAVELLY SANDY LOAM.

The soil of the Dunkirk gravelly sandy loam is a brown, friable, gravelly sandy loam, 8 to 10 inches deep. The subsoil is a yellowish brown fine sandy loam to a depth of 3 feet. In the second foot the subsoil is generally quite silty, but it becomes lighter in the third foot. The surface soil contains a relatively large proportion of waterworn gravel and stones.

This soil permits easy cultivation, owing to its loose and friable characteristics and can be worked under a wide range of moisture content.

The most important areas of the Dunkirk gravelly sandy loam are situated in the townships of Rush, Henrietta, and Wheatland, and in the Mendon kame region in the towns of Mendon and Pittsford. Other areas occur on and in the vicinity of the Ridge Road. The topography varies from undulating to rolling and hilly. Natural drainage is excellent.

The deposits from which the Dunkirk gravelly sandy loam is derived are glacial in age, consisting of water-laid deposits in glacial stream valleys, shore-line deposits of glacial lakes, and kame deposits.

Native trees of white pine and hemlock, oak, and a scattering of other hardwoods are found.

That portion of this soil type suited topographically for cultivation is well adapted to general farm crops. Wheat yields from 15

to 25 bushels; oats, 40 to 50 bushels; beans, 10 to 25 bushels; and hay, from 1½ to 2 tons per acre. Occasional fields of alfalfa prove its suitability for that crop.

For improvement of the soil may be recommended the systematic rotation of crops, in which legumes hold a prominent part, frequent manuring, using both green manure and stable manure, and the extension of the area in alfalfa.

The agricultural conditions on this type are good, and the value of the land varies from $60 to $85 an acre, in the more improved sections. The less desirable areas are held at somewhat lower prices.

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

Mechanical analyses of Dunkirk gravelly 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.*
25136	Soil	3.7	7.4	6.4	14.9	20.5	37.0	9.8
25137	Subsoil	1.4	4.5	5.3	17.3	27.2	36.0	8.1

DUNKIRK GRAVELLY LOAM.

The soil of the Dunkirk gravelly loam is a dark-brown friable loam 10 inches deep, containing a considerable amount of rounded and waterworn gravel, varying from fine to coarse. The subsoil is a gravelly loam in texture but of a lighter color than the surface soil. In the third foot it changes, usually becoming darker and more compact. Beneath the 3-foot section there is usually a deep subsoil of stratified sands and gravels.

Even though there is generally a high content of stone and gravel in this soil, it is quite easily cultivated and a good tilth is not difficult to secure and maintain. Owing to its open structure and consequent rapid internal drainage, it can be worked under a very wide range of moisture conditions, yet it contains enough fine material to prevent serious leaching.

The greater proportion of this soil type occurs in Wheatland Township. Another area of considerable size occurs east of Fairport, while the rest of the occurrences are rather widely scattered, mainly, however, in the southern part of the county. The surface is largely level to undulating, though some small areas occur on the tops of small hills or ridges. As a whole, drainage is good. In some of the lower-lying areas underdrainage would no doubt be beneficial.

The Dunkirk gravelly loam is derived mainly from deposits left by glacial streams. It is one of the best general farming soils in Monroe County. All the staple crops give good yields with reason-

ably careful cultivation. Corn yields from 75 to 100 bushels per acre; beans, 10 to 25 bushels; oats, 40 to 60 bushels; wheat, 15 to 25 bushels; and potatoes, 100 to 200 bushels per acre. Another feature of this type of soil is its value for the production of clover and alfalfa. The open structure insures good drainage and ease of root penetration, and the high lime content also favors the growth of both of these legumes. Alfalfa yields from 3 to 5 tons per acre, and red clover 1½ to 2½ tons. Where red clover is grown the field is usually seeded to clover and timothy, clover predominating in the product of the first year and timothy in the succeeding years.

Fertilizers are used to some extent, and stable manure whenever available.

That agricultural conditions are good is shown by the high state of cultivation maintained and the general condition of the farms, fences, and buildings. The average value of farms of this soil type is about $80 an acre, with prices ranging from $60 to $125 an acre.

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

Mechanical analyses of Dunkirk gravelly 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.*
25134	Soil	1.7	3.5	2.7	6.4	16.2	56.3	13.0
25135	Subsoil	3.6	8.5	6.3	11.2	21.8	38.3	10.1

DUNKIRK FINE SAND.

The soil of the Dunkirk fine sand consists of a fine sand or in some instances a loamy fine sand, with a depth of 4 to 10 inches. The subsoil to a depth of 3 feet is a yellowish fine sand, sometimes changing to very fine sand in the third foot. This soil is very easy to cultivate and is tillable under a very wide range of moisture conditions.

The Dunkirk fine sand is not widely distributed in Monroe County, but lies largely north of the Ridge Road in Hamlin, Parma, Greece, Irondequoit, and Webster Townships. Other areas are found in Perinton, Pittsford, Brighton, and Gates Townships. The surface is flat to undulating, with areas lying in the Ontario plain, but more rolling to the south of that plain. It is found at elevations ranging from a little below 250 to 700 feet above sea level. The natural drainage is good and frequently is excessive.

The greater part of the Dunkirk fine sand is a glacial-lake deposit. The belt in the southern part of the city of Rochester, however, as well as the large area a few miles southwest of the city and smaller areas elsewhere, are kame rather than glacial-lake deposits.

This soil is used for general farm crops, fruit growing, and trucking, but much of the area now occupied by general crops should be utilized for fruit and early truck crops. It is a well-drained, early soil, and the location is such that markets can be easily reached.

Much of this soil is at present used for fruit growing, and the orchards and plats could well be extended, especially in the growing of peaches, cherries, grapes, bush fruits, and strawberries. While apples are grown to some extent on this type and acquire good size and color, they do not have the flavor and keeping qualities of those grown on the heavier soils. Early truck crops should include early potatoes, peas, sweet corn, beans, tomatoes, and celery.

Corn yields from 50 to 60 bushels of ears per acre; wheat, 12 to 20 bushels; oats, 30 to 50 bushels; and potatoes, 125 to 150 bushels per acre. For the production of hay, alfalfa and the clovers yield best. Alfalfa in three cuttings gives 2½ to 3 tons, and clover 1½ to 2 tons per acre. Clover generally occupies an important place in the crop rotations, especially where potatoes are grown. Commercial fertilizers are generally used.

Suggestions for the improvement of the Dunkirk fine sand include more careful selection of the crops best adapted to this particular soil type, a more systematic rotation, in which legumes hold a prominent place, and manuring, by the application of stable manures or by green manures. At the present time green manures are quite extensively used in orchards on this soil. Buckwheat, clover, or rye are grown and plowed under for the sole purpose of maintaining the soil fertility and reducing the amount of tillage during the summer.

The price of farm land of this type ranges from $30 an acre on the poorest to $150 and $200 an acre in the best improved sections for areas in orchard or well suited for trucking.

DUNKIRK FINE SANDY LOAM.

The Dunkirk fine sandy loam is a dark-brown or yellowish-brown to gray, friable, fine sandy loam, 8 to 10 inches deep, underlain by a light-brown to yellowish fine sandy loam, always light in texture and in many places approaching that of a fine sand.

The size of the sand grains varies somewhat from place to place, and while the sand is, as a rule, fine to very fine, there is some medium to coarse sand present. On the other hand, in some localities the surface soil is inclined to be silty. Upon close examination, however, the average texture of the 3-foot section is seen to be a fine sandy loam. Gravel pockets are sometimes present in the subsoil, which in almost every case is lighter than the surface soil. Throughout the soil profile there is a varying content of gravel and waterworn stones, and this coarse material is sometimes present to such an extent that

it really forms a "gravelly" or "stony" fine sandy loam. In no case, however, are stone and gravel abundant enough to interfere appreciably with cultivation.

In the southern part of the county an important area occurs in the township of Perinton, where it adjoins an area of the same soil in Ontario County. Its topography consists of an elevated, nearly level plain, the highest land in the county. The steep slopes between the plain and the lower land around it also have the same soil as that on the top, in some cases, however, being somewhat gravelly.

The Dunkirk fine sandy loam is one of the less important soils in the county when considered from the point of view of the area covered. It occurs in the northern part of the county on both sides of the Ridge Road. One of the largest areas occurs just southwest of Rochester, and another just northeast of Adams Basin. Other bodies are found in Webster Township.

The Dunkirk fine sandy loam does not differ widely in its adaptation from the Dunkirk fine sand or the Ontario fine sandy loam. It lies between these in agricultural value, being heavier than the former and lighter than the latter. It is a better general farm-crop soil than the former and not so good as the latter; a little better for grain and potatoes than the former; not so good for these as the latter. It is better for trucking and small fruits, as well as peaches, than the Ontario fine sandy loam.

The topography of the type is gently rolling, except in small sections of the southeastern area. The natural drainage is excellent, there being usually no necessity of underdrainage. The Dunkirk fine sandy loam is a water-laid deposit, precipitated either on the bed of a glacial lake or as kame deposits. Those areas lying north of the Ridge Road belong in the former group, while those lying south of it, excepting a few small areas very close to the road, belong in the latter.

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

Mechanical analyses of Dunkirk fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
25140	Soil	1.3	4.0	4.6	16.1	24.9	35.9	12.7
25141	Subsoil	1.0	3.5	4.6	17.4	18.9	46.2	8.0

DUNKIRK LOAM.

The Dunkirk loam consists of a dark-brown to gray loam or silt loam, 8 to 10 inches deep, underlain by a subsoil of gray mottled silt loam. The subsoil often contains layers of gray sand or gravel.

While the subsoil varies considerably, the surface soil is relatively uniform. Some small areas of the type contain large quantities of rock fragments.

This soil occurs in small areas only, mainly in the central-western part of the county. It is much like the Genesee loam in character, but does not occur as a typical alluvial soil. It is found in shallow basins, apparently small local lake beds that have become silted up. It never occurs along the large streams of the county where alluvial soils have been formed, but at the heads of very small brooks that are too small to deposit true alluvium. Permanent lakes may never have existed in these basins. The material may have accumulated by colluvial wash and by deposition in times of temporary submergence by standing water.

The Dunkirk loam is adapted mainly to pasture, to which the greater proportion of its area is now devoted. Its areas of occurrence are so small that it is farmed only in connection with other soils and affords no opportunity for the development on it of a farming system.

DUNKIRK SILT LOAM.

The soil of the Dunkirk silt loam is a dark-brown or grayish silt loam 8 to 12 inches deep. It is generally friable and easily tilled, though where drainage is poor it is inclined to bake and crack. The subsoil consists of a yellowish silt loam to a depth of 24 inches, underlain by a darker colored, heavy, compact silt loam to 3 feet or more. The subsoil is often mottled with spots of yellow.

This soil occurs in large areas north of the Ridge Road in the townships of Hamlin, Clarkson, Parma, and Greece. Smaller areas occur in Webster, Irondequoit, Penfield, Pittsford, Mendon, and elsewhere.

The topography is flat to undulating, and the natural drainage is fair, considering the fine texture and dense structure of the type. Surface drains are used, however, in the more level tracts.

The Dunkirk silt loam is composed of glacial material which has been deposited in quiet waters. Those areas occurring on the Ontario plain show evidence of deposition in relatively shallow waters.

The native trees found on this type include elm, oak, walnut, beech, and hard maple.

The Dunkirk silt loam is well adapted to nearly all of the different kinds of grain and general farming crops and to fruit growing and dairying. Although formerly used largely for general farming, fruit growing has long been carried on, and at the present time orchards occupy a considerable proportion of the type.

Wheat yields from 20 to 35 bushels per acre; corn, 60 to 100 bushels of ears; barley, 40 to 60 bushels; oats, 40 to 70 bushels; beans, 9 to 25 bushels; potatoes, 100 to 150 bushels; and hay, 1½ to 2 tons per acre.

Orchard land in bearing on Dunkirk silt loam yields much larger incomes than where used for either grain or other general farm crops or for dairy farming. Apple orchards are the most successful, and when well cared for they yield from $50 to $1,400 per acre. The best orchards are those from 35 to 50 years of age that have been systemmatically cultivated, pruned, and sprayed. Pear and quince orchards are also very profitable. Peaches on the lighter areas of this soil begin bearing at 3 or 4 years of age and yield good crops of highly colored and fine-flavored fruit. Some small successful vineyards were observed. At the present writing (1910) there are many orchards not yet of bearing age.

The agricultural conditions on Dunkirk silt loam as a whole are good, especially where fruit growing is most extensively developed and where the desirability of good drainage and thorough cultivation is most fully appreciated. The fruit growers have also learned the value and need for organic matter in the soil of their orchards, which they supply by the cover-crop system and by applying stable manure and straw from their grain fields. The stable manure is either produced on the farm or is shipped from Rochester or Buffalo. To this system of management is due the present prosperous condition. The general agricultural conditions on those areas of the Dunkirk silt loam devoted to general, grain, and dairy farming range from good to poor. Those portions most highly developed show careful management and cultivation. The poorer sections could be greatly improved by thorough drainage and a more systematic rotation of crops best suited to the particular soil conditions. On the poorer drained areas there is a tendency for the soil to bake. This is avoided to a great extent where good drainage is effected and organic manures and lime are liberally used. Planting intertilled crops in hills and cultivating in both directions also prevent the formation of crusts or baking.

In general the methods that will bring about an improvement of this soil may be summed up as (1) drainage, both surface and subsurface; (2) systematic crop rotation in which legumes hold a prominent place; (3) manuring, either by green crops plowed under or by the application of stable manure; and (4) liming.

The value of this soil ranges from $40 to $60 an acre for the poorest farms, and from $150 to $200 an acre for farms improved with orchards. Prices range anywhere between these extremes according to the location, character of improvements, and orchard acreage. Some farms in the vicinity of Hilton are of almost unlimited value and are not generally for sale. This is due to the large acreage of old and extensively bearing orchards of apples, pears, quinces, and peaches.

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

Mechanical analyses of Dunkirk 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.*
25142	Soil	0.0	0.7	0.7	3.6	20.6	61.1	12.8
25143	Subsoil	.6	1.6	1.7	5.8	27.2	52.6	10.1

The following sample contained more than one-half of 1 per cent calcium carbonate ($CaCo_3$): No. 25143 1.68 per cent.

DUNKIRK SILTY CLAY LOAM.

The surface soil of the Dunkirk silty clay loam consists of a light-brown, brown, or grayish-brown heavy silty clay loam, with a depth of 6 or 8 inches. The subsoil, to a depth of 3 feet or more, is a brown or chocolate colored heavy clay. While the surface soil varies some in the silt and clay content, the subsoil is always a heavy, dense, compact clay.

The Dunkirk silty clay loam is the most difficult soil to till in Monroe County. The heavy surface soil underlain by the still heavier subsoil interferes with its internal drainage and tends to produce a puddled waterlogged soil, which on drying out cracks badly. If cultivated when either too wet or too dry clods form which are difficult to break up unless the field is left over winter, when alternate freezing and thawing soon disintegrates the soil and leaves it in good tilth. If handled under optimum moisture conditions a good tilth results without the aid of frost, and with a minimum amount of labor.

The Dunkirk silty clay loam, which is not an extensive type in Monroe County, is found principally southwest of Rochester, directly south of Rochester, and in the southern part of Rush Township, east of Honeoye Falls.

The topography is level to slightly rolling. This, together with the compact structure of the soil and subsoil, makes it a poorly drained soil.

In origin this soil type is lacustrine, the fine-earth particles of which it is composed being derived from glacial material and deposited from the impounded water of glacial lakes which existed subsequently to the retreat of the ice sheet.

The native trees of the Dunkirk silty clay loam consist of hard maple, oak, beech, ash, elm, wild cherry, walnut, and butternut. Almost all of the original forest has been cut off, leaving only small woodlots, mainly of second-growth timber.

The Dunkirk silty clay loam is a grain and grass soil. This is generally recognized, and the soil is used in the main for these crops. Wheat yields from 15 to 35 bushels per acre; oats, 40 to 50 bushels;

hay, 1½ to 2 tons; potatoes when grown yield from 50 to 100 bushels; and buckwheat, 10 to 15 bushels per acre.

Where the land is thoroughly drained apples, pears, and quinces will do well if properly cared for. As a special crop, nursery stock does extremely well. The most extensive area used as a nursery is directly east of Honeoye Falls. Smaller nurseries are found in other parts of the county.

Agricultural conditions on this soil are not as good as they should be. The fact that the stiff clay is difficult to cultivate and that crops fail easily in seasons that are too wet or too dry discourages the investing of money in the improvement of the farms.

The most essential step in the improvement of this clay soil is thorough drainage. Farmers have recognized this to the extent of constructing shallow surface drains. These, however, are not sufficient, as they fail to remove the surplus water from the subsoil, thus preventing the proper growth and development of plant roots.

Efficient underdrainage should be established to a depth of 2 or 3 feet. Underdrains will remove the excess water not only from the surface but throughout the soil to a depth equal to that at which the tiles are placed, but leave it within reach of capillary action, and sufficient moisture will be carried upward to the plant to supply their needs. By removing the excess water the air can enter the soil, oxidation will take place more rapidly, and the soil will become more open and porous. The soil is thus enabled to store larger amounts of water in an available condition, plant roots can more easily penetrate the soil, and cultivation will become easier. All these result in larger crop yields and at a less expenditure of labor for cultivation. In many instances the increased yields for the first year after installation of the drains have almost paid for the cost of the drains, and in every case have paid a good interest on the investment.

The value of the typical Dunkirk silty clay loam varies from $40 to $60 an acre in the more remote areas, and from $60 to $90 an acre in the better locations.

Dunkirk silty clay loam, light phase.—The soil of the Dunkirk silty clay loam, light phase, is a dark-brown heavy silt loam, 10 to 12 inches deep. The subsoil is a yellowish-brown silty clay loam. As a rule the subsoil becomes lighter in the third foot. The upper portion of the subsoil is very compact and impervious to water.

The Dunkirk silty clay loam, light phase, is found only in association with the typical Dunkirk silty clay loam, in the vicinity of Rochester and Honeoye Falls, with small areas near Mendon. It usually occupies the slightly higher elevations and is surrounded by the typical Dunkirk silty clay loam. Owing to the compact nature of the soil and subsoil, its natural drainage is only fair, but is somewhat better than that of the main part of the type.

The type is formed from glacial material deposited in quiet lake water. It is best adapted to grains and grasses, ordinary farm crops, and to such nursery stock as apples, pears, and quinces as special crops.

Wheat yields from 15 to 30 bushels per acre; oats, 40 to 50 bushels; corn 30 to 50 bushels; and hay 1½ to 2½ tons per acre.

Orchards of apples, pears, and quinces do well on this soil and grapes could be grown successfully.

Agricultural conditions are usually good, but the soil could be improved greatly by thorough drainage. It is valued at $60 to $90 an acre.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of typical Dunkirk silty clay loam and of the light phase:

Mechanical analyses of Dunkirk silty clay loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
Typical:		*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
25148.....	Soil.....	0.3	1.4	1.7	4.6	8.2	56.8	26.8
25149.....	Subsoil.....	.0	.4	.3	1.2	3.6	53.2	40.9
Light phase:								
25144.....	Soil.....	.3	1.0	.8	2.0	4.1	70.5	21.3
25145.....	Subsoil.....	.0	.4	.5	1.1	9.0	67.1	21.8

The following sample contained more than one-half of 1 per cent calcium carbonate ($CaCO_3$): No. 25149, 14.34 per cent.

ONTARIO FINE SANDY LOAM.

The soil of the Ontario fine sandy loam is a dark-brown friable fine sandy loam, 8 to 10 inches deep, underlain by a light-brown to yellowish fine sandy loam to fine sand to a depth of 36 inches or more. The texture is somewhat variable, and while the sand, as a rule, is fine to very fine in texture, there is some medium to coarse sand present. In some localities the surface soil is inclined to be silty. The prevailing texture is, however, fine sandy loam. Occasional gravel pockets are present in the subsoil, which in almost every case is lighter than the surface soil. Throughout the soil profile there is a varying content of gravel and waterworn stones, and sometimes the quantity is sufficient to constitute the material a gravelly or stony fine sandy loam. In no case, however, is the proportion of rock fragment great enough to interfere with cultivation.

The Ontario fine sandy loam occurs throughout Monroe County, but is most extensively developed in Henrietta, Rush, Penfield, Wheatland, and Riga Townships. It occupies gently undulating to rolling areas, varying from about 400 to 700 feet above sea level. The natural drainage is better than on most of the other soil types in the county. Some tile drains have been installed in the heavier

and more level portions with good results, though, generally speaking, it is not in need of artificial drainage, the open structure and gravel content of the subsoil favoring the rapid percolation of excess water far enough below the roots of growing crops to prevent injury. On the other hand, the ground water is sufficiently near the surface to supply moisture to the plants by capillary action.

The origin of the Ontario fine sandy loam material is glacial. It includes the more sandy portion of the unmodified glacial till occurring in the belt of country lying between the Ridge Road and the northern boundary of the Lake Warren deposits of the southern part of the county.

Nearly all the native timber has been removed and the greater part of the type is under cultivation. This type is adapted to a wide range of general farm crops and fruits and is one of the most valuable soils in the area. Of the general farm crops, potatoes are at present the most important. Suitable varieties yield from 125 to 300 bushels per acre. Wheat yields from 20 to 30 bushels; oats, 40 to 60 bushels; corn, 40 to 50 bushels of shelled grain; beans, 15 to 25 bushels; hay (clover and timothy), 1½ to 2 tons; alfalfa, 3 to 4½ tons in 3 cuttings; and cabbage, 8 to 15 tons per acre. In connection with the production of forage crops, dairying is extensively carried on in some localities.

Of the fruits, apples and peaches occupy the largest area. Both these fruits give bountiful yields of well-flavored and finely colored fruit. Cherries where grown are very successful, as one would infer from the numerous seedling varieties, both sweet and sour, that are found growing along the roadside and fence rows. Pears and quinces do not yield so well as on heavier soils. Strawberries and bush fruits are satisfactory crops. Of the truck crops, cucumbers and cantaloupes have given good returns.

The farming methods in use on the Ontario fine sandy loam are as good as can be found in Monroe County. The wide range of crop adaptation, ease of cultivation, good roads, and proximity to shipping points and markets make it a most desirable type of soil. The general farm conditions are good. Fences and buildings are well cared for and the farms well cultivated.

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

Mechanical analyses of Ontario fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
25140	Soil	1.3	4.0	4.6	16.1	24.9	35.9	12.7
25141	Subsoil	1.0	3.5	4.6	17.4	18.9	46.2	8.0

ONTARIO LOAM.[1]

The Ontario loam is one of the three most important soils in Monroe County, both in acreage and in agricultural value. The surface soil is a brown friable loam or silt loam to a depth of 8 to 12 inches. The subsoil is a light-brown to yellowish-brown loam to a depth of 36 inches. In every case the soil contains a sufficient quantity of fine sand or very fine sand to make cultivation relatively easy and to give good tilth. In some localities, viz, south of Spencerport and Brockport, and in the vicinity of Hamlin, there is a sufficient quantity of fine sand in the surface soil to give it the appearance of a fine sandy loam, though the influence of a heavier subsoil is such that the type is classed as a loam. The subsoil as a rule grows heavier as the depth increases, although in local areas it may be found either predominantly sandy or silty in the third foot. Varying amounts of rounded stones and gravel occur in both the soil and subsoil.

The larger distribution of the Ontario loam is south of the Ridge Road in the central and western parts of the county. It is most extensively developed in the townships of Sweden, Ogden, Gates, Pittsford, Mendon, Henrietta, and Riga. Other areas are located in Hamlin, Greece, Clarkson, Wheatland, and Rush Townships. Smaller areas are found in Irondequoit and Webster Townships.

The topography is gently rolling to somewhat hilly, and the elevation varies from 300 to 650 feet above sea level. Though the topography is such that surface drainage is generally adequate, the texture and structure make artificial drainage necessary in some cases in order to obtain a free movement of water through the subsoil.

The Ontario loam is formed through weathering of glacial material which, for the most part is foreign to this locality, but which is mixed with more or less of the local rock material ground up by the ice sheet in passing southward over this region. Upon recession of the ice to the north, the transported material was dropped as a blanket of till or glacial debris.

As mapped in Monroe County, the Ontario loam may contain small areas of water-laid soils that have escaped detection. These, if they oocur, may be expected within a mile or two south of the Ridge Road and in the extreme southern part of the county. The attempt has been made to exclude from the Ontario series all soils derived from stratified glacial material and to include in the Dunkirk only those soils that have been derived from such material or from material free from the bowlders of ordinary glacial till.

[1] The difference between Dunkirk soils and Ontario soils is one of arrangement and sorting of material and not, as a rule, one of difference in composition and origin of material. In some cases the sorting and the stratification which are characteristic features of the Dunkirk soils are not easily recognized in the field. In some cases, therefore, the boundary lines between the Dunkirk and the Ontario soils are somewhat arbitrary.

The native forests consist of oak, elm, ash, hard maple, white pine, walnut, wild cherry, butternut, and hickory.

All general farm crops are adapted to this soil. Dairy farming is also carried on to some extent, and fruit growing is an especially important industry. The latter is particularly true on the lighter phases of the soil. The fruits of most importance are apples, pears, peaches, cherries, and bush fruits. Asters and other flowers are grown as special crops, both for the blooms and seed. The production of flower seed is an important industry in the townships of Parma, Greece, and Gates.

Where general crops are grown wheat yields from 15 to 35 bushels per acre; corn, 50 to 75 bushels of shelled grain; oats, 40 to 65 bushels; beans, 15 to 30 bushels; hay (timothy and clover), 1½ to 2 tons; and potatoes, 100 to 150 bushels. Alfalfa is successfully produced on well-drained areas, and yields on an average from 3 to 5 tons per acre.

A crop rotation commonly practiced is sod followed by corn or potatoes, followed by beans, and then by oats or wheat, seeded to clover and timothy or alsike and timothy. Chemical fertilizers are commonly used and generally consist of mixtures put out by fertilizer companies for the particular crop to be grown. As is general with other types of soils in this county, commercial fertilizers are used in a haphazard way, no particular care being observed in their selection, the recommendation of the fertilizer manufacturers being the only guide as to their value.

In general for Ontario loam it is recommended that more efficient underdrainage be installed, that systematic crop rotation be established, the specific fertilizer needs of the soil for different crops be determined by field experiments, and that those crops and varieties of crops best suited to this particular soil type be carefully selected. Live stock should be more extensively fed and the manure returned to the soil. Many farms in the vicinity of Rochester could be operated to the best advantage as dairy farms. The adaptation of the soil for this purpose, together with good roads and the nearness to markets assist to make it a profitable industry. These farms if utilized in dairying could be operated more economically under soiling systems, as the land is too valuable to be used as pasture. Other sections more remote from the markets may be best utilized for mixed farming.

The agricultural conditions are good throughout the area of Ontario loam, though much improvement could be made along the lines just suggested.

Ontario loam farms sell at prices varying from $85 to $125 an acre, when located more remote from good roads and shipping points. Farms advantageously situated with reference to roads and shipping

stations, with good buildings and a moderate acreage of orchards, command prices which range from $125 to $200 an acre.

Mechanical analyses of typical samples of the Ontario loam are shown in the following table:

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.*
25138	Soil	0.4	1.6	2.2	8.5	11.4	59.8	15.6
25139	Subsoil	.6	2.5	4.3	17 0.	20.4	39.1	16.0

ONTARIO SILT LOAM.[1]

The Ontario silt loam is a dark-brown to grayish silt loam, 8 to 12 inches deep. It is, as a rule, friable and easily tilled, especially where it contains a small percentage of gravel and small stones, as is usually the case. In depressions and flat areas where the fine material has been accumulated and where the drainage is poor it is, however, inclined to bake.

The subsoil consists of a yellowish to grayish silt loam, passing sometimes into a heavy mottled reddish, yellowish, or gray silty clay. It has the appearance of having been derived to a considerable extent from the decay of the underlying shale and shaly limestones. In most of the areas of its occurrence there are usually a great many limestone fragments in both soil and subsoil. In the Mendon area limestone is much less common.

The topography is rolling to gently undulating. Only in narrow strips can it be said to be flat. The soil is found in those areas where the glacial till has been derived largely from soft rocks, such as shales and shaly limestones.

Agriculturally as well as physically this soil is similar to the Dunkirk silt loam. It differs from it in being, as a rule, better drained, in having a more rolling topography and many more stone fragments, usually small, however. It is more easily cultivated than the Dunkirk silt loam, is somewhat better adapted to clover and the heavier grain crops. It is not utilized to any great extent for growing fruit, but is used mainly for general farming. Wheat yields 20 to 25 bushels per acre; corn, 40 to 45 bushels; beans, 15 bushels; oats, 40 to 60 bushels; and hay, 1½ to 2 tons. The soil is valued at from $80 to $100 an acre, with an average perhaps slightly above $85.

[1] The Ontario silt loam was mapped as Dunkirk silt loam. When taken up for correlation it was seen that most of it lay above the level of ancient glacial lakes. It was found by inspection also that a large part of it was stony, differing very little, if any, from the less stony phases of the till. On this basis most of the type occurring south of the Ridge Road and that part of it mapped as the stony phase of the type lying north of the Ridge Road has been correlated with the Ontario silt loam.

ONTARIO GRAVELLY SANDY LOAM.

The soil of the Ontario gravelly sandy loam is brown to gray in color, about 8 inches deep, and friable. It is underlain by a more compact, yellowish gravelly loam to sandy loam.

The type occurs on a few drumlins only and in the extreme southern part of the county. It does not differ in any important respect from the gravelly phases of the Ontario fine sandy loam. It is more gravelly than the latter as a whole and occurs on drumlins that are steeper than the average, but the crop adaptations of the two soils are essentially the same.

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

Mechanical analyses of Ontario gravelly 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.*
25162	Soil	0.0	3.8	5.2	18.5	22.7	37.6	12.0
25163	Subsoil	2.4	4.1	4.4	14.6	21.2	37.6	15.5

LOCKPORT STONY LOAM.

The soil of the Lockport stony loam consists of a dark-brown friable loam, from 8 to 10 inches deep. It is underlain by a reddish-brown or Indian-red clay, which is characteristically mottled with yellow and gray, and rests directly on Medina sandstone. The surface soil is marked by the presence of numerous foreign bowlders and small stones of foreign rocks, together with fragments of Medina sandstone. Numerous small gravel and sand areas are scattered throughout the type.

This soil type occurs only north of the Ridge Road in the townships of Parma and Clarkson. The topography is flat to undulating, and combined with the close structure of the subsoil makes natural drainage poor.

The material of this type is derived from two sources, the soil portion being formed from the glacial material, reworked and laid down as an offshore deposit in the waters of old glacial Lake Iroquois, while the subsoil is mainly of residual origin from the Medina sandstone and shales, which probably formed the lake floor. The beach line of Lake Iroquois at that time was marked by what is now known as the "Lake Ridge." At the time of formation of this soil type the waters must have been relatively shallow, as lake clays and fine materials, through which are scattered gravel and sand bars, ridges of flat, waterworn stones, and large glacial bowlders, are found in the type.

The native forest vegetation includes elm, scrub oaks, hickory, poplar, etc. Where cleared the undrained portions are used for the production of hay and for grazing. When drained, corn, oats, wheat, and hay do well, with some fruit on the areas of deeper soils.

Drainage is the most essential step in the improvement of the type, after which the less stony areas should produce profitable crops.

Agricultural conditions are not as good as they should be, owing to poor drainage and the large area that is too stony to cultivate. The greater part of the latter is in forest.

Land values vary from $40 to $70 an acre, according to the character of improvements.

Lockport stony loam, heavy phase.—The Lockport stony loam, heavy phase, is a reddish-brown to dark-brown heavy silt to clay loam, 4 to 6 inches deep, underlain by a heavy silty clay of Indian-red color. This is, in turn, underlain by the red Medina shales, which frequently occur within 3 feet of the surface and occasionally outcrop.

The Lockport stony loam, heavy phase, is confined to the Ontario plain adjacent to the Ridge Road in the townships of Clarkson, Parma, and Greece. It has nearly level or gently undulating topography, and the natural drainage is consequently poor.

The Lockport stony loam, heavy phase, is derived through weathering from the red Medina shales and from reworked glacial material. It is mostly residual. It is marked by small gravel bars and sand bars and has numerous stones and glacial bowlders scattered over the surface.

The native vegetation includes elm, oak, hickory, beech, poplar, and other hardwood species.

The Lockport stony loam, heavy phase, is difficult to cultivate, owing to poor natural drainage and the presence of glacial bowlders. Large areas are yet uncleared and only a comparatively small area has been drained. Its general use is for pasture, although the better drained areas produce fair crops. Wheat will yield from 10 to 25 bushels per acre, oats as high as 45 bushels per acre, beans 8 to 15 bushels, corn 20 to 30 bushels, and hay 1½ to 2 tons per acre.

Orchards of apples, pears, and quinces have been planted on the higher and better drained areas and do fairly well. When planted on the heavier and poorer drained phases orchards do not make proper growth, on account of the poor drainage. Underdrainage is absolutely essential to the establishing of permanently successful orchards on this type of soil.

The Lockport stony loam, heavy phase, can be improved (1) by thorough drainage, both surface and underdrainage; (2) by good tillage at the proper moisture content; (3) by systematic rotation of crops and manuring that will maintain a high organic content; and (4) by adoption of those crops that are best suited to this soil and its conditions.

The agricultural conditions as a whole are poor. This is shown in general by the poor condition of the farms, buildings, and fences, and by the crops. These conditions can be greatly improved, and the soil will respond profitably to the methods mentioned above.

The value of Lockport stony loam depends upon the location and the amount of improvements. On the heaviest phases of this soil the price of farm lands ranges from $30 to $50 an acre. The lighter phases with better improvements range from $60 to $100 an acre.

The following table gives the result of mechanical anaylses of samples of the soil and subsoil of typical Lockport stony loam and of the heavy phase:

Mechanical analyses of Lockport stony 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.*
Typical:								
25156	Soil	0.6	3.1	2.9	8.5	14.1	54.6	15.3
25157	Subsoil	.8	2.1	2.2	5.0	21.3	43.9	24.3
Heavy phase:								
25160	Soil	.7	1.4	1.1	4.1	7.4	55.5	29.4
25161	Subsoil	.2	.6	.4	2.0	12.4	49.3	34.9

LOCKPORT FINE SANDY LOAM.

The soil of the Lockport fine sandy loam is a reddish-brown to Indian-red friable fine sandy loam, 8 to 10 inches deep. The subsoil is a little darker shade than the surface soil and consists of a sandy loam to sand. This soil to a depth of from 1 to 2 feet contains a large quantity of angular fragments of the Medina sandstone. It is easily cultivated where not too stony, and under proper management good tilth can easily be obtained.

The only area of Lockport fine sandy loam in Monroe County lies directly north of the Ridge Road in the township of Webster. It occurs on the eastern boundary of the county and extends about two-thirds of the way from the "Ridge" to the lake. The topography varies from nearly level to slightly rolling, and the flatter areas have poor natural drainage.

This soil type represents an off-shore deposit of reworked glacial material, which probably was laid down in the waters of Lake Iroquois. The appearance of the materials indicates that it was deposited in shallow water near the beach line, or what is now the old Lake Ridge, along which the Ridge Road extends. The native trees are elm, beech, hemlock, cherry, maple, and locust.

The Lockport fine sandy loam is especially adapted to the production of fruits, such as cherries, apples, pears, quinces, and especially small fruits and bush fruits. More of this type should be devoted to fruit growing, to which it is far better suited than to general farm-

ing, for which at present most of it is used. The value of this type for the growing of fruit has been recognized, and the best farms are improved with orchards. Ordinary farm crops yield well. Corn yields 75 to 125 bushels of ears per acre; wheat, 15 to 30 bushels; oats, 40 to 60 bushels; hay, 1½ to 2 tons; and potatoes, 150 to 200 bushels. Productive apple orchards yield an average return of about $50 per acre. Strawberries yield from 8,000 to 16,000 quarts per acre.

Although the soil is somewhat sandy, the drainage is deficient in level areas. Where surface drains, in combination with underdrains, have been installed the best results have been obtained on this type. The surface drains dispose of the surface water quickly, while the underdrains remove the excess water in the soil and lower the ground-water level.

Where strawberries have been grown the matted-ridge method of cultivation has been most successful. Wherever wheat or oats are sown surface ditches are always opened to aid in carrying off surplus water during winter and spring.

The agricultural conditions on this type of soil are fair, but could be much improved by a careful selection of crops suited to it.

The more remote and least improved farms bring from $40 to $60 an acre, while those better located, well fenced, and with good buildings and orchards, range in price from $90 to $200 an acre.

CLYDE FINE SANDY LOAM.

The Clyde fine sandy loam consists of from 6 to 10 inches of black mucky fine sand to fine sandy loam, underlain by a gray fine sand to fine sandy loam extending to a depth of 3 feet. Under optimum moisture content the soil is friable and easily worked, although the subsoil is generally compact..

This soil occurs in scattered areas mainly throughout that portion of the county south of the Ridge Road. Like others of this series it occupies depressions and low-lying flats, and the natural drainage is poor.

The Clyde fine sandy loam consists of reworked glacial material, washed from the uplands into low swampy areas. In these a rank water-loving vegetation flourished for ages, and its slow decay resulted in the high organic content of the surface soil. The native vegetation includes scrub oak, beech, elm, and smaller shrubs, grasses, etc.

Where cleared and well drained, this soil is excellent for celery, cabbage, onions, and root crops. If not drained it is generally used for pasture, occasionally for mowing, and for the growth of basket willows.

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

Mechanical analyses of Clyde fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
25130	Soil	0.3	7.6	9.9	37.9	7.4	22.8	13.8
25131	Subsoil	.1	6.3	14.7	41.2	13.0	14.2	10.1

The following sample contained more than one-half of 1 per cent calcium carbonate ($CaCO_3$): No. 25131, 0.90 per cent.

CLYDE LOAM.

The soil of the Clyde loam consists of a dark-brown or black loam or silt loam, from 6 to 8 inches deep; the subsoil is a gray to yellow compact heavy loam or clay loam. The dark color of the soil is due to the accumulation of decayed organic matter. The subsoil is usually streaked or mottled with brown iron stains to 3 feet or more in depth. This type varies considerably in different areas. In some cases it is marked by the presence of gray sand; in others by a high percentage of silt and clay. There is only a small proportion of the Clyde loam under cultivation, but when adequately drained it is easily cultivated and good tilth is secured.

This type of soil occurs throughout Monroe County, the largest areas being developed in Sweden, Wheatland, and Henrietta Townships. All of the areas occupy low-lying positions or depressions and are much in need of drainage. The Clyde loam is derived from unmodified glacial lake deposits, and because of its poor natural drainage is in a more or less puddled condition. The high content of organic matter gives the surface soil its more or less friable properties.

The native trees include elm, soft maple, linden, black ash, with occasional trees of other hardwood species on the slight elevations.

The Clyde loam is best adapted to general farming and is used for that purpose where cultivated. Wheat yields 20 to 30 bushels per acre; oats, 40 to 70 bushels; corn, 40 to 80 bushels; beans, 20 to 30 bushels; and hay, 1 to 2 tons. This is an excellent pasture soil, and the more poorly drained areas where cleared are principally used for grazing.

The most essential improvement for the type is better drainage, which will result in longer growing seasons and easier cultivation, and consequently in better crop yields.

The agricultural conditions as a whole are poor, because of the fact that the greater proportion of the soil is uncleared and undrained. The value ranges from $50 to $85 an acre.

Clyde loam, light phase.—The Clyde loam, light phase, consists of a friable black silt loam, 6 inches deep, underlain by a subsoil of gray silt loam to a depth of 12 inches and then by a yellow silt loam to 36 inches, though in some localities considerable very fine sand is encountered in the third foot. The soil is quite high in organic matter.

This soil type occurs associated with other types of this series and is quite uniformly distributed throughout the county. In common with the other Clyde types, the topography is generally flat and the natural drainage is poor.

The type was formed by deposition in glacial lakes or by the wash of fine materials from the uplands into depressions that remained at the close of the glacial epoch.

The native vegetation includes soft maple, basswood, elm, ash, willow, and small shrubs and grasses that thrive under similar swampy conditions.

Except where well drained, basket willow is about the only crop to which this soil is adapted. When drained it furnishes excellent pasture and meadows, and such crops as corn, potatoes, cabbage, carrots, and some truck crops are grown quite successfully.

No value can be given for this soil type separately, as it in nearly every case is farmed in connection with upland soils.

The results of mechanical analyses of samples of the soil and subsoil of the light phase are given in the following table:

Mechanical analyses of Clyde loam, light phase.

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.*
25132	Soil	0.0	1.4	0.8	6.3	26.2	45.5	19.4
25133	Subsoil	1.9	3.9	2.9	7.9	11.6	52.3	19.3

The following sample contained more than one-half of 1 per cent calcium carbonate ($CaCO_3$): No. 25133, 2.25 per cent.

GENESEE FINE SANDY LOAM.

The soil of the Genesee fine sandy loam consists of a grayish to light-brown fine sandy loam, 10 or 12 inches deep. The subsoil is a yellowish fine sandy loam sometimes merging into a gray fine sand in the third foot. The open structure of the soil makes cultivation easy.

This soil type occurs mainly along the Genesee River and Honeoye Creek, but is found in some smaller areas along other minor streams of the county.

The surface of the Genesee fine sandy loam is nearly level, and except at times of flooding the natural drainage is good. The soil

has been formed by stream action and represents the heavier material deposited nearest the stream at times of overflow.

The greater portion of the type is cleared and in use for pasturage. Some areas are cultivated to such crops as corn, wheat, oats, carrots, mangel-wurzels, and onions, and good yields are secured.

General agricultural conditions are good on this soil, but owing to the fact that it occurs in comparatively small areas, and always in connection with some other type, no separate value can be stated for it.

The following table shows the results of mechanical analyses of samples of the soil and subsoil:

Mechanical analyses of Genesee fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
25166	Soil	0.0	0.1	0.4	34.4	30.4	28.5	6.2
25167	Subsoil	.0	.0	.2	24.9	38.8	29.0	7.0

GENESEE SILT LOAM.

The soil of the Genesee silt loam is a light-brown or grayish silt loam, 8 to 10 inches deep. The subsoil consists of a yellow or yellowish-brown silt or silt loam, grading into a yellow silt which often carries an appreciable amount of fine to very fine sand in the third foot. The entire 3-foot section is compact. but especially so in the lower part. The surface soil is easily tilled and can be worked to form a mellow, friable seed bed.

The Genesee silt loam is one of the most important soils in Monroe County, both in acreage and in agricultural value. The largest area is situated immediately along the Genesee River and its largest tributaries. The remainder is distributed along other smaller stream courses of the county.

The topography is uniformly level as would be expected from its position and mode of formation. The drainage is very poor, unless assisted artificially.

This soil is alluvial in origin and consists of wash of materials from the uplands deposited along the streams in the position of first bottoms. Underdrainage is difficult because no outlet can be secured that will be open throughout the year. When these soils were first formed they may have represented the deposit of fine sediment under lake waters. After the recession of these lakes the streams continued to carry and deposit fine sediment upon their flood plains. This process of formation is still in progress at irregular intervals, as is shown by the sediment left after each inundation. The floods are

irregular and may occur at any time of the year and for a number of years in succession, or again a number of years may pass without overflow of the bottoms.

The area mapped as Genesee silt loam includes the true river-bottom deposit where the river has cut a well-defined valley into the upland and spread a plain of silty sediment over its floor and also a large area of irregular shape where the river floods have spread out over a low area that antedated the birth of the river. The river work within the latter has been a work of construction only, not preceded by the destructive work of valley cutting, as has been the case where the valley is a clear cut one. The same river-borne sediment has been spread over the lowland area and also over the valley floor, so that from the point of view of the origin of the material the soils are identical in both positions.

The river silt in its broad expansion just above Rochester, the area of irregular shape referred to above, seems to be underlain by reddish mottled clay probably of lacustrine origin. Around the margin of the silt area the clay forms the subsoil and beyond the margin in many places the clay forms a fringing belt of soil.

A small proportion of the Genesee silt loam is wooded. Some oaks and elms occur along the streams.

The crop to which the Genesee silt loam is best adapted is probably grass for both pasture and mowing. The yield of bluegrass sown for pasture is abundant and the quality good. The type also yields good crops of hay, either clover or timothy. Neither of these crops are in so much danger of injury from flooding as are tilled crops. When, however, the danger from floods can be avoided general crops, such as corn, wheat, and oats yield extremely well, and such special crops as sweet corn, beans, peas, tomatoes, and beets for canning are very successfully grown.

Besides the danger from floods, the difficulty of keeping the fields free from obnoxious weeds is another drawback in the growing of tilled crops. At times of flood weed seed are scattered over the fields and as a result there is a superabundance of weeds that require much hard labor in order to keep crops clean.

The principal improvement to be suggested for this type is the quicker removal of the flood waters. This can be best done by constructing, with an ordinary road leveler, broad, shallow channels with sloping sides, which will not interfere with the use of farm machinery. In connection with these surface channels, underdrains should be installed where this is practicable.

In spite of difficulties in farming the Genesee silt loam, it is one of the most valuable soils of the country when properly handled. Prices for land of this character range from $80 to $150 an acre.

GENESEE SILTY CLAY LOAM.

The Genesee silty clay loam consists of a brown or dark grayish colored heavy silty clay loam to clay loam, 6 to 10 inches deep, underlain by a mottled drab, brown, or reddish-brown compact sticky clay. The heavy surface soil together with the compact subsoil makes cultivation difficult.

This soil is scattered throughout the greater part of Monroe County and occupies nearly level stretches along streams and stream courses. Because of its low-lying position and dense, compact structure, the natural drainage is poor.

The Genesee silty clay loam is formed in the same manner as the other soil of this series, being of alluvial origin. It occupies the higher parts of the flood plains. The fine particles of which it is composed are light and consequently are deposited in the more quiet waters farthest from the stream current.

The native timber is principally elm, with some soft maple, and other trees that thrive in moist soils.

The soil is best adapted to corn, oats, wheat, and hay, of which fair yields are obtained. It also furnishes splendid pasture and when not drained artificially this is perhaps the best use to which it can be put.

The agricultural conditions are fair, but owing to the fact that this type is generally combined with some other type in the farms, its value can not be stated separately. It would be worth much more if thoroughly drained.

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

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.*
25152, 25168.....	Soil.....	0.3	0.7	1.4	5.0	4.9	61.9	25.4
25153, 25169.....	Subsoil.....	.1	1.1	2.3	7.4	9.4	54.7	24.8

The following sample contained more than one-half of 1 per cent calcium carbonate ($CaCO_3$): No. 25153, 3.47 per cent.

GENESEE LOAM.

The Genesee loam consists of dark-brown to gray loam or silt loam, 8 to 10 inches deep, underlain by a gray mottled silt loam. The subsoil like that of all alluvial deposits is stratified, the predominant silty material containing some thin layers of gray sand and fine gravel. The subsoil being the product of deposition with little or no modification by weathering, varies considerably in color as well as in texture. The soil on the other hand is relatively uniform in

both, the former being due to weathering, the latter to mixing by the roots of plants, by animals, and by cultivation.

The soil occurs along the narrow valley bottoms mainly in the southeastern part of the county. It is usually rather poorly drained. Like the Dunkirk loam it is utilized mainly for pasture, to which it is well adapted.

HONEOYE STONY LOAM.

The Honeoye stony loam is a brown loam, carrying a large quantity of limestone fragments of various sizes and shapes. The soil material is usually quite shallow and rests directly upon the massive limestone or upon large fragments of the rock. The soil varies in different localities. Large numbers of glacial bowlders may be scattered over the surface or mixed with the limestone fragments in the soil mass, or again outcrops and ledges of the bedrock may appear. In other areas the soil seems to be purely residual and filled with fragments of chert and limestone.

With the exception of a very few scattered areas, this type is found only in the extreme southwestern part of Wheatland Township and in the southern part of Rush Township west of Honeoye Falls.

The Honeoye stony loam is the result of a mingling of material with weathered products of the underlying Onondaga limestone of the Devonian age or in some areas to the latter without the presence of any noticeable admixture of foreign material. In many cases it is probable that the ice swept the rock surface bare, leaving it exposed to the weathering agencies, which, owing to the composition and peculiar structure of the formation, proceeded quite rapidly, leaving a soil strewn with nodules of chert and large and small rock fragments.

The native timber growth includes hard maple, elm, oak, ash, hickory, and other hardwoods, part of which remains over the rougher and stonier sections.

Wheat, corn, oats, hay, and other crops yield well on the deeper areas of this soil type, but the larger proportion of it is and should be in permanent pasture and woodland. The chief objections to this soil for general cropping are its shallowness and high stone content. This not only makes cultivation difficult, but reduces the supply of moisture to such an extent that ordinary farm crops suffer. Even the pastures quickly show the effects of lack of moisture during periods of droughts.

The general character of this soil is such that agricultural development has been slow. The selling price is low.

HAMLIN SILT LOAM.

The soil of the Hamlin silt loam is a chocolate to reddish brown silt loam, 8 to 14 inches deep. The subsoil, to a depth of 36 inches, is of the same texture and color, with the exception of some areas

where in the third foot there is an appreciable amount of fine sand. The soil differs from the subsoil principally in possessing a more open structure and a higher percentage of organic matter. This condition of the surface soil makes it easy to cultivate.

The extent of Hamlin silt loam in Monroe County is small. It occurs along the streams north of the Ridge Road, in the townships of Hamlin, Clarkson, Parma, Greece, and Webster. The topography is level and the drainage is fair, although the areas are subject to overflow.

The type consists of the fine materials washed from the surrounding uplands where the Lockport series is dominant and laid down on the first bottoms as an alluvial deposit. Its physical characteristics are due largely to the influence of material derived from the Medina formation, reworked of course by the streams.

A chemical peculiarity of this type is the occurrence of numerous small alkali spots scattered throughout the areas mapped. Analyses of the soil from these spots shows an alkali content of 4.5 per cent in the soil and 1.1 in the subsoil. The salts are largely sodium chloride or common salt.

The Hamlin silt loam is adapted to the general farm crops, but because the areas are small and consist of narrow bands following the stream courses they are rarely planted to intertilled crops. They are largely in pasture, and their position adjacent to streams make them desirable for this use.

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

Mechanical analyses of Hamlin 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.*
25154	Soil	0.1	0.4	1.1	6.5	16.6	59.7	16.1
25155	Subsoil	.1	1.4	1.4	5.9	25.4	50.0	15.5

ALLIS CLAY.

The surface soil of the Allis clay is a heavy silty clay loam to silty clay, drab, brown, or gray in color, and extending to a depth of 6 inches. The subsoil is generally purely residual and is a heavy silty clay or clay, lighter colored than the soil, and mottled with brown or yellow. The subsoil is not distinctly separated from the soil and passes in the lower depths into the underlying rocks without any perceptible change of color. This soil is difficult to cultivate when either too wet or too dry, but in the proper moisture condition good tilth can be obtained.

There are only two areas of Allis clay in Monroe County, one of which occurs in southwestern Riga and the other in northern Wheatland Townships. The topography of both tracts is nearly level and the drainage is poor. The area occurring in Riga occupies the lowlands along a stream course, in which the bedrock frequently outcrops. The one in Wheatland occupies an old glacial stream channel and is characterized by the many foreign bowlders scattered over its surface. Allis clay is distinctly a residual soil. Glacial action swept the underlying Salina shales bare, and these being soft weathered rapidly forming this soil. The process of formation has left the soil so undisturbed that rock structure is often seen in the subsoil.

Land of this type is used mainly for pasture, for which it is best adapted. The fields could be much improved by drainage. The agricultural conditions are poor and the land values low.

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

Mechanical analyses of Allis 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.*
25126	Soil	0.1	0.6	0.6	1.2	2.2	62.6	32.4
25127	Subsoil.	.0	.4	.7	1.4	4.7	50.5	42.1

WARNERS LOAM.

Warners loam consists of a surface soil of black or brown muck varying from a few inches to a foot in depth, underlain by a white to gray marl. The surface covering is often mixed with marl or shells or the marl layer may lie at the surface. Alternate layers of muck and marl are often found throughout the soil section to a depth of 3 feet or more.

This soil type is quite limited in area and occurs only in relatively small bodies in Wheatland and Riga Townships, the largest single area being located on the southern border of the county near Mumford. It is found only in low swampy places and the surface is level.

Warners loam has been formed by the accumulation of marl (carbonate of lime) in fresh water, together with the growth and decay of vegetation which forms the muck. Shells of aquatic animal life are found scattered through the marl, but the greater proportion was probably formed through the action of certain aquatic plants, which took up the lime carbonate from the water in which they grew, and brought about its deposition. These beds of marl were no doubt deposited under lake conditions when the water was clear and high in lime content. The muck was probably formed when the lake water was drained away and swampy conditions thus developed permitted

the growth of the luxuriant vegetation which upon decay forms the organic layers on the surface and through the profile.

The native vegetation as a rule is abundant and consists of elm, soft maple, linden, swamp grasses, and shrubs. The type is not generally utilized as an agricultural soil. Where cleared it is used as pasture and as a trucking soil, with an occasional field in corn or mowing. In its pure form the marl which constitutes the subsoil of this type may consist of 95 per cent of calcium carbonate.

MUCK.

The Muck soil of Monroe County is composed of more or less decayed organic matter of black to brown color. The texture and color, which depend upon the degree of decomposition and the quantity of mineral material present, vary from a fine black powder where most decomposed, to a coarse, peaty mass brown in color, where least decomposed. Where considerable mineral matter has been introduced the material takes on a dark-gray color. This is usually of local occurrence and often in thin strata only. The depth varies from plow depth to 10 or 15 feet or more, depending on the shape and depth of the depression in which the deposit has been formed and other conditions less well understood. In general the Muck beds are quite uniform in color, texture, and structure, to a depth of 3 feet. The material underlying the Muck is usually a dense clay or sand, blue or gray in color, or else a marl of gray or chalky color. Those areas of Muck, underlain by marl, vary in depth, and where the surface material was 8 inches or less in depth another soil type is mapped—the Warners loam.

Muck is scattered throughout the county south of the Ridge Road. Those areas of Muck that are most decomposed are, when drained, most easily cultivated. The coarser and least decomposed areas are not generally under cultivation, and those gray areas high in mineral matter are not as productive as the true Muck.

The entire area of Muck in Monroe County is made up of tracts varying in size from those too small to be shown on the map to areas as large as 600 acres. The largest area of Muck is an undeveloped tract of 600 acres, located about 6 miles directly east of Rochester. All of the areas are located in comparatively low depressions, and consequently have poor natural drainage.

In its undrained and unreclaimed state the native vegetation consists of soft maple, elm, mosses, reeds, rushes, grasses, and other water-loving plants.

Because of the ease of cultivation, ayailability of plant food and suitable moisture content when drained, Muck is especially adapted to such special crops as celery, onions, carrots, lettuce, cabbage, spinach, and tomatoes. In general it is used for these crops. Potatoes

and general farm crops are also grown to some extent, but the returns are not nearly so large as in case of the special crops.

Commercial fertilizers are, as a rule, applied in large quantities for special crops, and especially is this true where the truck crops are grown. A fertilizer of 2–8–10 composition is commonly used and is applied at the rate of 1,000 to 1,500 pounds per acre. It is generally sown broadcast before planting, and harrowed into the soil.

The average yield of celery on Muck is from 18,000 to 21,000 bunches; onions, 800 to 1,200 bushels; and carrots, 1,000 to 1,200 bushels per acre. Spinach yields from 5 to 8 tons per acre each crop, several crops being grown in a single season. Potatoes yield from 200 to 325 bushels per acre. In growing potatoes it has been found best to plant close in the row in order to prevent the potatoes from reaching such size as to make them unsuited for the markets.

Agricultural conditions on cultivated areas of Muck are usually good and represent the most intensive agriculture in the county. This shows that a much larger area of the type than is already cultivated should be reclaimed.

In draining Muck areas it is first necessary to use the open-ditch method. Then, after the excess water has been removed and cultivation has been carried on for some time and the soil has become more compact, tile drains may be installed and the surface drains filled up. However, some surface ditches are very useful for removing excess water at times of heavy rainfall.

The value of Muck varies from $50 to $200 an acre for undrained land, and from $300 to $1,000 an acre for the best-developed areas.

MARSH.

Marsh in Monroe County is confined almost entirely to those low-lying water-logged areas that have been separated from the water of Lake Ontario by the wave-built beaches of sand and gravel, occurring at various places along the lake shore west of the mouth of the Genesee River, but also includes the low marshy margins around Buck Pond, Long Pond, Cranberry Pond, Round Pond, and Braddock Bay. Other smaller areas are found farther west along Lake Ontario and to the east at the head of Irondequoit Bay. The soil in these areas is of a silty character. The vegetation includes rushes, reeds, cattails, and other water-loving plants. There are a few small areas of Marsh farther inland, the soil of which is a silt loam to a clay loam closely related to the Clyde series, or else it is Muck. The vegetation of these areas is the same as found on the soils similar in character.

Marsh has no present agricultural value, but if drained it would become a very productive soil. Those areas located inland could be drained without much difficulty, while those along the lake will require no little care and expense to make them of agricultural value.

DUNESAND.[1]

Dunesand consists of fine sandy material which, on account of its lack of moisture, has been blown about by the wind and deposited in heaps or dunes. In texture it is a fine to very fine sand, in color a light gray or white. The structure is quite loose, especially at the surface, which causes it to be easily shifted by the wind.

The largest area of Dunesand is located west of the village of East Rochester (Despatch), along the tracks of the electric line and the New York Central & Hudson River Railroad. Other smaller areas occur south of that village, and another at Bushnell Basin. There is also an area on the west shore of Irondequoit Bay, and another near Coldwater. In addition to these, the narrow strips of sand extending along the lake shore have been included with the Dunesand, though not strictly wind-blown material.

The topography is for the most part characteristic of wind-blown sands, rolling and undulating. The surface soil shifts and varies constantly, so that no definite surface form remains for any length of time. Owing to the open nature of the soil, drainage is excessive.

The material composing Dunesand is glacio-lacustrine sand laid down under lake waters at the time of the recession of the ice sheet.

The native vegetation includes principally those grasses that withstand the low moisture content of these sands, a few scrub oaks and pines, and some small poplars. Agriculturally, this land has no value at present.

DRAINAGE.

A large proportion of Monroe County is occupied by soils which require artificial drainage to insure their highest productiveness. This has been noted in the description of the agriculture of the area and in the discussion of each soil type. It seems desirable to emphasize the question still further because of its fundamental importance in soil improvement. Without thorough drainage no soil can reach the highest point in productiveness, and in cultivating inadequately drained areas much waste of time and energy occurs.

Those areas in need of drainage may well be divided into two groups: (1) Low-lying, swampy, or semiswampy lands, and (2) certain upland areas that may or may not be included at present in the cultivated areas.

Those areas in the first group include not only the type mapped as Marsh, but also Muck, Warners loam, and, in general, the soils included in the Clyde series. The Marsh of Monroe County occurs generally in small areas, most of which can be drained. Those presenting the most difficult problems are located along the lake shore and are separated from the lake by a narrow sand beach. They are

[1] Includes some Beach sand.

generally on a level with the lake water, and could perhaps only be reclaimed by means of dikes and pumping plants.

The Muck, Warners loam, and Clyde soils are low lying, and are not only wet because of the retentive subsoil but because of the amount of seepage they receive from the surrounding uplands. These usually have natural drainage ways, which when cleared and deepened will provide a means for carrying away the excess water. After obtaining an outlet other drains, either surface or tiles, should be placed in such a way as to intercept the seepage from surrounding uplands and carry away excess rainfall.

In draining such areas it is deemed best first to drain with open ditches until the excess water has been removed and the soil has had opportunity to adjust itself to the new conditions. Then tiles may be installed, care being used to obtain a uniform grade in the drain. The tiles should be carefully laid and joints closely made. These drains should be from 2½ to 3 feet deep and from 50 to 150 feet apart, depending on the texture of the soil and amount of seepage. It is not advisable to use tile smaller than 3 inches in diameter.

Those soils in need of drainage in the second group include in general those of fine texture. The coarser types, such as gravels and sands, as a rule have ample drainage, and, in fact, are often excessively drained. The mere fact that a soil has a good slope does not necessarily indicate that it has sufficient drainage. The surface may be such that surface water flows freely and yet the soil and subsoil may be of such fine texture and so compact that drainage is in reality very poor. Where the natural drainage is not good, artificial drainage is always possible and generally not difficult. Those soils included in this class can best be discussed by series.

The Dunkirk soils are quite generally in need of artificial drainage. Those types needing it least are the gravels, gravelly loams, and sands. The fine sandy loam, on account of its heavier subsoil in certain localities, is in need of drainage. The loam, silt loam, and silty clay loam are generally all much in need of drainage. The deep and compact subsoil of these types prevents the percolation of water absorbed by the surface soil and makes artificial drainage desirable and necessary for best results.

The Lockport soils, especially the stony loam, are very poorly drained. Their fine texture and compactness, together with their proximity to the underlying rock makes artificial drainage necessary. Where this has been done, very beneficial results have been obtained.

The Ontario soils are all well drained, with the exception of the loam.

On account of the flat topography and possibility of overflow, the drainage of the Genesee soils in general is difficult. Where flooding is common, care should be used to remove the surface water as quickly

as possible by means of open ditches. Where there is no danger of flooding, tile drains are to be recommended.

Other soils in need of drainage are the Hamlin silt loam, which is a first bottom soil and generally poorly drained, and the Allis clay, which is much in need of drainage, both on account of its flat topography and clayey properties.

The extreme lack of drainage is indicated in a soil by the blue, yellow, or brown mottled appearance of the subsoil and by the dense, compact structure. Both these characteristics indicate too much water and too little air in the soil. This condition will not permit of the best growth and development of plants or the largest yield of crops.

On upland soils the need of drainage is not always manifested by a mottled appearance, but by the compact condition of the subsoil and length of time required after a rain before cultivation can be performed.

Generally speaking, the sandy and silty soils can be drained with tiles at a greater depth and farther apart than the loam and clay soils. The heavier soils should have the drains placed nearer the surface, say, 2 to 3 feet deep and closer together, from 30 to 60 feet apart. As improvement in the methods of agriculture have advanced in Monroe County, the great need of thorough drainage has been felt more and more and is being supplied with results that show an increased return for the money invested.

SUMMARY.

Monroe County is located midway along the southern shore of Lake Ontario and is divided in two equal parts by the Genesee River. Topographically there are two general divisions, the northern half is a moderately level plain, the southern half rolling to hilly upland. The elevation varies from 246 feet to 928 feet above sea level. There are no very marked differences of elevation within the county.

The drainage is entirely into Lake Ontario. The Genesee River and its tributaries carry most of the water. The present stream channels are post glacial.

Settlement is dense, except in a few scattered areas. It is most concentrated along the Ridge Road. The chief towns are Rochester, Brockport, Fairport, Charlotte, Honeoye Falls, Pittsford, Webster, Churchville, Spencerport, and Hilton.

The mean annual temperature is about 47° F. The maximum ranges from 99° F. to —12° F. The lake on the north influences the climate for a distance of several miles inland from the shore. The length of growing season between killing frosts is about 171 days, from April 29 to October 17. The mean annual rainfall is about 34.5 inches.

Transportation facilities for both local and distant markets are excellent. Shipments are carried by steam and electric railway and by boat. Passenger service is good to almost all points of the county and is especially good in the northern part.

The first settlement was made about 1789. Agriculture has been an important industry from the first. The first settlers came from eastern New York, New England, and Pennsylvania.

This region has a high reputation for fruit growing and attracts many buyers from this country, Canada, and foreign countries.

Wheat has always been a leading crop. The average yield per acre has steadily increased since 1849. This county ranked first in the State in the production of wheat in 1899.

The livestock industry was prominent until about 1870.

Potatoes are an important crop. In only two census years, 1865 and 1870, has the potato production reported been less than 1,000,000 bushels since 1859. In 1899 Monroe County was second in the State and fifth in the United States in potato production.

Orchards were planted as early as 1799. Fruit production on a commercial scale became prominent about 1860 and has steadily increased since that date. In 1899 there were nearly a million and a half bushels of apples produced. Other fruits were largely planted about 1875 to 1880. In 1899 there were 94,300 bushels of peaches produced. Pears, quinces, plums, cherries, and small fruits are also of great importance. The total value of fruits alone in 1899 was $896,900.

The agriculture of the present day consists of fruit and grain farming, nursery stock productions, truck growing, general farming and dairying. Fruit growing is most prominent in the northern part of the county.

Ninety-three per cent of the county is farm land. Eighty-nine per cent of the farms are classed as improved land. The average size of farms in 1900 was 64.9 acres. Sixty-three and a half per cent of the farms are operated by the owners.

The soils have been largely formed under glacial lake influence and are closely related to the soils of other counties along Lake Ontario.

There are 27 soil types recognized and mapped in the county. Five series are represented, besides a number of miscellaneous types.

The Ontario, Dunkirk, and Genesee series occupy most of the county and are of the most importance agriculturally.

There are eight types of Dunkirk soils ranging in texture from a fine clay to sand and gravel. They are by far the most important soils in the county. Besides being suited to all general farm crops, they furnish the bulk of the fruit soils.

Dunkirk silt loam is the best for apples and pears, though the silty clay loam is used for these products to some extent. The silt loam is the best soil of any extent for nurseries.

The fine sandy loam, fine sand, and the lighter phase of the silt loam are the best for peaches and cherries.

The silty clay loam and the heavier areas of silt loam are best for grain and grass crops, while the fine sand and fine sandy loam are best for potatoes.

The Clyde soils are of small areal extent. When drained they are very fertile.

The Lockport soils are generally flat and wet. If drained they would make good grain and general farming land, and the lighter would produce fruit.

The Ontario soils are samewhat irregular in topography, though fertile, and produce good general crops. The loam and the fine sandy loam are excellent soils for fruit production. This series includes the largest area of the best fruit land.

The Genesee series is a series of very fertile soils and of great importance agriculturally. The silt loam is most valuable.

Of the miscellaneous soils the Honeoye stony loam, Hamlin silt loam, and Allis clay are largely pasture, while Dunesand, which includes some Beach sand, Warners loam, and Marsh are largely non-agricultural.

Muck when drained is one of the most valuable soils found.

The most important need for soil improvement is drainage. This should be carefully done and should receive early attention. Surface ditches so far as possible should be replaced by tiles.

Crop adaptation should be more carefully studied.

A systematic rotation should be carefully adhered to on each farm.

Lime is very generally needed for the improvement of the soils north of the Ridge Road, and is often beneficial in the southern part of the county.

Farmers should study more closely the fertilizer needs of their soils and supply those needs so far as possible by the use of manures and by crop rotation.

Organic matter is needed by all upland soils. Clays and silty clay loams need it to loosen their structure and make drainage and tillage easier. Sands and sandy loams need it to prevent leaching.

A systematic rotation in which legumes are prominent should be employed on each farm, and the more general use of alfalfa and clovers for forage is urged.

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