

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS.

IN COOPERATION WITH THE NEW YORK STATE COLLEGE OF AGRICULTURE,
CORNELL UNIVERSITY.

SOIL SURVEY OF WAYNE COUNTY,
NEW YORK.

BY

CORNELIUS VAN DUYNÉ, IN CHARGE, AND N. M. KIRK, OF THE
U. S. DEPARTMENT OF AGRICULTURE, AND WILLIAM SELTZER,
JOHN P. GUM, AND H. W. ERDE, OF THE NEW YORK STATE
COLLEGE OF AGRICULTURE.

[Advance Sheets—Field Operations of the Bureau of Soils, 1919.]



WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1923.

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[PUBLIC RESOLUTION—No 9.]

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

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

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

Approved, March 14, 1904.

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

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MAP.

Soil map, Wayne County sheet, New York.

SOIL SURVEY OF WAYNE COUNTY, NEW YORK.

By CORNELIUS VAN DUYNE, In Charge, and N. M. KIRK, of the U. S. Department of Agriculture, and WILLIAM SELTZER, JOHN P. GUM, and H. W. ERDE, of the New York State College of Agriculture.

DESCRIPTION OF THE AREA.

Wayne County is situated in the north-central part of New York State, on the southern shore of Lake Ontario, nearly midway between Rochester and Syracuse. The county is roughly rectangular in shape, with a maximum width from north to south of about 22.5 miles and a length east to west of 34.4 miles. It has a land area of 599 square miles, or 383,360 acres.

The base map used in this survey includes all or parts of the following quadrangles of the United States Geological Survey topographic map of the United States: Clyde, Macedon, Oswego, Palmyra, Pultneyville, and Weedsport.

The physiographic features of Wayne County are those of a level or undulating to rolling country, with elevations from 250 to 700 feet above sea level. The county has no especially prominent ridges or valleys, but has a markedly systematic arrangement of hills similar in shape and direction and more or less uniform in height. Two topographic features of local prominence are the Fairport-Lyons glacial-stream channel and the glacial-lake beach west of Sodus.

The old glacial-stream channel follows a winding course in a general west-east direction, dividing and reuniting in places and having a number of less prominent branches. It has a floor from one-fourth to one-half mile wide and well-defined sides, the lower parts of which are at times in the shales underlying the fine-earth mantle. The New York Central, the West Shore, and the Rochester & Syracuse Electric Railroads and the Barge Canal follow its course either wholly or in part. The glacial-lake beach follows a somewhat sinuous line west from Sodus. It occurs either as a bench bordering the glacial hills or as a bar built across valley troughs, and lies from 15 to 25 feet above the level country immediately to the north. It is traversed by the Ridge Road and by the Rochester & Sodus Bay Electric Line. Occasional stretches of the beach are found east of Sodus, but they are seldom of sufficient length to be prominent.

The county comprises two distinct physiographic divisions, (1) the undulating to rolling and hilly or drumlin region and (2) the lake plain, the former occupying the southern and the latter the

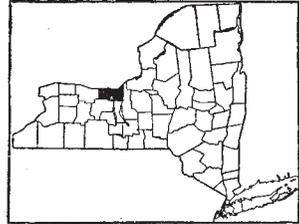


FIG. 7.—Sketch map showing location of the Wayne County area, New York.

northern part of the county. They are, on the whole, fairly distinct. The line between them follows a rather regular course along the old beach line as far east as Sodus, then swings southeastward to the Clyde River valley as far as the southern county line. It then bears northeastward, following an extremely irregular course to a point about 2 miles east of Wolcott, where it again swings southeastward to the county line.

The undulating to rolling and hilly or drumlin region falls naturally into two subdivisions, the undulating to broadly rolling area, and the rolling to hilly area. The former, very much the smaller, occurs south of the "Ridge" and west of a line running due south from Williamson. It is about 4 miles wide at the Monroe County line and tapers irregularly but gradually toward the east. Its surface is broadly undulating to broadly rolling, with very few isolated hills or drumlins. It is from 450 to 500 feet in elevation and is traversed by northward-flowing streams.

The rolling to hilly area occupies a little more than half of the county. It is separated into two main bodies by the southward-extending neck of the lake plain. A number of small isolated tracts also occur within the lake plain. The surface features consist of a succession of hills occurring in groups or singly and separated by north-south valley troughs of varying size. There are several hundred of these hills, including prominent isolated drumlins, groups whose outlines blend, and narrow low ridges. These hills or drumlins rise abruptly at their northern ends and merge gradually with the general level to the south. They are flanked on the east and west by steep slopes which decrease in height and abruptness toward the south. The majority of these hills are characterized by a similarity of base and direction and a smooth outline. They do not have rock cores, and they rise to elevations of 500 to 680 feet, with rounded to narrow crests 100 to 175 feet above the floor of the valley troughs. The long axes of the hills bear a little to the east of due south. The valley troughs vary in width, length, and prominence. They contain areas of Muck, or terrace and smooth till soils, and are too large to have been formed by the present streams, which often head in and flow both north and south from the same poorly drained tract. Only a small proportion of this subdivision is too steep for cultivation. The Montezuma Marsh in the southeastern corner of the county, if more extensive, would be classed in another subdivision.

The lake plain, or that part of the county once wholly or partly submerged by the glacial-lake waters, is made up of areas of rather characteristic topography, which may be divided for descriptive purposes into the level to terraced and undulating area, containing a very small proportion of lake-laid soils, and the level to undulating and rolling area, in which the lake-laid soils predominate. The former covers sections of little relief over a wide stretch of country, while the latter has a large number of isolated hills of drumlin outline, some of which are of sufficient height to have formed islands in the glacial lake. In addition the erosion of deep lake-laid sediments has developed in places a rolling topography.

The region north of the "Ridge" or old glacial beach has very little relief, being nearly level in the proximity of the old beach. The whole region has a general slope toward the north, and its eleva-

tion ranges from 250 to 425 feet. The soils are predominantly stony, and the streams flow for the most part in shallow, inconspicuous channels. Farther to the east are a number of level to terraced areas, divided into two main areas by the wide valley which extends southward toward the Clyde River. These have an elevation of 425 to 450 feet, and most of them were partly submerged by glacial-lake waters and subjected to their leveling action. They lie intermediate between the lake plain proper and the drumlin region to the south.

In the second subdivision, or what is more properly the lake plain from the standpoint of proportion of lake-laid soils, the surface is quite diversified. In addition to the presence of the isolated hills and sections of rolling surface, in which the stratified deposits have been more or less eroded, there are fairly wide areas here and there that are level and poorly drained. This division borders the lake for the greater part of its extent in the county, being widest in the eastern part, and also covers the wide valley trough which reaches southward to the Seneca County line.

Lake Ontario eventually receives the drainage waters of the entire county, the northern part or slightly less than half of it draining directly into the lake, the southern part draining by a circuitous course via the Oswego River system. The divide between the direct lake drainage and that of the remainder is seldom conspicuous and follows an extremely irregular line from west to east across the middle tier of towns,¹ in places swinging several miles to the north or south. The headwaters of northward and southward flowing streams are frequently in the same valley trough, sometimes in the same area of Muck.

The northern part drains through a series of generally northward flowing streams from 5 to 10 miles in length. These streams, though having well-defined channels, follow somewhat irregular courses with low gradients. They have very narrow first bottoms or none at all, have few tributaries, and seldom occupy any conspicuous valley. As they approach the lake the gradient becomes greater, and some of the larger streams, especially in the northwestern part of the county, become quite deeply entrenched in places or occupy rather well defined valleys. Among the largest of these creeks are Salmon, Second, Sodus, Wolcott, and Red Creeks.

Ganargua or Mud Creek enters the county near its southwestern corner and follows a winding though generally west-to-east course from 3 to 6 miles north of the southern line of the county to Lyons, where it is joined by the Canandaigua Outlet from the south to form the Clyde River. The Clyde River follows a meandering channel and flows into the Seneca River south of the county line. The Seneca River, flowing northward, forms the eastern boundary for about 4 miles. This system is over 40 miles in length and has a rather sluggish current. It enters the county at about 500 feet elevation and leaves it at slightly less than 380 feet elevation. The natural flow is interrupted by the Barge Canal, which in places follows the same valley and in other places the channel of the Clyde River. The Ganargua Creek has a flood plain averaging one-fourth mile in width, and for a part of its course follows a conspicuous old glacial-

¹The term "town" as used in this report is synonymous with township.

stream channel. The Clyde River bottom is variable in width, being in places too narrow to map and again widening to one-half to 1 mile or more. Its bottom merges with the Montezuma Marsh, which also forms the bottoms of the Seneca River. This system receives several tributaries from the north and south, the largest two of which are both called Red Creek. Quite an area in the southeastern part of the county drains direct into the Seneca River through Butler, Black, and Crusoe Creeks. These streams traverse arms of the Montezuma Marsh and have sluggish currents. Tributaries of the main system rise at elevations of 500 feet or less, and usually have low gradients. The bottoms are usually narrow and rather poorly drained and in some cases consist of areas of Muck. Many of the minor streams carry little water during the summer months. During the early settlement of the section small mills here and there were operated by waterpower, but at present this is being utilized in less than half a dozen places.

West of Sodus Bay the shore line of Lake Ontario is fairly regular and is marked by a low bluff 15 to 25 feet high. Sodus Bay is an irregular-shaped body covering several square miles and extending more than 3 miles inland. It is nearly inclosed by sand and gravel bars on the lake side. East of the bay the lake shore line, though rather regular, consists of a series of almost perpendicular bluffs from 75 to 150 feet in height, connected with each other by gravel bars, back of which are either areas of Marsh or small bays. These bays are known as East, Port, and Blind Sodus Bays. There are no inland lakes, except local small ponds.

As a whole Wayne County is well drained. The streams for the most part follow old valley troughs or old glacial-stream channels, which have been modified very slightly by the present drainage. Their courses are largely determined by irregularities due to glacial action. All sections of the county are reached by streams, but as these have almost no short branches, visible drainage ways do not reach all farms. Much of the precipitation finds its way downward through the upland soils and reaches the streams at lower levels. Springs are not numerous. Scattered, poorly drained areas, mainly Muck, are conspicuous along some of the stream courses. The Montezuma Marsh and its northward extending arms in the extreme southeastern part comprise the largest poorly drained area. Others occur southwest, west, and northwest of Clyde, and northeast of Wolcott, and a strip a mile or so in width lies north of the Ridge Road.

Wayne County was organized in 1823 from the northern parts of Seneca and Ontario Counties. Previously to that date its territory had been successively included in the counties of Albany, Montgomery, Onondaga, Cayuga, Seneca, and Ontario. Its eastern half was a part of what was known as "military tracts," and the western half was a part of the "Phelps and Gorham Purchase," while a narrow triangular-shaped area between them, having its apex on Sodus Bay and known as "the Gore," was bounded by the old and new preemption lines.

Permanent settlement dates from about 1790, and began in the southern part along the Clyde River, Canandaigua Outlet, and Ganargua Creek, which were the early arteries of travel. Land in the

western part was subject to purchase and was settled by pioneers from eastern New York, the New England States, Pennsylvania, Maryland, and Virginia, and some from England, Scotland, and Holland. The eastern part consisted of land grants given to Revolutionary soldiers in recognition of their services, and many of these tracts changed ownership several times before permanent settlement was established. The descendants of the early settlers constitute a fairly high percentage of the present population, with the remainder made up of immigrants from the surrounding regions and from foreign countries.

According to the United States census for 1920, the population of the county is 48,827, of which 71.8 per cent is classed as rural. The density of the rural population, excluding villages having a population of 2,500 or more, is given as 58.6 per square mile. The total population of the county has varied very little in the last 60 years. There has been a gradual increase in the population of the villages at the expense of the rural districts. In comparison with other counties that are mainly agricultural, Wayne County has a fairly dense rural population on account of the high proportion of improved land and the low percentage of poorly drained and other waste land. The rural population is exceptionally well distributed, being slightly more dense in the fruit belt than elsewhere.

The chief centers of population are Newark, 6,964; Lyons, the county seat, 4,253; Clyde, 2,528; Palmyra, 2,480; Macedon, 526; and Savannah, 516, in the southern part; Sodus, 1,329; Wolcott, 1,186; Red Creek, 499; and Williamson, North Rose, Ontario, and Sodus Point, in the northern part; and Marion in the central part of the county. All these are marketing and shipping points for farm products. Newark and Palmyra have some manufacturing plants. The other villages are residential centers whose business and industries are dependent to a greater or less extent upon the surrounding country.

The main line of the New York Central Railroad traverses the southern part of the county. It is paralleled more or less closely by the West Shore Railroad and by the Rochester & Syracuse Electric. The Rome, Watertown & Ogdensburg Division of the New York Central crosses the northern part of the county in a general east-west direction, and the Rochester & Sodus Bay Electric line extends from Sodus Point via Wallington and Sodus westward to the county line and to Rochester. The Northern Central Railway, Sodus Bay Branch, operated as a part of the Pennsylvania lines, traverses the county from Sodus Point southward through Newark and affords transportation to points to the south, and also connects at Wallington with the Rome, Watertown & Ogdensburg Division, and at Newark with the main line of the New York Central and the West Shore. A local branch railroad connects Marion with Newark, where connections east and west are also afforded. The Pennsylvania division of the New York Central extends southward from Lyons. Water transportation is afforded by the Barge Canal, which enters the county from the west, passes through Macedon, Palmyra, Newark, Lyons, and Clyde, where it swings southeastward and continues into Seneca and Cayuga Counties. Sodus Point is the only lake port. Its shipping is confined to freight, mainly coal for Cana-

dian ports. The several railroads and electric lines afford ample transportation facilities to points east, west, and south and are so distributed that the greater part of the county is within 6 miles of railroad points and none of it more than 10 miles distant. Passenger and freight transportation by trucks and automobiles between local places is gradually increasing.

The county has an extensive system of public roads. The north-and-south roads carry most of the heavy traffic and are maintained in good condition. The short east and west roads are lightly traveled and are frequently in poor condition. There are nearly 75 miles of State roads, both macadam and concrete, in the county. Route 30, or the Ridge Road, across the northern part, is nearly completed, and route 20, in the southern part, is in process of construction. State roads extend from Marion northward through Williamson to Pultneyville, from Alton southward through Lyons to Geneva, and from North Rose to Clyde. Many of the main highways are surfaced with gravel.

All sections of the county are reached by rural free delivery routes and telephone lines. All the villages are lighted by electricity and have good graded and high schools. The rural sections are well supplied with schools.

The local markets comprise the several villages, but as the population is so largely rural, these markets require only a small proportion of the farm products. Other markets easily accessible are Rochester, between 15 and 20 miles from the western side of the county, and Syracuse, from 30 to 35 miles from the eastern side. Milk is shipped mainly to these two cities. Fruit, both dried and green, is sent to eastern and to European markets. In addition, all of the large eastern cities and the coal-mining regions of Pennsylvania afford markets for Wayne County crops.

CLIMATE.

Wayne County has a temperate climate with extremes of heat and cold, and with variations in temperature and precipitation from north to south owing to the modifying influences of Lake Ontario. The northern part has a slightly greater precipitation and a smaller range in temperature, being a few degrees warmer in winter and cooler in summer than the southern part.

The winters are rather long and severe. January and February are the coldest months. The mean temperature of the winter months is 25.6° F., and the absolute minimum is -14° F. The mean annual snowfall is 88.4 inches. The summers are short and pleasant. The summer months have a mean temperature of 68.3° F., and an absolute maximum of 101° F. July and August are the hottest months. Short periods of intense heat may occur at any time between the middle of June and the middle of September. Wet cool spells may also occur at any time during the spring, summer, or fall season. Periods of intense cold during the winter season are usually of short duration.

The average date of the last killing frost in the spring is April 29, and of first killing frost in the fall October 17, giving an average growing season of 170 days. In the southern part of the county it is from two to three weeks less. The earliest recorded date of

killing frost in the fall and the latest in the spring are October 7 and May 12, respectively. The growing season is usually long enough to insure the maturing of all crops. Cool wet spells in the spring and cool weather in the fall sometimes shorten the season, so that certain crops do not mature.

The mean annual precipitation is 34.27 inches, with extremes of 17.04 inches for the driest year (1834) and 49.89 inches for the wettest year (1873).

As a rule precipitation is distributed evenly enough to prevent serious damage to crops by drought or by excessive rainfall, although seasons occur in which loss is caused by either or both conditions, especially on certain soils.

The following table, compiled from the records of the Weather Bureau station at Rochester, located at an elevation of 523 feet and about 6 miles from Lake Ontario, is fairly representative of climatic conditions in a belt several miles in width across the northern part of Wayne County. Slight variations from these conditions are common in the southern part of the county.

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

[Elevation, 523 feet.]

Month.	Temperature.			Precipitation.		
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year (1834).	Total amount for the wettest year (1873).
	<i>° F.</i>	<i>° F.</i>	<i>° F.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>
December.....	28.9	67	-8	2.88	0.53	4.60
January.....	24.0	71	-14	3.13	.11	3.33
February.....	23.9	70	-11	2.83	.73	1.52
Winter.....	25.6	71	-14	8.84	1.37	9.45
March.....	31.3	86	-7	2.93	.78	7.02
April.....	43.9	90	17	2.44	1.60	4.71
May.....	56.7	93	27	2.94	.91	3.52
Spring.....	44.0	93	-7	8.31	3.29	15.25
June.....	66.1	95	39	3.13	1.61	1.86
July.....	70.4	101	45	3.09	1.45	5.44
August.....	68.3	95	44	2.96	1.38	3.01
Summer.....	68.3	101	39	9.18	4.44	10.31
September.....	61.9	99	34	2.32	1.89	2.97
October.....	50.8	87	23	2.86	4.06	8.67
November.....	37.9	75	10	2.76	1.99	3.24
Fall.....	50.2	99	10	7.94	7.94	14.88
Year.....	47.0	101	-14	34.27	17.04	49.89

AGRICULTURE.

Agriculture has been the foremost and practically the only industry of Wayne County from the beginning of its settlement to the present time, having expanded more or less gradually from the early primitive conditions to its present well-organized and highly developed

state. The early settlers of necessity produced food for themselves and their stock, as well as the material for clothing. The heavy growth of timber had no money value and necessitated much hard labor in its removal. Clearings were made in the forest, and subsistence crops, mainly wheat and corn, were grown. Other early crops were potatoes, rye, oats, tobacco, flax, hemp, vegetables, and fruit for family use. Methods of farming were necessarily crude and slow. Oxen were used as work stock. Gristmills to produce flour and meal and sawmills to provide lumber for building were early in operation. Wool and flax were produced to provide material for homespun clothing. Tanneries were early established to furnish leather. Pearlash, "black salts," was made from ashes. Liquor was made from surplus grain. As the production of crops and stock and the outside demand for these products increased, the surplus was carried by boat, wagon, or sled, or stock was driven on foot, to eastern points, especially to Albany.

The completion of the Erie Canal in 1825 greatly improved transportation conditions and stimulated agricultural activities. For a number of years it was the chief outlet for farm products to eastern markets. Some shipping was also carried on from Sodus Point and Pultneyville to other lake ports.

The 15-year period from 1840 to 1855 marked the greatest activity in railroad building. The Rochester & Syracuse Railroad, now the Auburn branch of the New York Central, though not touching the county directly, was completed in 1841; the Sodus Point & Southern opened early in the fifties; and the main line of the New York Central was put in operation in 1853. The completion of these lines marked the beginning of quick transportation to outside markets to the east and south. It was accompanied by an increase in the crop production and other agricultural and industrial activities. The Lake Ontario Shore Railroad, completed in 1876, greatly assisted in the development of the northern part of the county.

According to the United States census for 1920, 90.3 per cent of the total area of the county was included in farms in 1919. There were 4,980 farms, with an average size of 69.5 acres, 82 per cent of which was classed as improved land. Nearly 78 per cent of the farms contain from 20 to 175 acres, with a greater number under than over these limits. Comparison with previous censuses shows that for several decades the figures relative to land in farms have remained nearly constant, with a small reduction in the total area in farms and a slightly greater reduction in the total area of improved land in farms. This would indicate that most of the land suitable for farming has for a long time been devoted to that purpose. There has been little extension of the cleared acreage, except that of Muck. The development of new agricultural industries has taken place on land previously devoted to other crops.

The value of all farm property in 1920 is given by the census as \$10,208 per farm, of which land constituted 45 per cent, buildings 34.3 per cent, implements 9.5 per cent, and domestic animals 11.2 per cent. Since 1880 there has been a gradual and consistent increase in the proportion of the total value represented by buildings, implements, and live stock.

The following table, compiled from United States census reports, gives the acreage and yields of the five principal general farm crops for the years 1879, 1889, 1899, 1909, and 1919:

Acreage and production of principal farm crops.

Year.	Hay and forage crops.		Corn.		Oats.		Wheat.		Potatoes.	
	<i>Acres.</i>	<i>Tons.</i>	<i>Acres.</i>	<i>Bushels.</i>	<i>Acres.</i>	<i>Bushels.</i>	<i>Acres.</i>	<i>Bushels.</i>	<i>Acres.</i>	<i>Bushels.</i>
1879.....	48,934	60,890	30,840	1,172,374	24,512	855,629	39,018	714,181	7,524	744,218
1889.....	59,306	84,494	23,447	690,637	27,053	860,956	30,181	520,527	6,400	323,091
1899.....	62,907	82,244	27,983	866,640	30,081	1,115,740	36,925	688,070	8,895	787,557
1909.....	66,414	103,994	25,633	911,653	34,583	1,010,043	16,470	337,333	9,280	1,049,202
1919.....	76,703	172,017	16,667	738,767	23,424	533,427	26,335	461,549	6,679	492,524

The above table shows that in a period of 40 years there was comparatively little increase in the total acreage devoted to these crops. There has been, however, a decrease in the acreage of corn and wheat and a steady increase in that devoted to hay and forage crops. These changes are due in part to an increase in the number of cattle, especially dairy cows.

The principal sources of farm income in the county are shown in the following table, which gives the acreage, proportion of total acreage, value, and proportion of total income, of the crops by classes, and the value and proportion of total income from live-stock products for the year 1919.

Income from farm products in 1919.

Products by classes.	Area.	Proportion of total area in crops.	Value.	Proportion of total income.
	<i>Acres.</i>	<i>Per cent.</i>	<i>Dollars.</i>	<i>Per cent.</i>
Fruits and nuts.....	128,344	14.1	4,256,937	24.1
Cereals.....	75,713	37.6	3,111,738	17.6
Hay and forage crops.....	76,703	38.1	2,974,931	16.9
Vegetables.....	15,019	7.5	3,122,998	17.7
Other grains and seeds.....	4,021	2.0	409,742	2.3
All other crops.....	1,676	.8	34,518	.2
Income from crops.....			13,910,864	78.8
Animals sold and slaughtered.....			² 1,244,612	7.0
Dairy products (excluding home use).....			1,671,921	9.5
Poultry and eggs.....			751,992	4.3
Wool.....			44,419	.3
Honey and wax.....			12,760	.1
Income from live stock and products.....			3,725,110	21.2
Total income.....			17,635,974	100.0

¹ These figures are only approximate. They are obtained by dividing the number of trees, as given in the census, by the average number of trees per acre, as found in special surveys in fruit-growing districts.

² Income from this source is not reported in the 1920 census. These figures are only approximate. They are based upon the assumption that the income from this source in 1919 had the same relation to the total value of domestic animals as it had in 1909.

The area in barley was greatest in 1879 and 1899, exceeding 20,000 acres, but decreased to 4,481 acres in 1919; that in rye increased from 713 acres in 1879 to 2,314 acres in 1909, and fell to 1,145 acres in 1919.

The acreage of buckwheat shows only a seasonal variation. Tobacco was grown on 13 acres in 1879, on 796 acres in 1899, and on 88 acres in 1919. In 1879, 189 acres were in hops, but none were reported in 1909. Beans were grown on an increased acreage until 6,401 acres were reported in 1899, but dropped to 3,895 acres in 1919. In the same period there was a marked increase in the production of all fruit, small fruit, and cabbage. The value of dairy products, of poultry and eggs, and of animals sold and slaughtered, has greatly increased in the last 20 years. The census reports show a reduction in the total acreage in crops other than fruit, from 175,169 acres in 1879 to 173,006 in 1919. The agricultural development in the last 40 years has consisted of a change from general farming, with the sale of grain as the chief source of income, to general and dairy farming, with the introduction of beans, cabbage, and other vegetables as cash crops, and the tendency toward specialization in fruit, small fruit, truck, and canning-factory crops.

The production of fruit in the county dates from its early settlement. For several decades the orchards were confined to small tracts near farm buildings, and the crop was consumed at home. The development of the industry, though slow at first, has been marked by several stages of intensive planting, especially from 1865 to 1879 and from 1900 to 1910, the later plantings being confined mainly to the northern part of the county. The industry increased in importance as more trees came into bearing and methods of management became more intensive, until in 1919 it led all other crops with a valuation, including small fruit, of \$4,256,937, or 24 per cent of the total income from all sources.

The growing of peppermint for oil was at one time a fairly important industry in the county, with Lyons the chief marketing point. The industry declined on account of small profits, but is now being revived. The crop is grown on moist low-lying areas, especially in the vicinity of Fairville.

Several years ago the production of sugar beets promised to develop into an important industry in the central and southern parts of the county, with a factory located at Lyons. Satisfactory yields of good quality beets were produced, but conditions developed which caused the industry to be discontinued, and the factory is now used for other purposes.

Approximately 38.1 per cent of the total area of land in crops was devoted to the production of hay and forage crops in 1919. These ranked fourth in value, constituting 16.9 per cent of the total farm income. Of a total of 76,703 acres, one-half was in timothy and clover mixed, 17,618 acres in timothy, 2,881 acres in clover, 3,823 acres in alfalfa, 6,297 acres in silage crops, and 6,055 acres in coarse forage. The average yield of hay from tame and cultivated grasses was 1.6 tons per acre. In addition, a large acreage, not accounted for in the census figures, is used for pasture. Grass is grown on practically all soil types in all sections of the county. Red and alsike are the leading varieties of clover, the latter being largely grown on poorly drained soils. As a rule the stand of grass is good and fairly free from weeds, and the hay is of good quality. Clover frequently predominates in the recently seeded fields, gradually giving way to timothy. Hay is both a feed and a cash crop. Wild carrot is quite prevalent in the second growth.

Alfalfa is grown mostly on small to medium-sized tracts of Ontario and Palmyra soils. From two to three cuttings are obtained in addition to some pasturage. Other grasses frequently appear in the fields and crowd out the alfalfa. Judgment is used in the selection of the fields and care is given in the preparation of the seed bed. Inoculation is not generally practiced. Liming is usually unnecessary. The crop is fed on the farm.

Cereals are grown on practically every farm and on many farms are the chief crops. They were grown on 75,713 acres, or 37.6 per cent of the area in crops in 1919, and were valued at \$3,111,738, which was 17.6 per cent of the total farm income.

Oats were grown on 23,424 acres in 1919, producing 533,427 bushels. This crop is grown mainly for feed and is common on nearly all farms in all sections of the county. This acreage was smaller than usual and the yield was lighter than the average in 1919.

Corn was raised on 16,667 acres in 1919, yielding 738,767 bushels. This crop is grown throughout the county. Nearly all of it is fed on the farms.

Wheat was the leading cereal crop in 1919, being grown on 26,335 acres and yielding 461,549 bushels. This acreage is somewhat greater than usual. Wheat is generally grown as a cash crop on well-drained soils in all sections of the county.

The minor cereals are barley, buckwheat, and rye, grown on 4,481, 2,823, and 1,145 acres, and producing 72,568, 55,446, and 16,093 bushels, respectively, in 1919. Buckwheat is usually grown on rather poorly drained soils, and is a cash crop. Barley and rye are grown as feed and cash crops.

Other grains and seeds are grown on 2 per cent of the area in crops and produce 2.3 per cent of the total income from all sources. Beans were grown on 3,895 acres in 1919, and yielded 74,247 bushels. They are grown chiefly on soils of the Ontario and Palmyra series and more largely in the western than in the eastern part of the county. The leading variety is the Red Kidney, with some "pea" beans. Beans are a cash crop. Dry peas were raised on 126 acres and produced 2,508 bushels in 1919.

Potatoes were reported on 6,679 acres, with a production of 492,524 bushels. The crop is grown for home use and for commercial purposes. It is not a special crop in any section, though an important source of income on a number of farms. The fields range from 1 to 10 acres in extent on well-drained soils, especially of the Ontario and Palmyra series. The crop is more widely grown in the southwestern part of the county than elsewhere. Late purple-sprout varieties, mainly Carmen, Dibles Russet, and Rural New Yorker, are planted.

Tobacco was reported on 88 acres in 1919, with a yield of 101,978 pounds. Tobacco is grown as a cash crop on small tracts on a few farms in the extreme eastern part of the county, chiefly on the Ontario loam and its reddish phase.

The growing of crops for the canning factories, of which there are 13 in the county, is an important industry. The report of the State Food Commission for 1918 gives an acreage of 3,803 for canning-factory crops. Peas are grown in the southern, eastern, and northeastern parts of the county. Only small tracts are grown on

individual farms. Several vineries² have been established in sections at some distance from the factories. Peas yield from 1,000 to 1,800 pounds per acre, with 1,500 pounds a good average yield. Tomatoes are grown largely west of Macedon, and some in the northern part. Sweet corn is canned principally at Newark. The canning of apples is a growing industry, practically all factories putting up this product. Peas and tomatoes are among the leading vegetables canned. String beans, rhubarb, and spinach are other canning-factory crops. All these are usually grown under contract.

Canning factories are located at Sodus, East Williamson, Williamson, Marion, Wolcott, Red Creek, Clyde, Newark, and Lyons. These factories packed 1,500,000 pound cans of fruit and vegetables in 1918. Cold-storage warehouses are located at Lyons, Ontario, Williamson, East Williamson, Sodus, North Rose, Red Creek, and Macedon. Four central packing houses for fruits are located at Macedon, Alton, Lyons, and Red Creek.

According to the census 1,628 acres were in cabbage in 1909. The census of the State Food Commission reports 3,398 acres for 1917. This crop is grown for the most part on general and dairy farms on tracts of 1 to 5 acres. Its production is widely distributed, being grown less in the fruit section than elsewhere. The crop provides considerable forage for cattle in addition to the part sold. The leading late variety is Danish Ball Head. Early varieties include All Head, Copenhagen, and Glory of Enkhousen. Some red cabbage also is grown.

The report of the State Food Commission gives 336 acres in nursery crops and flowers. These are grown on the Ontario soils, mainly southeast of Newark in the southern part of the county. Osiers (basket willows) are grown on a comparatively small acreage of poorly drained land in the vicinity of Lyons and Clyde. The sets or slips are set at intervals of a foot or more in rows 3 feet apart. Several years elapse before they produce a crop. The yields range, according to the age, from 1 to 6 tons per acre, with upwards of 3 tons a very good average. They are cultivated to keep down the weeds. The whips, from 4 to 6 feet long, are cut usually in December, tied into bundles, and shipped direct to basket and furniture factories.

Onions, celery, lettuce, and spinach are quite extensively grown on improved areas of Muck, mainly within a belt a few miles wide south of the Ridge Road, with Sodus and Williamson the chief marketing centers. Another important area devoted to these crops lies about a mile east of Rose, and scattered smaller areas occur elsewhere. The onions grown are chiefly the Southport Yellow Globe, with some Red Weathersfield. From 400 to 500 bushels per acre is regarded a good average yield, although yields as high as 1,000 bushels are reported. The Golden Self Blanching is the leading variety of celery, with an average yield of 200 crates, 7 dozen bunches to the crate, per acre. The Big Boston is the chief variety of lettuce, producing 500 to 600 boxes per acre. Carrots are a crop of some importance. Cucumbers are grown on upland soils for pickling and for market. All these crops are grown under intensive farming methods. Good average returns are obtained, though vary-

² The vinery is a plant for shelling green peas harvested with the vines.

ing quite widely from year to year. The growers are well organized and are carrying on fertilizer and variety experiments.

According to the 1920 census, the number of fruit trees of bearing age is 1,487,242, distributed as follows: 906,938 apple, 195,628 peach, 216,982 pear, 145,453 cherry, and 22,241 plum and prune. The production of apples was 1,549,730 bushels, and of peaches, 71,658 bushels. The county ranks third in the State in number of fruit trees, being exceeded by Niagara and Monroe Counties; but first in the number of apple trees, and second in the production of orchard fruit. It also ranks first in number of cherry trees, and fourth in number of peach and of pear trees. The estimated acreage of all bearing fruit trees is about 28,000 acres. Although there are, in addition, several hundred acres of orchard not of bearing age, the orchard area is not being extended at the present time.

While the growing of fruit is a source of income in all parts, the industry is more important in the northern than in the southern half of the county. The most intensively farmed fruit areas are in the towns of Sodus, Williamson, Ontario, Huron, Wolcott, Rose, Marion, and Walworth. The first two are doubtless the most extensive producers, with the villages of the same name the most important marketing and shipping points for orchard products.

On some farms fruit is practically the only source of income, on some it is a special crop with other sources of income, and on some its production is a side line with other industries as the chief source of income. On the latter apple trees are planted along highways and in orchard tracts from 1 to 5 acres in extent. As a rule they receive very little attention, and much of the fruit is shaken off and sold, to be evaporated or made into cider or vinegar. On strictly fruit farms, which are in the minority and nearly all in the northern part of the county, the greater part of the crop is picked, the best being barreled and the remainder either evaporated on the farm or sold for evaporating, canning, or the manufacture of cider or vinegar. On farms where it is a special crop but not the chief or only source of income, which class is in the majority, part of the crop is barreled and part of it evaporated on the farm or sold to be evaporated, canned, or made into cider or vinegar.

Fruit is grown on a variety of soils, the greatest acreage being on the Ontario loam and its phases, the Lockport loam and stony loam, the Dunkirk very fine sandy loam and silt loam, and the Alton stony loam and gravelly loam. Other types on which fruit is grown are the Worth silt loam and Worth loam, stony phase, Palmyra gravelly loam, and Tyler very fine sandy loam, loam, and silt loam. The types are for the most part a loam or lighter in texture and porous to friable to slightly compact in structure throughout the 3-foot section. The areas selected for orchards are, on the whole, well drained, yet certain orchards and especially local spots in others need under-drainage. Peaches are grown largely on the Lockport and Dunkirk soils in a narrow belt near the lake in Sodus and Williamson towns. The pear orchards are usually small and are quite widely distributed in the northern part of the county. Soils heavier in texture, or at least more compact in structure and less well drained than in the case of apples, are frequently selected.

The varieties of apples in the older orchards are mainly Baldwin and Rhode Island Greening, with some Northern Spy, Twenty Ounce, Roxbury, King, Hubbardston, Ben Davis, Wagener, and Spitzenburg. In the younger orchards there is a smaller proportion of Baldwin and Greening as well as a greater range in varieties, with a tendency toward earlier-maturing kinds. In addition to the above-mentioned varieties are the Oldenburg, Wealthy, Wolf River, Grimes, Rome Beauty, Maiden Blush, Snow, McIntosh, Gravenstein, and others. The leading varieties of peaches are Carmen, Elberta, Rochester, and Early Crawford.

The production of small fruit has developed into an important industry. It is confined largely to the northwestern part of the county and is grown on tracts from 1 to several acres in extent, on fruit farms, and also on farms devoted largely to general crops. Most of the small fruit consists of raspberries. Strawberries are produced on a much smaller scale for local and city markets. The county ranked third in the State in the acreage and second in the production of small fruit in 1919, with 1,588 acres, of which 1,343 acres were in raspberries and 150 in strawberries. The raspberries yielded 2,935,549 quarts. The crop is sold locally and in Rochester for canning or drying or for shipment. Motor trucks are used extensively in hauling the crop, the buyers frequently doing all the hauling. The Columbian is the leading variety.

An apple orchard survey of Walworth, Ontario, and Macedon Towns³ made in the summer of 1903 gives reliable data fairly applicable to present (1919) conditions.

The value of dairy products, excluding home use, in 1919 is given by the census as \$1,671,921, which constitutes 9.5 per cent of the total farm income in the county. There were 19,718 dairy cows, with a production of 8,125,417 gallons of milk in 1919, of which 3,993,852 gallons were sold. So that while dairying is not the chief source of income it is relatively important. On a few farms the farming operations center about the dairy, but in the majority of cases it is only a supplementary source of income. Dairying is practiced most extensively in the central, southern, and eastern parts of the county, and is being extended in the northeastern part of the county. The herds are mainly grades, with Holstein and Jersey the favorite breeds. Milk and cream are supplied to local markets. Milk is shipped to Rochester and Syracuse and is also delivered to several local creameries. There are a number of milk routes which deliver milk from a distance to shipping points or to creameries.

Dairying fits well into the system of general farming practiced on many farms. It furnishes a profitable use for the bulky farm crops and at the same time provides the means of maintaining the productivity of the soil by the return of stable manure. The soils are adapted to the production of grain, forage, and pasture crops, so that the need of purchasing feed is reduced to a minimum. Markets are available for a greater production of dairy products.

The importance of the live-stock industry is indicated by the number of animals on farms. The census of 1920 reports 28,198 head of cattle, 14,459 horses and mules, 20,840 swine, and 13,578 sheep. The

³ An Apple Orchard Survey of Wayne County, New York, by G. F. Warren. Bul. 226, Agr. Expt. Sta., Cornell Univ.

number of cattle and sheep is somewhat less than reported in 1910. The number and value of animals sold or slaughtered are not reported in the 1920 census. For 1909 the number of calves sold or slaughtered was reported as 12,474; of other cattle, 11,365; of swine, 24,715; and of sheep 7,308. The number of horses sold was 1,023. The value of these animals constituted a considerable source of income. This is derived from the sale of a few hogs and cattle from each of many farms rather than from a specialized development of the industry. There are practically no farms on which it is a leading source of income. The local villages and the near-by cities afford markets for these products. In 1919 the wool, 10,282 fleeces, with a total weight of 76,737 pounds, was valued at \$44,419.

In the same year the value of poultry and eggs produced was \$751,992, or 4.3 per cent of the total income from farms. The total number of poultry was 328,807. This industry is a supplementary source of income on many farms but the leading source on comparatively few. Poultry and eggs find a ready market at good prices.

The topography is such that it permits the same general character and distribution of crops, except for a comparatively small proportion of the county which is too hilly or steep for the successful production of crops and the use of modern farm machinery. Soil conditions have had a more marked influence. While there is a rather noticeable similarity in the classes of crops grown on all soil types in all parts of the county, their relative acreage is not the same in all cases. Clover, beans, alfalfa, and wheat are grown much more extensively on the well-drained Ontario and Palmyra soils than on soils of other series. Improved areas of Muck are devoted almost exclusively to the production of truck crops. Good transportation and markets also influence the general distribution of crops. Elevation alone seldom influences the character and distribution of crops, but there are certain positions and slopes which are more favorable for the production of certain crops, especially fruit. The most potent factor in the control of distribution in this county is the modifying influence of Lake Ontario on climatic conditions. This has been largely responsible for the development of the fruit belt in the northern part of the county.

There is a general recognition of the natural adaptation of the various soil types to different crops, as evidenced by the more extensive use of the Ontario and Palmyra soils, derived in part from limestone, for such crops as beans, alfalfa, clover, wheat, and peas; of the lighter-textured Dunkirk soils for special crops; of the Worth soils, derived from sandstone and shale material, for general and dairy farming; of the less well-drained Tyler, Caneadea, and Granby soils for corn, grain, and grass crops; and of Muck for truck crops.

While agricultural methods range all the way from poor to good and up to date, the county as a whole is fairly well farmed. Corn planters and harvesters, potato planters and diggers, hay loaders, cabbage setters, two-horse cultivators, bean pullers, grain drills, binders, and other modern labor-saving farm machinery are in moderately common to general use. Two-way plows are used on the hill-sides and often on the more level fields. Sod land is plowed while the stand of grass is still good. Fields are usually thoroughly har-

rowed or disked before the crop is planted. Crops are seldom sown on land which has been harrowed or disked but not plowed. Wet spots in fields are usually underdrained. Cooperative methods are sometimes used in the reclamation of Muck areas. Tilled crops are as a rule, kept moderately free from weeds.

The orchards receive all the way from poor to good and efficient management. As a rule, the small older orchards are in sod and are otherwise neglected, while the larger and especially the younger ones receive much more attention. Many of them are plowed or disked in the fall or spring, and cover crops are sown early in the summer. Others are pastured or the grass is cut and left to decay. The use of stable manure, straw, green manure, or commercial fertilizers is quite a general practice with the better class of orchardists. The better orchards are pruned and sprayed. Labor conditions of the last year or two have handicapped owners in taking the proper care of orchards.

The farms of Wayne County are, on the whole, very well equipped and well stocked. In general the appearance of the farm buildings, farm yards, and fences indicate prosperous agricultural conditions and a spirit of thrift and pride on the part of the owners in keeping the farms in good order. The farmhouses are substantial, and the barns and other buildings, usually painted, are sufficiently large to house the farm crops and farm stock. Dry houses or evaporators are commonly found on the fruit farms. The fences are mainly of woven wire, though some are of barbed wire, and in certain sections of stone.

The farms are fairly well equipped with modern farm machinery which is generally given good care and housed when not in use. There were 94 tractors on farms in the county in 1918, according to the census of the State Food Commission. The work stock consists almost entirely of horses. Automobiles are owned by many farmers and quite a number of motor trucks for hauling crops and supplies to and from market are being used, especially on fruit and truck farms.

While there is no fixed system of crop rotation, a general plan is followed, with variations to suit the character of the soil and the needs of the individual farmers. On general and dairy farms the plan is to plow sod land for some cultivated crop, such as corn, potatoes, beans, or cabbage, the first year; oats the second year; wheat with seeding to grass the third year; and grass crops, either hay or pasture, for two to four years. The chief variations consist in planting a tilled crop, such as beans or cabbage, the second year; in substituting some of the minor cereal crops for oats; and sometimes following the tilled crop immediately with wheat. Young orchards usually take their turn in the rotation or are planted to special crops. The rotation in the older orchards, when practiced, consists of variations in the use of sod, cover crops, and fallow.

The census gives the expenditure for commercial fertilizer in 1919 as \$447,613, or an average of \$119.50 on 3,746 farms, or three-fourths of the total number of farms. This rather high average is accounted for in part by the fact that fairly heavy applications of fertilizer are used for truck and other special crops. The available supply of stable manure is applied either to sod land to be plowed for cultivated crops or to land just before seeding to wheat. Some

lime in the form of ground limestone is used, chiefly for general farm crops, especially alfalfa, in the northern part of the county. None is used in orchards. There are three lime mills in the north-eastern part of the county.

The amount expended in 1919 for farm labor on 3,235 farms, or 65 per cent of the total number, was \$1,741,734, or an average of \$538.40. The normal supply, which was not equal to the demand, has been decreased, especially in the last two years, by a movement to industrial centers where steady employment is offered at higher wages. Considerable outside labor is employed in harvesting the fruit crops.

The expenditure for feed in 1919 was \$713,648, an average of \$201.65 for the 3,539 farms reporting.

In 1880 the proportion of the farms operated by owners was 82.9 per cent. The ratio fell to 73.3 per cent in 1900, but rose to 78 per cent in 1920. Farms are usually rented on shares, the owner furnishing land, seed, and half the fertilizer, the tenant the remainder of the fertilizer and the stock, tools, and labor.

Land values have advanced in the last few years, and there is at present a good demand for Wayne County farms, though the exchange of ownership is not very active. The value of land suitable for general and dairy farms does not vary greatly in the different parts of the county; the range is from \$70 to \$125 an acre, or when an orchard tract of some size is included, somewhat more. Well-developed Muck is held as high as \$1,000 an acre, and land adapted for special crops, such as orchard and small fruits, at \$100 to \$250 or more an acre.

SOILS.

The soils of Wayne County are more or less closely related to the underlying rocks. The rocks are nearly horizontally bedded, with only a slight dip toward the south. They are composed of sediments laid down during the Silurian period, indurated and subjected to no disturbances other than those of elevation and depression. These rocks, which are classified according to character into four distinct groups, the Medina, Clinton, Niagara, and Salina, comprise the underlying rock over four fairly well defined successive belts extending east and west across the county.

The northernmost as well as the oldest group is the Medina, which consists of red, gray, and variegated sandstones and occupies a belt from 2 to 4 miles wide along the lake shore. West of a line due north of Sodus it is covered by a comparatively shallow mantle of glacial till or of lake deposits, and outcrops occur in places in the low lake bluff at or near the level of the present lake, while to the east the fine-earth mantle is much deeper. This is the smallest of the four belts. The Clinton belt is next in succession and is from 3 to 5 miles wide. The rocks consist of gray to greenish-gray thin-bedded shales interbedded with strata of limestone. The iron ore mined near Ontario occurs in this formation. North of the Ridge the rocks are for the most part covered with a shallow fine-earth mantle, though in places exposed and weathered into residual soils. The rocks of the Niagara group comprise bluish and grayish thin-bedded shales and impure limestones, with an upper member of thin crystal-

line limestone. Farther west the limestone stands out as a ridge or escarpment, but in this county it outcrops or is exposed in quarries in low positions between hills in isolated areas over a belt from 3 to 4 miles south of the Ridge.

The largest and southernmost belt, located south of a line passing close to the northern boundaries of Macedon, Palmyra, Galen, and Savannah Towns, is underlain by rocks of the Salina group, which consist of thin-bedded red and gray shales. These are exposed only in places on slopes along the old glacial stream channel in the extreme southern part and in some low valley troughs in the southeastern part of the county, where they are either covered by a thin mantle of glacial till or have weathered into residual soil.

Several geologic ages covering a long period of time intervened between the formation of these rocks and the invasion of the region by the continental ice sheet, the advance and recession of which is largely responsible for the existing topography and the unconsolidated mantle which overlies the rocks. This mantle consists of (1) material reworked and deposited by the ice sheet as glacial till, (2) stratified sand and gravel deposits laid down by glacial streams as terraces, deltas, or outwash plains or built up as beaches, and (3) stratified fine-textured sediments deposited in temporary glacial lakes. The mantle rests upon a more or less even rock plain which has a general slope northward to the present lake level or lower.

Glacial lake waters have had almost as great an influence in the deposition or modification of soil material as the ice sheet. Lake Iroquois, the only one of the succession of glacial lakes directly affecting this county, represented an accumulation of glacial waters ponded between the ice front to the north and the higher lying region to the south up to a level at which an outlet was afforded through the Mohawk Valley. Its limits and highest level are shown by a well-defined beach line wherever conditions were favorable for its formation. The "Ridge," extending from Sodus to the Monroe County line and farther west, either fringing hills of glacial till or built up as a bar across southward-extending valley troughs, is the most conspicuous example of such a formation in the county. It ranges in elevation from 450 feet at the Monroe County line to 457 feet at Sodus, and its crest is 15 to 25 feet above the generally level country immediately to the north. A conspicuous beach line is also developed on or near a group of rugged hills in the northern part of Butler town, where it has an elevation of 460 to 470 feet. Prominent beaches are also found southeast of South Sodus, near West Butler, northeast of Rose, and from North Rose to Clyde, while others of less importance occur in exposed places elsewhere within the lake region.

This glacial lake covered the strip between the Ridge and the present Lake Ontario, yet fine-textured water-deposited soil material is of comparatively small extent. A short distance to the east of Sodus its shore line swung to the south, following an irregular course, and the water covered the wide valley trough to the west of Rose and Clyde. Farther east there were a number of other arms, among them the narrow valley trough now occupied by Wolcott and Butler Creeks, and extending southward to connect with the present Montezuma Marsh. Near the eastern county line the shore line again

swung far to the south. Within the area covered by its eastern and southern extension there are a number of isolated hills that were either wholly submerged or partly submerged and appearing as islands. Here the fine-textured lake sediments are the dominant material and are deeper than over its western extension.

The soils of the county are therefore derived from glacial till, from the decomposition of rocks in place, and from water-laid material, including old-terrace, beach, lake-bottom, and recent-alluvial deposits. Various agencies of weathering, especially oxidation in conjunction with drainage conditions, have resulted in the formation of the greater part of the soils of the county, which are broadly separated on the bases of derivation and processes of accumulation into the following groups: (1) Soils derived from glacial till, (2) soils derived from the decomposition of the underlying rocks, (3) soils derived from old-terrace and beach deposits, (4) soils derived from lake-laid sediments, (5) soils derived from recent-alluvial material, (6) soils derived from accumulations of organic matter, and (7) miscellaneous soils.

Each of the first five groups mentioned includes a number of soil series consisting of soils of similar origin, color, structure, topography, and stage of development. Each series is represented by one or more soil types, which are based upon differences in texture—i. e., the relative proportion of the different-sized particles of mineral matter making up the soil mass.

Twenty soil series, embracing 37 soil types and 13 phases, and 5 types of miscellaneous material have been recognized in the survey of Wayne County. Their extent and distribution are shown on the accompanying soil map.

Soils derived from glacial till.—These soils occupy the undulating to rolling and hilly sections of the county. They are composed of unassorted material known as glacial till or drift, ranging from silt and clay to cobbles and medium-sized boulders, though carrying little sand or coarse sand. The depth of this till ranges from 2 to 10 feet in the case of the thinner deposits, and from 50 to 175 feet or more in the region of the deeper deposits. Rock outcrops do not occur as a rule, and the hills do not have a rock core. The material, though derived from a variety of rock sources, usually bears a close relation to the near-by rock formations and has been transported only short distances. The crystalline erratics are from more distant sections. The character of the drift and the topography indicate that the material was deposited underneath the ice and was exposed upon its recession. Many of the soils of the group have the characteristic drumlin topography so common in the county. The soils of this group from deep till are classed in the Ontario, Lyons, Worth, and Westbury series and from the thin till in the Lordstown and Lockport series.

The Ontario series includes types with light-brown to brown surface soils and a yellowish-brown subsoil that in places grades into a lighter or grayish brown in the lower part of the 3-foot section. A characteristic feature of the series is that the subsoil, though rather compact, has a texture as light or lighter than the surface soil. The substratum is a yellowish to grayish or slightly mottled, compact, unassorted till. The stone content is usually moderately

low and well distributed on the surface and in the soil section and substratum, and consists of subangular to rounded sandstone and limestone fragments of small to medium size, together with a few boulders of crystalline rock. Fragments of limestone are usually not conspicuous in the surface material, but become more abundant with depth. The lower subsoil is in places moderately calcareous, but effervescence with acid is much more marked with depth. The surface is undulating or sloping to rolling or steep, the wide variation being due to the prevalence of many elongated hills or drumlins. Drainage is good. The types are composed of fairly well oxidized glacial till derived from rock formations of sandstone, shale, and limestone. The Ontario soils differ from the Worth soils in having darker surface soils and a yellowish-brown instead of yellow subsoil, and in being calcareous. The Ontario loam and four phases are mapped in this survey.

The soils of the Lyons series are light grayish brown to a depth ranging up to 10 inches. The upper subsoil is a pale yellowish brown rather compact mottled horizon heavier than the surface. This stratum extends to a depth of about 2 feet. The deeper subsoil consists of the dark-bluish, highly calcareous glacial drift, mottled, and leached of the carbonates at top but highly calcareous at less than 3 feet. The series is essentially an imperfectly drained Ontario. The loam is the only type of the series mapped in this county.

The surface soils of the types included in the Worth series are grayish to light brown in color, and the subsoil brownish yellow to yellow, which commonly grades into light-yellow or yellowish-gray material below a depth of 24 to 30 inches. Both soil and subsoil have a friable structure, with the subsoil as light or lighter than the surface soil. The typical substratum is deep, unassorted, grayish or mottled glacial till. The material is noncalcareous and moderately stony, the stone content being well distributed in the soil profile and consisting mainly of angular to partly rounded fragments of sandstone, together with some medium-sized boulders of crystalline rock. The topography is undulating to rolling or hilly, the hilly part being confined to the drumlin areas. Drainage is good. Deposits of glacial till, derived mainly from sandstone, with some shale and crystalline rock, and fairly well oxidized, give rise to the soils of the Worth series, represented in this county by the loam and silt loam types and four phases.

The Westbury series includes types with dark-gray surface soils and a gray or gray mottled with yellow and brown subsoil. It has a compact structure, though seldom heavier than the soil. The substratum is a gray unassorted mass of fine earth and stones. Small to medium-sized boulders are usually abundant on the surface, and less abundant within the 3-foot section. The material is noncalcareous and consists of glacial till originally similar to that of the Worth series but, on account of poor drainage, only slightly oxidized and otherwise modified by the incorporation of organic matter. It is evident from the position of the Westbury loam, the only type mapped in the county, that the leveling effect of lake water and some further reworking of the original material have been factors in its development.

The Lordstown series embraces types which have brown surface soils and a yellowish-brown subsoil and which overlie bedrock at depths of 2 to 5 feet or more. They are friable and noncalcareous, and have a medium to high stone content at the surface and throughout the soil section. The topography is flat to slightly undulating, and the drainage is usually adequate. Well-oxidized glacial till, derived mainly from sandstone and shale, gives rise to the Lordstown series. Only the silt loam was mapped in Wayne County.

The types included in the Lockport series have reddish-brown surface soils over a brown to reddish-brown subsoil, the lower part of which usually consists of a red clay loam to stony clay loam. Wherever the red sandstone or shale bedrock does not come within the 3-foot section, it occurs at only slightly greater depths. The material is usually exceedingly stony, not only on the surface but throughout the soil profile. The stones consist of small angular fragments of red sandstone together with medium-sized rounded boulders of both sandstone and crystalline rock. The surface is level to broadly undulating, and drainage is usually adequate. The soils of the series have their origin in a thin mantle of glacial till composed mainly of material derived from red sandstone, with the zone of weathering extending in many places into the underlying rock. The stony loam, loam, and heavy phase of the loam represent the series in this county.

Soils derived from the decomposition of the underlying rocks.—The soils of this group occupy areas of smooth to steep topography, which either originally had no covering of glacial till, or which have been exposed by its removal. They consist mainly of fine-textured compact material which carries shale and limestone fragments and rests upon the parent rock at comparatively shallow depths. They represent the most recent upland soil material. On the basis of character of material and of parent rock, the soils of the group are classified in the Allis and the Livingston series.

The types in the Allis series are characterized by light-gray to yellowish-gray compact surface soils, a stiff gray upper subsoil, and gray to drab lower subsoil, commonly faintly mottled with yellow and shades of gray. Small partly disintegrated shale fragments are fairly common, and bedrock is encountered here and there within the 3-foot section. The material is noncalcareous and is derived from the decomposition of beds of gray shale. The surface ranges from undulating to sloping and steeply sloping. Drainage is slow and is inadequate in wet seasons. The Allis silty clay is the only type mapped in this county.

The surface soils of the types included in the Livingston series are gray to brownish gray in color. The subsoil is gray to greenish gray, usually slightly mottled with yellow, heavy in texture, and stiff to plastic in structure. A few small shale and limestone fragments occur on the surface and in the soil mass. The material overlies bedrock at depths of 2 to 5 feet or more, is calcareous, and is composed of the more or less thoroughly weathered products of calcareous shales and interbedded limestones. The surface is broadly undulating to sloping, and drainage is poor. Only one type, the silty clay loam, is mapped in Wayne County.

Soils derived from old-terrace or beach deposits.—The soils of this group occur as terraces, deltas, or outwash plains in the valleys of glacial and present streams; as beaches marking the shore line of glacial Lake Iroquois; and to a limited extent as stratified glacial drift in the form of kames and eskers. They are composed of assorted sand, gravel, and cobblestones (mainly of either sandstone or sandstone and limestone), and are in places stratified in a complex manner. The material is derived to a large extent from reworked older deposits of glacial till and was laid down by swiftly flowing glacial streams, built up as beaches by wave and current action, or deposited by streams flowing within or underneath the ice sheet. Material of this character is found at elevations of 425 to 475 feet and has a wide distribution in small to medium-sized areas. The soils of the group are typically gravelly or stony in character and belong to the Palmyra and Alton series.

The Palmyra series includes soil types having brown to slightly reddish brown, friable surface soils, a light-brown, friable, though compact upper subsoil, and a coarse, porous lower subsoil and substratum. The material is moderately to strongly calcareous. Well-rounded gravel and stones, mainly sandstone and limestone, are usually abundant in the surface soil and upper subsoil and comprise the greater part of the lower subsoil and substratum. The sand content is low. The surface is level to terraced and drainage is good. The series includes practically all the old-terrace soils in the county. The material is well assorted and well oxidized and has been modified to a considerable extent by weathering since its deposition. The members of the series in this county are the stony loam, gravelly loam, fine sandy loam and its gravelly phase, and the loam.

The types of the Alton series have brown to faintly reddish brown, friable surface soils and a yellowish-brown loose and porous subsoil. The soil material rests upon compact, unsorted glacial till at comparatively shallow depths, sometimes within the 3-foot section. Stones, consisting of rounded gravel and small cobbles, mainly of sandstone, are usually abundant and fairly well distributed throughout the soil section. In addition there are in places many small to medium-sized boulders of sandstone and of crystalline rock. The surface is level to undulating and sloping, and drainage is excessive in places. The material is noncalcareous and well oxidized. It is rather imperfectly assorted and represents the products of the reworking by lake waters of glacial till similar to that giving rise to the Worth soils. The character and depth of the soil material depends upon the thoroughness of the reworking. The stony loam and gravelly loam represent the Alton series in Wayne county.

Soils derived from lake-laid deposits.—The soils of this group, though occurring largely on the main lake plain, are also found in isolated areas within the upland types. They cover areas of level to undulating country and consist of fine-textured stratified deposits practically free from material coarser than medium sand. These deposits are usually many feet in thickness and are underlain by glacial till or by bedrock. They represent accumulations of fine sediments deposited in quiet water. The agencies of weathering, drainage, erosion, and wind action have been active in the development of the present soils, which are classed in the Tyler, Schoharie, Dunkirk, Granby, Lucas, Homer, and Caneadea series.

The Tyler series embraces soil types with brownish-gray surface soils and a mottled yellow, gray, and rusty-brown subsoil, which, though seldom heavier, is usually much more compact in structure than the surface soils. The substratum consists of gray to mottled stratified fine material free from stones or gravel. The topography is level and the drainage slow and imperfect. The types are non-calcareous and have been developed by incomplete oxidation and the incorporation of organic matter as a result of rather poor drainage conditions within areas of fine stratified sediments, derived largely from sandstone and shale. They are intermediate in stage of development between the well-drained Dunkirk soils and the more poorly drained Caneadea or Granby series. This series is represented by the fine sandy loam, the very fine sandy loam and its stony phase, the loam, silt loam, and silty clay loam.

The Schoharie series is represented by one type of small extent, the stony very fine sandy loam. This is characterized by a brown surface soil and a pinkish to reddish subsoil and substratum. Small to medium-sized fragments of red sandstone and occasional boulders of crystalline rock are scattered over the surface. The surface is flat and the natural drainage poor.

The Granby series consists of soil types having dark-gray surface soils and a mottled gray and light-yellow subsoil, compact in structure, and similar in texture to the surface soil. Grayish stratified material makes up the substratum, which, like the soil profile, is free from stones. The types are non-calcareous, have a level surface, and are poorly drained. Their development is due to the imperfect oxidation and the accumulation of organic matter resulting from poor drainage conditions existing over a long period of time in areas of fine-textured sediments, derived mainly from sandstone and shale. Two types, the Granby loam and silty clay loam, are recognized in Wayne County.

The soil types belonging to the Dunkirk series have light-brown to brown surface soils and a yellowish-brown to brownish-yellow subsoil, which in places at depths of 24 to 30 inches grades into grayish yellow, and in the heavier types may show faint mottlings. The soils are friable in structure, and the subsoil, though compact, is seldom perceptibly heavier than the surface soil and is non-calcareous. The substratum, which usually is deep, consists of fine-textured stratified material. The types are practically free from stones. The surface is level to gently rolling and the drainage is good. The soils of the series have been formed from an accumulation of lake-laid sediments derived largely from sandstone and shale and subsequently modified by fairly thorough oxidation resulting from good drainage and also modified slightly by wind action in the case of the lighter types. The Dunkirk series is represented by the loamy fine sand, very fine sand, fine sandy loam and its rolling phase, very fine sandy loam, and silt loam with its steep phase.

The soils of the Lucas series are characterized by light brownish gray surface soils and a pale-yellow subsoil in which gray mottlings increase in number and size with depth. The subsoil is as heavy or heavier than the soil, has a rather tough structure, and is calcareous. The substratum is fine stratified material. Gravel and

other coarse material are commonly lacking. The surface is smooth to undulating and the drainage is fair though slow. Imperfectly oxidized lake sediments derived to some extent from limestone give rise to the series, which is represented by the silty clay loam in this county.

The Homer series includes soil types with gray to light brownish gray soils and a faintly mottled yellow and gray to gray subsoil of tough structure, though slightly more friable or brittle in the lower part of the 3-foot section, which is also moderately calcareous. Gray impervious material forms the substratum. The material is prevailingly stone free. The surface is flat and the drainage is poor. The development of the series has resulted from the slight oxidation and the poor drainage of lake sediments derived in part from limestone material. The Homer silty clay is the only type of this series in the county.

The types included in the Caneadea series have light-gray surface soils and a gray mottled with yellow and rusty brown subsoil, as heavy or heavier than the soil in texture and stiff to somewhat plastic in structure. Fine, compact, stratified material comprises the substratum, which is also noncalcareous. The virgin soil usually consists of 2 or 3 inches of dark-gray surface material underlain by an ash-gray subsurface layer. The types carry no gravel or bowlders. They are level and poorly drained. They occur over areas of lake sediments derived from sandstone and shale, where poor drainage has resulted in very poor oxidation and little accumulation of organic matter. The silty clay loam is mapped in this county.

Soils derived from recent-alluvial material.—The soils of this group, though of limited occurrence, are widely scattered throughout the county. They occupy the lowest elevations and positions in the sections in which they occur. They are composed of recent-alluvial sediments occupying first bottoms along streams, and are derived from materials washed from upland and terrace soils lying in the stream basins. Differences in drainage conditions and parent material have resulted in the development of three series in this group, the Genesee, Holly, and Papakating.

The soil types of the Genesee series have brown surface soils and a light-brown subsoil and occupy first-bottom positions. They are compact in structure, and have a flat surface and fair drainage, though subject to overflow. The material consists of sediments derived mainly from Ontario and Palmyra soils. Three types, the loam, silt loam, and silty clay loam, represent this series in Wayne County.

The types included in the Holly series have light-brown surface soils, a mottled yellow, gray, and rusty-brown subsoil. They have a level surface, rather poor drainage, and are subject to overflow. Sediments derived mainly from soils of the Worth, Dunkirk, and Tyler series and deposited during overflows, with modifications resulting from poor drainage, give rise to the Holly silt loam, the only type of the series in the county.

The Papakating series consists of types having dark-gray to black surface soils and a gray to gray mottled with yellow subsoil. They occupy narrow first bottoms subject to overflow and are very poorly drained. Their development is due to the lack of oxidation and to

the accumulation of organic matter resulting from poor drainage in stream-laid sediments derived from the upland types. Only one type, the silt loam, is mapped in Wayne County.

Soils derived from organic accumulations.—The soils of this group consist of accumulations of organic matter in various stages of decomposition. They occupy basins or depressions where conditions have been favorable for the growth of water-loving vegetation and for the preservation of its partly decayed products. These range from the black well-decomposed material classed as Muck to the brown fibrous material known as Peat. Both are flat and have very poor drainage.

Miscellaneous soils.—This group includes Marsh, Madeland, and Coastal beach, which are nonagricultural in their present condition.

The following table gives the names and the actual and relative extent of the various soils mapped in Wayne County:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Ontario loam.....	83,712	34.9	Lockport stony loam.....	3,776	1.0
Reddish phase.....	32,128		Palmyra stony loam.....	3,584	.9
Steep phase.....	11,584		Granby silty clay loam.....	3,200	.8
Steep red phase.....	5,504		Lordstown silt loam.....	2,944	.8
Gravelly phase.....	960		Schoharie stony very fine sandy loam.....	2,944	.8
Worth loam.....	19,712	7.9	Lucas silty clay loam.....	2,496	.7
Poorly drained phase.....	5,440		Genesee loam.....	2,240	.6
Stony phase.....	3,328		Westbury loam.....	2,048	.5
Steep phase.....	1,856	7.1	Alton gravelly loam.....	1,984	.5
Dunkirk silt loam.....	23,936		Palmyra fine sandy loam.....	1,472	.5
Steep phase.....	3,264	6.8	Gravelly phase.....	448	
Muck.....	25,920		4.5	Dunkirk fine sandy loam.....	1,344	.5
Palmyra gravelly loam.....	17,280	Rolling phase.....		576	
Worth silt loam.....	12,672	3.8	Holly silt loam.....	1,792	.5
Poorly drained phase.....	1,728		3.2	Livingston silty clay loam.....	1,536	.4
Alton stony loam.....	12,352	2.9		Tyler fine sandy loam.....	1,472	.4
Tyler very fine sandy loam.....	8,320		2.4	Lyons loam.....	1,344	.3
Stony phase.....	2,112	2.4		Madeland.....	1,216	.3
Lockport loam.....	8,960		2.4	Palmyra loam.....	960	.3
Heavy phase.....	448	2.4		Allis silty clay.....	896	.2
Caneadea silty clay loam.....	9,344		2.3	Dunkirk loamy fine sand.....	576	.2
Dunkirk very fine sandy loam.....	8,960	2.2		Genesee silt loam.....	512	.1
Granby loam.....	8,256		2.1	Homer silty clay.....	448	.1
Tyler silt loam.....	8,192	1.9		Dunkirk very fine sand.....	320	.1
Marsh.....	7,296		1.4	Coastal beach.....	256	.1
Papakating silt loam.....	5,440	1.3		Peat.....	192	.1
Genesee silty clay loam.....	4,928		1.2		
Tyler silty clay loam.....	4,672	1.0			
Tyler loam.....	3,968			Total.....	383,360	.....

ONTARIO LOAM.

The surface soil of the Ontario loam is a fine-textured, friable brown loam, 8 to 10 inches deep. The subsoil is a yellowish-brown loam which usually becomes lighter or more yellowish in color in the lower part of the 3-foot section. The substratum is an unsorted compact mass of fine-earth material of light-yellow to mottled yellow and gray color. The subsoil, though more compact, is seldom heavier than the surface soil in texture. As developed in this county, the type is not stony; in only a few places are stones present in sufficient quantities to interfere with cultivation. The stones consist of small to medium-sized angular to subangular fragments of sandstone and limestone, with a few medium-sized rounded boulders of sandstone and crystalline rock in places. As a rule

limestone fragments are not conspicuous on the surface but become gradually more abundant with depth, occurring quite prominently in the substratum as dark-colored subangular pieces seldom larger than cobblestones. A depth of 3 feet and in some cases as much as 5 feet is reached before the material effervesces freely with acid.

From north to south, the type grades from a light-brown, light-textured loam closely resembling the Worth loam to the reddish-brown, smooth, fine-textured loam mapped as the reddish phase, according to the percentage of the material derived from the belts of underlying rocks, which range from sandstone or limestone to red and gray shales. In the northern part of the extensive belt occupied by the type, it is light brown in color, with yellow quite prominent in the subsoil, and carries almost enough fine and very fine sand for a very fine sandy loam; while to the south, where it is influenced by the red shales, it is slightly reddish brown when moist, and in deep cuts has a reddish to pinkish cast, and grades toward a silt loam in texture in places where the shale influence has been greatest. Along the western part of its northern limit the type grades into the Worth loam, and the boundary is rather arbitrarily placed, and to a lesser degree this is true of the boundaries between the type and its reddish phase.

The type is derived from a deep layer of unassorted glacial till, being shallowest in the valley troughs and deepest on the hills, which have no rock core. While the greater part of the Ontario material is thoroughly weathered and oxidized to a depth of 3 feet, variations in drainage conditions, position, and topography result in gradations toward the Lyons loam. There are therefore a number of less well-drained spots or tracts in which the surface soil has the typical color, but the subsoil, especially in the lower part, is faintly mottled with gray and sometimes with rusty-brown spots or iron stains. Such areas occur in troughs between hills, at the foot of steep or long slopes, and in other positions where the natural drainage is slightly retarded. Owing to their small extent, these areas are included with the type as mapped.

In the southern part of the county the surface soil in many places has a reddish-brown color when moist, and the boundary between this variation and the reddish phase is arbitrary. Except near its northern limits, the soil is darker and slightly heavier than that of the type, and the subsoil appears less compact, possibly because of the higher stone content. In places, especially south of the old glacial-stream channel in the southern part, subangular gravel is more or less conspicuous but is not sufficiently abundant to warrant separate mapping.

This variation is most extensive in the towns of Macedon and Walworth, where the drumlin topography is not as pronounced and the steep phase is least extensive.

The most important variations in this type, based mainly on surface features, consists of about 10 inches of brown to rather dark brown friable loam to silty loam, underlain by a light-brown to yellowish-brown loam, which either extends to a depth of 3 feet or becomes faintly mottled with gray in the lower part of the 3-foot section. The substratum is deep unassorted material with no bed-rock showing. In certain areas the stone content is apparently

higher than typical, especially of that part composed of large fragments and medium-sized rounded boulders.

The Ontario loam with its phases is the dominant soil in the southern half of the county. The typical soil occurs most extensively in Walworth, Macedon, Palmyra, Arcadia, Lyons, and Butler towns and is associated with soils of the Palmyra, Holly, Genesee, and Papakating series, and Muck, all of which occur at lower levels.

The surface of this type is in general made up of a series of elongated hills which rise abruptly at their northern ends and merge gradually with lower country to the south. These hills occur in groups or singly, separated by valley troughs in which the smooth phase, soils of the Palmyra series, and alluvial soils are found. They have smooth rounded outlines, range from one-half to one mile or more in length, and ordinarily rise from 100 to 175 feet above their bases, with here and there a few of less relief. The topographic detail shows best when viewed from the north. The average height of the hills is nearly 600 feet, the highest, Baker Hill, being 680 feet in elevation, and nearly a dozen of them exceeding 640 feet. In detail the surface is undulating to broadly rolling and hilly. Drainage is adequate to good. Streams are not numerous and tributaries do not reach all parts of the type. There is little run-off, the surplus water sinking into the soil. Here and there are small tracts which drain slowly.

The Ontario loam is the most extensive and widely distributed soil type in the county and is the most important from an agricultural standpoint. Approximately 95 per cent of the type is cleared and used for farm crops, the remainder being in forest. Two railroads, one electric line, and the Barge Canal, traverse the section occupied largely by the type, and probably none of it is more than 10 miles from some marketing point. The surface soil has a moderately good content of organic matter, is easily tilled, and is farmed with modern farm machinery. It dries fairly quickly after rains, yet holds considerable moisture within the reach of growing crops. The type is productive and is adapted to a wide range of crops. It covers a rather thickly settled and prosperous farming section.

General farming combined with dairying is the leading type of agriculture. The dairy industry ranges in importance from the practice of keeping cows to supply dairy products for home use and a small surplus for sale to that on farms where all farming operations center around the dairy. It is a side line rather than a specialty on the majority of farms where it contributes to the farm income and is practiced most extensively near the railroads. Another fairly important side line is the growing of fruit. Most farms have orchards, mainly apple orchards, 1 to 10 acres or more in size, from many of which fruit is sold in commercial quantities. The planting of fruit trees along the roads is a common practice.

Considerably more than one-half of the type is in grass for hay and pasturage, mainly timothy and clover mixed in varying proportions, and to a less extent timothy or clover alone, timothy and alsike, and alfalfa. Alfalfa is grown on a small but increasing acreage. Permanent pasture is uncommon, but the use of the type for pasture is often a step in the rotation of crops, especially where fields are not well adapted to tillage. Hay is fed on the farms where grown

and the surplus sold. Wheat and oats are the leading grain crops, wheat being grown on the larger acreage during the present season (1919), the plantings ranging from 2 to 10 acres on individual farms. It is mainly a cash crop. Oats are for the most part a feed crop, with some farms producing a surplus for sale. Rye, barley, and buckwheat are minor grain crops. A large part of the bean crop of the county is grown on this type, the individual plantings varying from 1 to 5 acres. It is a cash crop. This is also the soil used most often for the production of cabbage which is grown on small tracts as a minor cash crop. The greater part of the potatoes raised on a commercial scale are grown on this type, although most farmers produce potatoes mainly for home use; the farm acreage ranges from 1 to 5 acres or more. The production of small fruits and of canning-factory crops, especially peas, though the acreage devoted to it is not large, is an increasing source of income on quite a number of farms in sections moderately close to markets.

The yields of crops on this type are above the general average for the county. Hay yields 1 to 2½ tons, averaging 1½ tons per acre. Wheat yields 15 to 30 bushels, with an average of about 20 bushels; oats, 30 to 65 bushels, averaging about 40 bushels; corn, 50 to 100 bushels; beans, 10 to 25 bushels; cabbage, 8 to 20 tons, and potatoes, 75 to 200 bushels, averaging about 100 bushels per acre.

Corn is practically the only crop used for silage, from one-fifth to one-fourth of the acreage being devoted to that purpose. Seldom is more than one crop of hay taken from a field in the same season, the aftergrowth usually being grazed. From 2 to 3 cuttings of alfalfa are obtained. The general crop rotation consists of corn, beans, or potatoes, followed by beans or oats, and in turn by wheat and seeding to grass. Fields are left in grass from 2 to 4 years or more. Departures from this are many and varied, according to the character of the farming and the needs of the farmer. The available supply of stable manure is applied to sod land before plowing or used for top-dressing hay land or land about to be sowed to wheat. Some commercial fertilizers are used. Modern farm machinery is in almost universal use.

Farms located on the Ontario loam sell for \$75 to \$125 an acre.

Ontario loam, gravelly phase.—The surface soil of the Ontario loam, gravelly phase, consists of a brown friable loam carrying considerable quantities of rounded gravel of fine to medium grade. At an average depth of 10 inches the material becomes lighter in color and the gravel content increases, so that the subsoil is a more or less assorted porous mass of gravel, sand, and finer earth extending to a depth of 3 feet or more. The substratum is also coarse and porous. The gravel content comprises waterworn limestone and sandstone fragments, frequently showing a white coating. There are comparatively few fragments of the size of cobblestones and boulders. In places the soil carries more than the typical amount of sand.

The gravelly phase occurs in only a few scattered areas in association with the other Ontario soils and Palmyra soils. Areas are located 2½ miles east of Rose, 1 mile southeast of South Sodus, southeast of Newark, and between Newark and Minstead.

The phase occupies high, hummocky, or billowy hills, which usually contrast with the hills of smooth outline of the Ontario loam. The drainage is good to excessive. The phase is inextensive and of little agricultural importance. The soil is productive and is adapted to a variety of crops. All of it is farmed to fruit, grain, potatoes, beans, and alfalfa and other hay crops. Fairly good average yields are obtained, though varying with the character of the season.

The yields, sale value, and methods of farming are practically the same as for the typical Ontario loam.

Ontario loam, reddish phase.—The reddish phase of the Ontario loam consists of reddish-brown friable loam to silty loam to an average depth of 10 inches, underlain by a compact reddish-brown silty loam, which grades into a faintly reddish brown to pinkish compact loam extending to a depth of 3 feet or more. A substratum of partly oxidized, faintly mottled pinkish unsorted material continues for many feet. Both the surface and the soil material are comparatively free from rock fragments and boulders for a glacial-till soil. Fragments of limestone and sandstone, though occurring within the soil profile, are more conspicuous in the substratum and are seldom larger than cobbles. In places mottlings appear in the lower part of the soil section. The subsoil usually effervesces with acid.

In many places there is no well-defined boundary between the typical soil and this phase, the gradation being influenced by the presence of the red shales. Only areas showing a decidedly reddish shade have been included in the phase, though the influence of shale is noticeable throughout the southern part of the county.

The reddish phase occurs in the south-central and southeastern parts of the county, chiefly in Galen and Savannah Towns, with less in Arcadia, Lyons, and Butler Towns. It lies within the drumlin region and its surface features resemble those of the typical Ontario loam in a general way. It is made up of groups of the elongated hills that blend in smooth outline, with comparatively few conspicuous hills and steep slopes. The trend of these hills is slightly to the east of south. In addition there are many narrow ridges whose width and elevation are so slight that they are not shown on the topographic base map. These are more characteristic of this phase than of the typical Ontario loam. In the south-central part the phase covers a number of more or less isolated hills. It varies in elevation from 400 to 600 feet above sea level. It is well drained, largely through internal means. Drainage courses are rather infrequent, follow troughs between hills, and have almost no well-defined branches.

The reddish phase of the Ontario loam is not very widely distributed, though fairly extensive. As it is a productive soil, and all under cultivation, it is of considerable agricultural importance in the county. Scarcely any of it lies more than 5 miles from the villages of Clyde, Savannah, Newark, and Lyons. Its surface on the whole is not quite as favorable for tillage as that of the main type, as it includes many narrow ridges with steeper slopes, which would have been separated as a steep phase on a map of larger scale. There is, however, very little waste land in this phase, which is

generally well farmed, although in certain sections the farms do not show as much evidence of prosperity as on the main type.

General farming prevails, with dairying and a little fruit raising.

Ontario loam, steep phase.—The differentiation of the Ontario loam, steep phase, from the type is almost wholly on the basis of topography. The surface soil of the phase is as a rule from 6 to 8 inches deep, and therefore slightly shallower than that of the typical soil. There appears to be also a slightly higher gravel content, but stones are not more abundant. A feature of this phase is the exposure, usually on narrow sharp crests on the northern end of some hills, but sometimes extending southward along the crest of all or of a large part of the hill, of a strip of the subsoil, where the soil has been removed by erosion. Such strips or spots are commonly destitute of vegetation and are exceedingly gravelly on the surface.

The steep phase is widely distributed in the same general region as the type. It is most abundant in the central part of the county, north of Palmyra, Newark, and Lyons, and in the eastern part northeast and northwest of South Butler. It covers the steep slopes of a large number of the elongated hills or drumlins that are so numerous and well developed in this section of the State. The areas include the northern end of such hills, usually extending southward along one or both flanks of the hills and tapering as the hills gradually merge with lower country toward the south. These hills rise quite abruptly from 100 to 150 feet or more above the country immediately to the north. The slopes, in addition to being very steep, are sometimes made up of a series of transverse ridges or ribs. In places the phase covers all of certain narrow hills or of a series of hills made up of steep slopes. This phase is also mapped along the old glacial stream channel in the southern part of the county on slopes which appear to be in part erosional. Its drainage is adequate to excessive.

Probably about one-third of this phase is in forest, another one-third is used for farm crops, and the rest is utilized for pasture or is waste land. The waste land results from the fact that cultivation extends down the slope from the top of the hill and up the slope from the base, leaving a narrow strip untilled and unsuited for use as pasture. The soil of the phase is productive and holds moisture fairly well considering its steepness. It is located within a fairly thickly settled and well-farmed region. Tillage is difficult on account of the hilly topography, and the phase is subject to erosion during heavy rains unless in grass.

The phase is kept in grass as much as possible. Plowing is done with two-way plows. Corn, beans, or potatoes are planted one season, followed by oats or wheat and seeding to grass, and then by several years in grass. The yields compare favorably with those of the typical Ontario loam. Unless there is quite a proportion of the phase on a farm, it seldom affects land values to any considerable degree.

Ontario loam, steep red phase.—The Ontario loam, steep red phase, closely resembles the reddish phase of the type in color, texture, and structure and the steep phase in surface features, position, drainage, and agricultural value. The surface soil is not quite as deep and carries a little more gravel than that of the reddish phase.

The phase is confined to the south-central and the southeastern parts of the county in association with the reddish phase of the type. It is the least extensive of the several phases.

Approximately one-fourth of it is in forest and the remainder in farm crops, pasture, and waste land. The phase occurs in a well-farmed section, is productive, and is close to markets. It is best adapted to grass crops and pasture. Tillage is difficult on account of its steepness and its tendency to erode under heavy rainfall. It is farmed in the same manner as the steep phase of the type.

LYONS LOAM.

The Lyons loam consists of a grayish-brown or brownish-gray loam underlain at a depth of 8 inches by a compact yellow loam, mottled slightly with gray and rusty brown, which extends to a depth of 3 feet or more. In places in virgin areas the surface soil is nearly black and there is a subsurface layer of light-gray material. Rock fragments of varying size occur in small quantities both on the surface and in the soil. Scattered bowlders, mainly of crystalline rock, are present. The lower subsoil is calcareous.

The type is developed in small, widely scattered areas associated with the Ontario soils. It occurs at the foot of slopes, in troughs or depressions, and in glades near the heads of streams. Its topography is, therefore, level to depressed, and its drainage is slow on account of the compact subsoil and the accumulation of seepage water from higher lying soils.

The Lyons loam comprises material originally similar to the Ontario loam, but subsequently modified by the retarding of oxidation and the incorporation of a small amount of organic matter as the result of poor drainage.

Practically all the type is cleared, and a small proportion of it is in permanent pasture. It is inextensive and local in occurrence, and is never important in any one section or on any farm. Hay, oats, corn, and cabbage, the leading crops, give average yields. It is sold only with adjoining soils.

WORTH LOAM.

To a depth of 6 to 8 inches the surface soil of the Worth loam is a light-brown loam of friable structure, grading in places toward a very fine sandy loam. The subsoil is a brownish-yellow to yellow friable loam, which at a depth of 20 to 24 inches rests upon a pale-yellow to grayish-yellow loam to fine sandy loam extending to a depth of 3 feet or more. The substratum is a mass of unsorted material of compact structure. Angular to subangular fragments of sandstone are present in varying quantities on the surface and throughout the 3-foot section. Sandstone and crystalline rock bowlders occur on the surface and in the soil mass, though seldom in numbers sufficient to interfere seriously with tillage. Little of it is stony enough to be classed as a stony loam. The material is noncalcareous to a depth of at least 5 to 10 feet, although some limestone fragments and some effervescence with acid were noted in very deep cuts.

In the typical soil, as developed in rolling to hilly areas, the 3-foot section is free from mottlings, but a variation, representing a stage

intermediate between the typical Worth loam and its poorly drained phase, has a mottled yellow and gray lower subsoil which may contain rusty-brown spots or iron stains. Areas of this character occur on rather broad hilltops and on long slopes where the underdrainage is retarded. As this variation approaches the poorly drained phase in character the mottling appears nearer the surface, and the soil loses its brown color.

Within the lake plain only a few of the hills attain an elevation high enough to have existed as islands in the old glacial lake, and those not quite attaining the old lake level underwent some modification. Small areas occur in which the reworking by water action has resulted in accumulations of rock fragments on the surface and well-defined beach lines of sufficient extent to show on the soil map exist. The line between the lake sediments and the Worth loam is usually very distinctly marked by the character of material and topography. The areas of the type that were deeply submerged seem to have been modified very little during that period.

The subsoil of the type is usually as light or lighter than the surface soil. The subsoil is slightly heavier than typical in certain areas lying about 3 miles north of Ontario Center. In a few places a pinkish to reddish color appears, especially in the deep substratum. This is due to the high percentage of material derived from red sandstone rather than to oxidation. The surface soil grades light rather than heavy, and small areas of very fine sandy loam texture are doubtless included.

In most cases there was no difficulty in separating the Worth loam from the Ontario loam, as the transition takes place in a belt covered largely by other soils. From a point south of Sodus westward to the Monroe County line the division is not so distinct. The limestone content increases gradually toward the south, and the zone in which effervescence with acid occurs comes nearer to the surface in going from north to south. Here the boundary between the two types is quite arbitrary, but is marked in a general way by the belt within which the soils of the Lordstown series are mapped.

The Worth loam occurs within a belt averaging 6 miles in width in the northern part of the county, both north and south of the old beach line which marks the southern limit of the lake plain. It occupies extensive areas in the towns of Huron and Wolcott within the lake plain, and in the parts of the towns of Sodus and Williamson south of the Ridge. Elsewhere within the belt the areas are rather widely scattered.

Within the lake plain the type occupies drumlinlike hills 50 to 300 acres or more in extent, and rising from 25 to 100 feet or more above the general level of the associated Dunkirk and Tyler soils. They are most conspicuous near the lake shore and gradually merge with the plain to the south. East of Sodus Bay there are approximately 70 of these hills, usually elliptical in outline with the long axis in a north-south direction, attaining elevations of 300 to 500 feet. The majority of them are about 400 feet above sea level, so that comparatively few extended above the surface of the old glacial lake. Many of the hills rise abruptly on the north and merge gradually with the other soils to the south, the steepest parts being mapped as a steep phase of the type. The hills have a smooth outline and

relatively broad tops. Those fronting on the lake rise 50 to 250 feet almost perpendicularly from the beach, and are being worn away by the action of waves and gravity. South of the Ridge the type covers a series of hills with an elevation of 500 to 600 feet or more, separated by nearly north-to-south troughs. Most of the hills are smooth in outline and have broad, gently sloping tops. The type is adequately drained. Tracts occur here and there on hilltops and long slopes and in interhill areas where the drainage is retarded or the soil kept wet by seepage. Although there is some run-off, especially from the surface of cultivated fields, much of the drainage is internal. The type is not traversed by well-defined stream courses.

The Worth loam, the most extensive type of the series and the second in extent in the county, is one of the more important soils in the agriculture of the county. Approximately 90 per cent of it is cleared and farmed; the rest consists of forested slopes and scattered woodlots. It lies from 1 to 8 miles from railroad transportation and markets, and within a moderately thickly settled and well developed region. While some fairly steep slopes are in cultivation, almost all of it has a topography favorable for farming. There is little waste or abandoned land. The Worth loam is regarded as a moderately productive and desirable soil for general crops, and in certain sections for special crops. The soil is easily tilled, except in the more stony areas. Modern farm machinery may be used on practically all of it.

Nearly all the crops common to the region are grown on this type under a system of general farming. Fruit is raised in small commercial orchards on individual farms, but commercial fruit growing is not especially developed. Dairying on a small scale is a source of income, especially in the northeastern part of the county. The character of the farming is frequently determined by the associated types, as in the vicinity of Sodus and Williamson, where special crops are grown on Muck and the feed and forage crops on this type. The same use is made of the land where the associated types are extensively used for fruit growing. The acreage in hay probably exceeds that of all the other crops combined. Wheat, oats, corn, and potatoes are other important crops. The minor crops are beans, cabbage, fruit, small fruit, and vegetables. The Worth loam is quite extensively used for pasture.

Fair average yields, though slightly lower than on the Ontario loam and its phases, are obtained. Hay yields from 1 to 2 tons, wheat 15 to 20 bushels, beans 10 to 20 bushels, oats 25 to 60 bushels, and potatoes 75 to 200 bushels per acre. The type produces fruit of fine quality.

Many of the farmers practice a rotation in which hay is the principal crop. The sod land is plowed for corn, potatoes, beans, or some other tilled crop, followed by either oats or wheat and seeding to grass, or oats followed by wheat and seeding, and then by grass crops for two to four years or more. The grass seeding is timothy and clover mixed, but timothy greatly predominates after one or two seasons. Practically no alfalfa is grown. Stable manure is applied for cultivated crops or for wheat. Commercial fertilizers are quite widely used. The care given orchards ranges all the way from poor to good.

The selling price of farms in sections where this type occurs is often influenced by that of the adjoining types, and also varies with the location and character of the improvements. The price ranges from \$60 to \$100 or more an acre.

Worth loam, steep phase.—The steep phase of the Worth loam is differentiated mainly on the basis of topography and agricultural value. The surface soil in places is slightly shallower and contains more gravel than that of the typical Worth loam, and in spots the subsoil material is exposed.

This phase has the same general distribution as the type, occupying the steep north, east, and west slopes of elongated rounded hills. Its drainage is good to excessive.

A considerable proportion of the phase has been cleared, and approximately one-third of the cleared area is now used for farm crops, with the rest in more or less permanent pasture. The slopes are kept in grass as much as possible on account of the tendency to erode and the difficulty of cultivation.

Worth loam, stony phase.—To a depth of 6 to 8 inches the surface soil of the Worth loam, stony phase, is a light-brown to brown loam carrying large quantities of small to medium-sized angular fragments of red and gray sandstone, with smaller quantities of rounded, medium-sized boulders of sandstone and crystalline rock. The subsoil to a depth of 3 feet or more is a yellowish friable loam which has a stone content similar to that in the surface soil, and in the same or a greater proportion. Unsorted stony material comprises the comparatively thin substratum over bedrock. Stones often interfere with cultivation, even where large quantities have been removed from the fields.

This phase resembles the Lockport stony loam except in color and the absence of the red, semiresidual, deep subsoil of the latter. The two soils are closely associated and one frequently grades into the other, so that their boundaries are often arbitrary, and small tracts of the one are doubtless included with the other. The phase is the shallowest soil of the Worth series and is developed in areas of thin till, the typical Worth material being derived from deep till. It has in places been modified by water action, as well as by the deposition here and there of lake sediments.

The Worth loam, stony phase, occurs only in that part of the lake plain lying in Sodus, Williamson, and Ontario Towns. The largest area lies northwest of Sodus. Others are located in a belt one-half to 1 mile wide extending westward from Pultneyville to the Monroe County line, between fine-textured lake material on the lake side and the Lockport loam on the south. Other associated soils are the Lockport stony loam and the Worth loam. A few small areas are found 1 to 3 miles east of Pultneyville. In places the phase projects through the Lucas silty clay loam and the Dunkirk silt loam as low knolls, sometimes too small to show on the soil map.

The surface of this phase is broadly undulating and is from 300 feet, in the areas nearest the lake shore, to 400 feet above sea level farther south toward the ridge. Streams are few in number and without branches. Drainage, though almost wholly internal, is good and in places excessive.

Approximately one-half of the Worth loam, stony phase, is cleared. It has a local agricultural importance in the fruit industry, as it

lies within the belt where climatic conditions are modified by proximity to the lake, and its stony character renders it better adapted to orchards than to general crops. It is relatively close to transportation facilities and markets and is regarded as moderately productive when properly cultivated. The soil is rather low in organic matter.

Fruit growing is the leading industry on farms located wholly or in part on this phase. On some farms it constitutes the chief source of income. Apples and peaches are grown most extensively, with smaller acreages in pears, plums, cherries, grapes, and small fruits. Hay, corn, and oats lead among the general farm crops, with a smaller acreage in wheat, potatoes, and vegetables.

Under careful cultivation of the soil and scientific management of the orchards profitable yields of good quality of fruit are obtained. General farm crops do fairly well.

Orchards as a rule are carefully tilled and managed. Clean cultivation with cover crops and fall plowing is the general practice. Pruning and spraying receive attention at the proper season. Hay, followed by corn or some other cultivated crop, and then by grain and seeding to grass, is a common rotation on fields devoted to general farming. Comparatively little stock is kept on farms in the general region where this soil occurs.

The selling price of farms composed of the stony phase is from \$75 to \$150 or more an acre, according to location, the acreage in orchard, and the improvements.

Worth loam, poorly drained phase.—The surface soil of the Worth loam, poorly drained phase, is a brownish-gray to light grayish brown friable loam, 6 to 8 inches deep. The subsoil is a mottled yellow, gray and rusty-brown, compact loam, which extends to a depth of 3 feet or more and rests upon a substratum of grayish unassorted glacial till which is moderately stony and deep. A typical feature of areas of virgin soil is the presence of medium-sized boulders of crystalline rock and of sandstone on the surface and embedded in the soil. In spots these are sufficiently abundant to class the material as a stony loam. The surface of the virgin soil is fairly dark in color and underlain by a very pale yellow or gray subsurface layer. In addition to the surface stone, rock fragments of varying size occur throughout the 3-foot section.

The poorly drained phase represents an intermediate stage of soil development between the better drained Worth soils and the more poorly drained soils of the Westbury series, and there is therefore a variation in the character and intensity of the mottling of the subsoil. The variation in texture is slight. The subsoil is usually as light or lighter in texture than the surface soil, though appearing heavier in places on account of its compact, poorly drained nature. Another fairly characteristic feature of virgin areas is the presence of low hummocks, a few inches to a foot or more in height, of light-brown material, with dark-gray to nearly black soil between them; and the surface of a cultivated field of this soil often has a spotted appearance, especially in the more recently broken areas.

The phase covers areas of a few acres to more than 250 acres in the towns of Wolcott, Huron, Sodus, Rose, and Butler, or mainly in the northeastern part of the county. It has two characteristic positions, either the flat to gently sloping areas capping the tops of smooth drumlinlike hills, or flat to very gently undulating areas in

sections of less relief in close association with the Alton stony loam. In either case it has an elevation of 400 to 440 feet and lies near and to the north of the old glacial lake beach, and the greater part was probably covered by water during a part of the time the lake existed. Though found in sections where lake-laid soils occur at elevations 25 to 100 feet lower, the phase shows no modification by the deposition of lake sediments, but its character, position, topography, and the associated soils make it probable that it was modified to some extent by wave action. As the more or less level surface allows little run-off, drainage is almost entirely internal.

The Worth loam, poorly drained phase, is relatively unimportant. Approximately 75 per cent of it is cleared; the rest supports a growth of maple, elm, ash, and other trees. Probably not over 50 per cent of the cleared acreage is sufficiently improved for the production of annual farm crops. Fields cleared of timber but not of stone are in permanent pasture. In general, the unimproved areas of the phase are as well suited to farming as the cultivated areas. Practically all the phase is well located with respect to transportation and markets. Its chief use in conjunction with more desirable soils is for pasture and woodlots. The surface soil has a moderate content of organic matter. Tillage is sometimes difficult on account of stones and an unfavorable moisture content.

General farming with dairying, often in combination with fruit growing, mainly on other types, prevails on farms made up in part of this phase. Hay, oats, corn, and buckwheat return low to medium yields. Apple orchards are seldom set wholly on this phase, but in places extend into it, and the trees show plainly the bad effects of poor drainage. In pear orchards, which are more commonly set on it, injury from this cause is less apparent.

The poorly drained phase is usually sold with adjoining soils, and its selling price is therefore based on the character of farming and the desirability of the associated types. It ranges from \$50 to \$100 an acre.

The most essential factor in improving land of this type is better drainage. In many cases this is not an expensive or difficult matter. The use of lime would also prove beneficial.

The following table gives the results of mechanical analyses of samples of the soil, subsurface, and subsoil of the typical Worth loam:

Mechanical analyses of Worth 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.	<i>Per cent.</i>
162909.....	Soil.....	1.9	4.1	2.8	23.8	32.5	23.4	11.4
162910.....	Subsurface..	2.6	4.6	2.9	24.5	32.8	23.9	8.7
162911.....	Subsoil.....	2.1	4.9	3.3	27.4	36.0	20.1	6.2

WORTH SILT LOAM.

The Worth silt loam consists of a light grayish brown silt loam 6 to 8 inches deep, underlain by a yellow silty loam to silt loam, which gives way at about 24 inches to a pale-yellow to grayish-yellow silty loam. A substratum of similar material continues to bedrock. The

soil carries some gravel, enough in places to make it a gravelly silt loam, consisting almost entirely of angular to subangular fragments of sandstone. The subsoil contains slightly less gravel. The type also carries some rounded, medium-sized boulders, mainly of crystalline rock, and a few of sandstone. These are commonly found on or near the surface, but seldom in sufficient quantities to interfere with tillage, and they are not as abundant in the silt loam as in the loam of the series. The ice-laid deposit is deeper than under the stony phase of the loam, but not nearly so deep as under the typical loam of the series. In places a slight mottling appears in the lower subsoil. This type is fairly uniform throughout its extent. It is noncalcareous.

The Worth silt loam is not widely distributed. It is the dominant soil over an area of approximately 35 square miles which lies immediately south of the Ridge and southwest of Williamson. Several other areas occur southwest and southeast of East Williamson. In general it is found between the Ridge and the hilly country to the south. The Worth loam and the poorly drained phase of the silt loam are the associated soils.

The Worth silt loam covers a broadly undulating section with little relief except for a few isolated hills near its southern border. In detail it is nearly level to very gently sloping. It rises gradually in elevation from 450 feet near the Ridge to 500 feet above sea level to the south. It is moderately well drained, though draining slowly at times and in certain places, as the streams traversing it have very few branches. Drainage is almost entirely by percolation.

This is one of the more extensive of the minor types in the county. Agriculturally it is an important type in the section where it occurs, as it lies close to transportation facilities, has a topography favorable for farming, is rather thickly settled, and is practically all in cultivation. It is regarded as a moderately productive soil and is adapted to all of the general crops of the region. The soil has a moderate to low content of organic matter and is easily tilled.

General farming prevails on farms of medium size. Dairying is not an important industry, though providing an additional income on quite a number of farms. While there are few large commercial orchards, there are many scattered orchards of 1 to 10 acres or more on farms otherwise devoted to general crops, and fruit is a source of considerable income. A greater acreage is given to the production of hay crops than to all other crops combined. Corn, wheat, and oats are the leading grain crops, and beans, potatoes, cabbage, small fruits, and vegetables are minor crops. The growing of crops for the canning factories is receiving increased attention. Almost no alfalfa is grown. The farm income is derived from a variety of sources, including the sale of wheat, fruit, beans, potatoes, and cabbage, and the surplus of hay and other crops.

Yields on this type are approximately an average for the county. Hay yields from three-fourths to 1½ tons, wheat 15 to 20 bushels, oats 20 to 50 bushels, corn 35 to 75 bushels, and beans 10 to 18 bushels per acre. Fruit ranges in yield and quality from fair to good, according to the season and the care given the orchard.

Agriculture on this type is similar to that in practice on the Worth loam, except that less attention is given to dairying and more to orcharding.

The selling price of land of the Worth silt loam ranges from \$75 to \$100 or more an acre.

Worth silt loam, poorly drained phase.—The Worth silt loam, poorly drained phase, consists of a gray to grayish-brown compact silt loam 6 to 8 inches deep underlain by a mottled yellow, gray, and rusty-brown compact loam to silt loam extending to a depth of 3 feet or more. The substratum is usually rather thin and rests on the bedrock. The phase is fairly free from stone, except for a few angular sandstone fragments of gravel grade.

The phase occurs as small areas, mostly in association with the typical soil in the southern part of the towns of Ontario and Williamson and the northern part of the town of Walworth. The areas are nearly level and some are slightly lower than the adjoining soils. They have an elevation of 450 to 480 feet above sea level and as the name implies are poorly drained. The phase lies to the south and above the old glacial lake level. Its character has been determined largely by poor drainage, which is intensified in places by the nearness of the underlying rock.

The Worth silt loam, poorly drained phase, is inextensive and of relatively low agricultural importance. Probably 70 per cent of it is cleared and used for crops or pasture. Low to medium yields of hay, corn, and oats, the leading crops, are obtained. General farming prevails in the section where the phase is found, and all of it is within easy reach of transportation and markets. The soil is moderately well supplied with organic matter. It is somewhat difficult to handle on account of its texture and the character of its drainage.

The sale value of this land is \$50 to \$85 an acre, but very few farms consist largely of this phase.

Artificial drainage is necessary for increased crop production. The small size of the areas and the accessibility of outlets for ditches tends to make the problem comparatively easy.

WESTBURY LOAM.

The surface soil of the Westbury loam is a dark-gray loam 6 to 8 inches deep. The subsoil is a compact gray loam, mottled with yellow and rusty brown, and having a greenish cast in places in the lower part of the 3-foot section. Crystalline rock bowlders of medium size are especially abundant on the surface and less abundant in the soil. In places there is a thin surface layer of rather mucky material and a subsurface layer of light-gray color. As mapped the type doubtless includes a small proportion of Worth loam.

An area 3 to 4 square miles in extent occurs from 2 to 4 miles north-east of Wolcott and another area lies $1\frac{1}{2}$ miles south of that village. The surface is level, with rather numerous small hummocks, typical of flat, poorly drained glacial-till soils. There is no run-off, and water stands on the surface or the material is in a saturated condition for a large part of the growing season.

The Westbury loam comprises the most poorly drained soil derived from glacial till of sandstone and shale origin. It has the same relation to the Worth series as the Granby series has to the Tyler and Dunkirk among the lake-laid soils. This type has been modified by wave action since its deposition, as it lies near and slightly lower

than the old glacial beach line. It has received no accessions of lake-laid material.

This is an inextensive type of little agricultural importance. From one-fourth to one-third of it is cleared or partly cleared of forest and used for pasture. The rest is covered mainly with second-growth forest. The land is best adapted to use for forest and pasture land and is not in demand for farming.

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

Mechanical analyses of Westbury 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.	<i>Per cent.</i>
162925.....	Soil.....	0.7	4.3	3.3	22.8	24.5	23.3	21.2
162926.....	Subsoil.....	2.5	4.9	2.8	22.0	27.5	25.4	15.0

LORDSTOWN SILT LOAM.

The surface soil of the Lordstown silt loam consists of a light-brown to brown friable silt loam with an average depth of 8 inches. The subsoil is a yellowish-brown to yellow, faintly mottled, compact loam, which rests directly upon bedrock at depths of 2 to 3 feet or more. As a rule the underlying rock comes within the 3-foot section and is seldom more than 6 feet below the surface. Outcrops, mainly of fine-grained grayish sandstone, occur in places, and angular to subangular fragments of the same rock comprise the greater part of the stone content, which is fairly high. Small tracts here and there contain thin, slablike fragments of limestone and are underlain by limestone rock. Medium-sized boulders of crystalline rock are present in some areas. Stone fences are a characteristic feature of the type. The soil grades from a silt loam to a loam or very fine sandy loam and is snuff-colored in places. The subsoil ranges from well-oxidized material showing little or no mottling to a quite highly mottled, somewhat plastic silty clay loam in local areas. This type as mapped includes some stony land, and also small areas of Farmington loam and of rather poorly drained material not yet classified. Except in limited areas overlying limestone, the type is noncalcareous.

The Lordstown silt loam is confined to a belt extending from about 2 miles south of Sodus Center westward to near the Monroe County line. The areas, ranging from 10 to several hundred acres in extent, are located in the southern part of Sodus and the northern parts of Marion and Walworth Towns, along the line between the Worth and Ontario soils. The associated soils are the Worth loam and silt loam and the Ontario soils on higher elevations and the Alton stony loam, the Ontario loam, the Palmyra gravelly loam, and Muck on the same or slightly lower elevations. A number of abandoned limekilns occur within the same belt.

The surface of the type is level to gently undulating, conforming closely to that of the horizontally bedded underlying rock. The areas occupy low positions, some of them in troughs or valleys between higher lying hilly areas of glacial soils, and range in elevation

from 400 feet in the eastern areas to 500 feet above sea level in the western part of the county. The drainage, though almost entirely internal, is fairly good except in small local tracts.

The Lordstown silt loam is inextensive and of little agricultural importance. Ninety per cent of it is cleared, of which about one-third is in permanent pasture. The rest is used for the production of hay, wheat, oats, and potatoes. Alfalfa is grown in a few small areas. A few small orchards are located on the type. Average crop yields are obtained. The demand for land of this character for farming purposes is not active, as the agricultural value of much of it is rather low.

LOCKPORT STONY LOAM.

The surface soil of the Lockport stony loam is a friable loam, reddish brown to brown with a reddish tinge, about 6 inches deep, and carrying a considerable quantity of small angular fragments to medium-sized slablike boulders on the surface and embedded in the soil. The subsoil is a reddish-brown to brownish-red stony loam, which usually becomes more red and more stony with depth until at 24 to 30 inches it rests directly upon bedrock or upon a stratum of red stony clay loam, a few inches thick, resting on bedrock. The stones consist chiefly of red sandstone, some gray sandstone, and a few rounded boulders of crystalline rock. The bedrock is red sandstone. The partly residual reddish material or the bedrock ordinarily lies within 3 feet of the surface. The soil has a low to medium content of organic matter, and all the material above the lower subsoil is fairly loose and friable.

The variations in this type are toward the loam of the series with a lower stone content, and toward the Worth stony loam, which differs mainly in the light-brown color of its fine-earth material and the absence of the red stony clay loam stratum within the 3-foot section. Here and there are evidences of the reworking and the assorting action of water, as, for instance, the presence of partly rounded gravel in the form of beaches or bars and the occurrence of lower lying areas of lake-laid soils.

Nearly all of this type occurs in a more or less continuous area of several square miles in the northwestern part of Sodus town and the northeastern part of Williamson town. Considered as a whole, it has a gradual northward slope from 400 feet in elevation to 260 feet near the lake front, all below the glacial lake level. In detail its surface is undulating. Knobs or knolls are characteristic, as well as basinlike areas in which lake-laid soils are found. The drainage is good as a whole, though much of it is internal and slow. A few streams traverse it, but their branches do not reach all parts.

About one-half of the Lockport stony loam is cleared and farmed. The forest is composed chiefly of beech and maple, with thick undergrowth. General farming, fruit farming, or a combination of both, are in common practice. It is a relatively important type in a small section of the lake plain. Corn yields from 35 to 70 bushels, oats 20 to 40 bushels, wheat 15 to 20 bushels, hay three-fourths to 1 ton, and potatoes about 100 bushels per acre. The orchards consist chiefly of apples and peaches, the latter being found mainly in a narrow belt near the lake front. A small acreage is devoted to pears, quinces, and berries. Intertilled crops are grown in some of the younger orchards.

A considerable expenditure of time and money is necessary to put this type in shape for cultivation. Among other things the stones must be removed from considerable areas. A rotation consisting of some cultivated crop, as corn or potatoes, followed by oats or wheat, or by oats and then wheat with seeding to grass, is in fairly general use. Orchards are usually given clean cultivation, and in some cases cover crops are sown in the late summer.

The selling price of this type depends upon the kind of farming practiced, farms producing general crops bringing from \$75 to \$100 an acre and fruit farms a somewhat higher figure.

As this type is better adapted to special than to general farming, the acreage in fruit may be extended with profit. Its shallow character and rather loose structure give it a tendency to dry out in seasons of less than normal rainfall, making frequent and shallow cultivation necessary. The use of lime and the growing of legumes would improve its physical condition.

LOCKPORT LOAM.

The Lockport loam consists of about 8 inches of friable loam, brown with slightly reddish tinge to reddish brown in color, underlain by a pinkish-brown to reddish-brown, loose to friable loam, which at 24 to 30 inches rests upon a rather stiff reddish clay loam extending to a depth of 3 feet or more. Angular fragments of red sandstone, ranging in size from gravel to slablike boulders, occur on the surface and throughout the 3-foot section, but in smaller quantities than in the stony loam of the series. Gray sandstone fragments and rounded crystalline rock boulders of medium size are also present. Stone fences are common. Bedrock of red sandstone is found at depths ranging from 4 to 10 feet. It is probable that in places the heavy residual stratum does not come within the soil profile. The soil is rather low in organic matter. Cultivation is easy where the stones do not interfere.

The soil material is deeper and the topography smoother than in the stony loam. In places the type grades in color toward the Worth stony loam, and it also includes small poorly drained areas whose extent and importance were not sufficient to warrant separate mapping. In a few cases even the surface soil is red and rests upon a heavy red subsoil almost wholly residual in origin.

This is the predominating type in an area about 8 miles long and averaging 2 miles wide in the northern parts of Ontario and Williamson towns. A belt of glacial-lake and other ice-laid soils about a mile in width covers the intervening strip between the type and the lake, and an area of Dunkirk very fine sandy loam separates it from the Lockport stony loam to the east. It lies at an elevation of 300 to 400 feet above sea level, with a general slope toward the north. In detail the topography is broadly undulating, with a fairly smooth surface. In general the drainage is good, though slightly retarded here and there in small tracts throughout the type, especially where the bedrock is near the surface. Streams traversing it have no branches, so the drainage is mostly downward through the soil.

The Lockport loam has a rather high local agricultural value on account of its wide distribution within a small section of the county. Although it is not as productive nor as desirable a soil as many of

the other types, it has a favorable location with respect to transportation and markets and also lies within the belt in which the climatic conditions are modified by the waters of Lake Ontario. The farms are of small medium size, but there appears to be a tendency toward consolidation into larger farms, as indicated by the large number of vacant farmhouses. Approximately 60 per cent of the type is in crops, with a small proportion in cleared permanent pasture. The land in forest supports a growth of beech, maple, elm, cherry, and other trees.

General farming prevails on farms covering about half of the cleared area, followed by general farming and fruit crops, and in turn by fruit growing as the chief source of income. The general farm crops are hay, corn, wheat, oats, and potatoes. Apples comprise the bulk of the fruit, with a small proportion of pears and peaches. Berries, quinces, tomatoes, and cucumbers are minor crops. Dairying is not an important industry. Hay, timothy, or clover and timothy mixed yields from three-fourths ton to 1½ tons, wheat 15 to 20 bushels, oats 20 to 50 bushels, and potatoes 100 to 150 bushels per acre.

Many of the orchards are well cared for, spraying, pruning, and clean cultivation, with cover crops in some cases, being the general practice. Other orchards showing various stages of neglect are in sod. The greater part of the land in orchards is fairly well adapted to fruit, but some of it shows the need of artificial drainage. On the farms devoted to general crops the farming methods range from good to very poor. On the whole, these farms do not show the evidences of prosperity that are common to many other sections of the county.

The Lockport loam is held at \$50 to \$100 an acre, the higher prices being obtained for farms with some orchard acreage. Farms wholly or mainly in orchard sell for still higher prices.

The type is better adapted to special than general farm crops, and a larger acreage should be devoted to fruit, small fruit, and crops for the near-by canning factories. Better methods of cultivation, the adoption of systems of crop rotation, and the use of lime would tend to increase the yields.

Lockport loam, heavy phase.—The Lockport loam, heavy phase, consists of a brownish-red silty clay loam underlain at a depth of 5 to 6 inches by an Indian-red stiff silty clay loam to silty clay, which rests upon partly disintegrated or unaltered bedrock of red shale at depths ranging from 2 to 3 feet or slightly more. Rock fragments other than shale are uncommon. The phase is noncalcareous. In places the surface soil is a reddish-brown silt loam, and here and there the surface carries a thin covering of reddish glacial material.

Several small widely scattered areas occur in the southern half of the county, chiefly in association with the Ontario soils. The more prominent ones are located 2 miles northwest of South Butler, 2 miles west of Lyons, and 1 mile northwest of Newark.

The Lockport loam, heavy phase, has a very gently sloping to sloping surface and fair drainage. It is residual from the red shale which is associated with gray shale in the Salina formation. The gray shale gives rise to the Allis soils.

The phase is of such small total extent that it has no agricultural importance. It is productive, but is difficult to handle. All of it

is cleared and farmed to hay, corn, and wheat, which give fair to medium yields. Its sale value is dependent upon the character of the surrounding types.

Below are given the results of mechanical analyses of samples of the soil, subsurface, and subsoil of the typical Lockport loam:

Mechanical analyses of Lockport 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.	<i>Per cent.</i>
162930.....	Soil.....	1.8	2.4	1.4	10.1	29.0	35.5	19.2
162931.....	Subsurface..	2.4	2.9	2.1	14.6	35.6	31.9	10.6
162932.....	Subsoil.....	.8	1.6	.9	6.6	26.4	42.5	21.2

ALLIS SILTY CLAY.

The surface soil of the Allis silty clay is a compact light yellowish gray silty clay loam to silty clay, with a depth of 6 inches. The subsoil is a rather stiff gray silty clay, which becomes stiffer and tougher with depth below 20 inches and gradually assumes a drab color with faint gray and yellow mottlings. The bedrock of gray shale is reached at depths ranging from 2 to 4 feet below the surface. Small soft fragments of shale occur on the surface and throughout the soil profile, and gravel and stone may occur scatteringly near the margins of other types. The transition from the higher lying glacial-till soils is usually rather abrupt, so that the zone where the material consists of an Ontario loam surface soil over a residual subsoil is very narrow, and the surface soil is seldom of mixed till and residual origin. The type is tinged in spots with red where associated with red shale. It is usually noncalcareous.

The Allis silty clay occurs only in the southern tier of towns, for the most part as small narrow areas on slopes facing old glacial and other stream channels. It occupies a position intermediate between the higher lying glacial-till soils of the Ontario series and those of either the Palmyra, on the terraces, or the Granby or Genesee, on the valley floors. The type is residual from the underlying gray shale. Areas too narrow to map are included with the upland soils.

The areas are sloping to steeply sloping, and have good surface but slow subsurface drainage. Springs are rather common along the boundary with the Ontario soils. Where the surface is unprotected the type is subject to serious erosion during heavy rains.

Ninety per cent of the Allis silty clay is cleared and approximately 50 per cent is farmed. The rest of the cleared acreage is in permanent pastures. Fair to medium yields of hay, oats, wheat, and corn are obtained. In places small orchards have been set in part on the type. The type is regarded as fairly productive for grass and grain crops, and is farmed mainly in conjunction with other types. The surface soil is deficient in organic matter and may be safely tilled only under a rather narrow range of moisture content. It has no separate sale value on account of its patchy occurrence.

Deeper plowing, the incorporation of organic matter, and the use of lime would tend to increase the productiveness of land of this type.

The following table gives the results of mechanical analyses of samples of the soil, subsurface, and subsoil of the Allis silty clay:

Mechanical analyses of Allis silty 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.	<i>Per cent.</i>
162941.....	Soil.....	0.5	1.1	0.8	5.9	17.1	45.7	28.9
162942.....	Subsurface..	.1	.3	.2	1.2	5.0	50.5	42.6
162943.....	Subsoil.....	.0	.0	1.0	2.0	7.0	53.7	36.3

LIVINGSTON SILTY CLAY LOAM.

The surface soil of the Livingston silty clay loam consists of 5 or 6 inches of brownish-gray to gray silty clay loam, sticky when wet and hard and compact when dry. The subsoil is a gray to greenish-gray, rather stiff silty clay loam, faintly mottled with yellow, which below a depth of 24 inches gives way to a sticky material of about the same color and texture but containing fragments of partly disintegrated limestone and shale. The latter continues to bedrock (interbedded limestone and shale), which is encountered at depths ranging from 2½ to 5 feet or more. Slabs of limestone occur on the surface and throughout the soil section and lenticular masses of the same rock are exposed in cuts. Foreign boulders are found in places on the surface. In some cases the surface of plowed fields presents a spotted appearance, alternately light and dark. The subsoil is highly calcareous. A silt loam texture occurs in places, while in other places the texture approaches a silty clay.

The greater part of the type lies within a belt one-half to 1 mile wide north of the Ridge Road and west of Sodus. Another area is found at Wallington and others southeast of Williamson. The type occurs in association with the types of the Tyler and Lockport series.

The areas cover slight rises or swells above the general level of the country to the north and from 2 to 10 feet below the gravelly beach which borders them on the south. Though nearly level, the areas have sufficient relief to distinguish them from the lake-laid soils. Both the surface drainage and underdrainage are poor and the soil is readily affected by extremes of wet and dry weather.

The Livingston silty clay loam is a relatively unimportant type, both in extent and agricultural value. Practically all of it is cleared and, with the exception of small areas in permanent pasture, was at one time utilized for farm crops, though the present season (1919) not more than 70 per cent of it is in cultivation, the rest being waste land. Its early development was largely due to its favorable location with respect to towns and transportation. This is regarded as a productive soil when the season is favorable, but it is difficult to handle on account of textural and drainage conditions. Grass for hay and pasturage leads in acreage. Other crops are oats, wheat, corn, and fruit. Timothy is the principal grass crop; some mixed timothy and clover and a little alfalfa are also grown. Pears are more successful than apples. Crop yields range from low to medium and good according to the crops and the season.

The selling price of the type is determined largely by its location and by the value of the associated types.

The incorporation of organic matter and improved drainage are the greatest needs of the type.

PALMYRA STONY LOAM.

The surface soil of the Palmyra stony loam is a brown loam about 8 inches deep, which carries on the surface and within the soil large quantities of more or less rounded cobblestones and gravel. The upper subsoil is a light-brown loam, with about the same proportion of gravel and cobbles as the surface soil. Below a depth of 15 to 20 inches there is a marked change in the amount and character of the fine-earth material, as the upper subsoil quickly grades into a bed of assorted deposits composed of gravel, a few cobblestones, and some interstitial sand, which continues with little change to form the substratum. While both the soil and the upper subsoil are friable in structure, the interstitial material is so fine in texture (being largely silt instead of the sand typically associated with such large quantities of gravel and cobbles) that it fills the spaces between the fragments to form a rather compact mass. The lower subsoil and substratum are porous in structure, but even in these at some depth, usually below the 3-foot section, the material in places is cemented together into a more or less solid mass by a white coating on the surface of the fragments. The gravel and cobblestones consist of more or less well-rounded fragments of sandstone, limestone, and crystalline rock. In places they are so abundant on the surface as to cover it almost completely. The stones, which are from 3 to 5 inches in diameter, usually decrease in number as the depth increases; the proportion of gravel increases with acreage in depth. Large bowlders are uncommon. There is a suggestion of red in the color of quite a large part of this type under average field conditions.

This type occurs mainly in the vicinity of the old glacial stream channel extending across the southern part of the county. Areas are located west, southeast, and 3 miles southwest of Macedon; north of Palmyra; northeast of Marion; west, south, and southeast of East Palmyra; northwest, south, and southeast of Lyons; and northwest of Lock Berlin. It is associated with the gravelly loam of the series and with the Ontario loam of the uplands.

The surface is level to very gently undulating and terraced, covering deltas, terraces, and small outwash plains. It lies at elevations of 400 to 500 feet above sea level. Drainage is good to slightly excessive.

The Palmyra stony loam, though not widely distributed or extensive, has considerable agricultural importance. It was one of the first soils to be cleared, and all of it is now under cultivation. It is well located near railroads and towns and is adapted to a variety of crops. The surface soil has a moderate content of organic matter and may be tilled under quite a range of moisture conditions. The soil and upper subsoil hold moisture surprisingly well, considering the porous subsoil and substratum.

General farming in conjunction with dairying prevails, with here and there home orchards and some small fruit. The farms, which

appear prosperous, are of moderate size. Hay, largely clover and alfalfa, corn, wheat, beans, and potatoes, are the leading crops, and cabbage, oats, fruit, small fruit, and vegetables are grown to some extent. Canning-factory crops are becoming increasingly important.

Good average yields of all crops are obtained. They compare favorably with those of the gravelly loam of the series.

This type is handled in practically the same way as the Palmyra gravelly loam and the Ontario loam. It also has about the same range in value.

PALMYRA GRAVELLY LOAM.

The surface soil of the Palmyra gravelly loam is a brown friable loam of fine texture, averaging 8 inches in depth. The subsoil consists of light-brown compact loam, which at about 20 to 24 inches grades abruptly into a bed of gravel and sand extending to a depth of 3 feet or more. Both the surface soil and subsoil have a high content of small to medium rounded gravel, consisting of waterworn fragments of sandstone, limestone, and in some cases of crystalline rock. The substratum may be underlain at 8 to 10 feet by compact ice-laid material similar to that giving rise to the soils of the Ontario series. In places some cobblestones are present and a few larger bowlders may occur. Partly cemented layers 2 to 4 feet in thickness may occur in the substratum, and a white coating frequently occurs on the surface of the gravel in the lower subsoil. The principal variation in the type is in the size and proportion of the gravel, but the color departs from the typical in some places, mainly in the southern part of the county, where the soil has a slightly reddish color when moist. In places also the surface soil has more than the normal amount of sand. Several small areas, not true Palmyra gravelly loam, on low terraces along Wolcott Creek are included with this type. These have a gravelly silt loam surface soil underlain by a gravelly loam subsoil, and the typical porous structure of the lower subsoil and substratum is lacking. The areas are from 2 to 5 feet above the first bottoms.

The Palmyra gravelly loam has a fairly wide distribution. A number of areas lie on each side of the old glacial stream channel extending from east to west across the southern part of the county. The villages of Palmyra, Newark, Lyons, and Clyde are located largely on areas of the type. Other prominent areas occur in some of the north-south valleys, as in the vicinity of Marion, 4 miles southeast of Williamson, near Fairville and Fairville Station, 3 miles northwest of Clyde, and 2 to 4 miles east of Wolcott. Many small areas occur in valleys between hills of Ontario soils.

The Palmyra gravelly loam occupies terraces of level to very gently undulating surface, representing glacial-outwash plains, stream terraces, and deltas, and old lake beaches. The type lies 10 to 50 feet above the present streams, which is well above overflow. The drainage, which is largely internal, is everywhere good.

The Palmyra gravelly loam is the most extensive of the terrace soils. It has a relatively high agricultural value, and all of it, except the part occupied by villages, is used for the production of crops. It has a favorable topography for farming and is fairly close to transportation and markets. It is productive and is adapted to the general and the intensively farmed crops of the region. The surface soil

contains a moderate amount of organic matter, its gravel content seldom interferes with tillage, and it may be worked under a fairly wide range of moisture conditions. Considering the open, porous lower subsoil and substratum, the type holds moisture remarkably well.

The same class of farming and the same crops prevail on this type as on the upland soils, but there has been little attempt at specialization. A larger acreage is in grass (timothy and clover) than in any other crop. Alfalfa is a crop of growing importance, though at present confined to a rather small acreage. Wheat is the leading grain crop, followed by oats. Corn is grown for grain and for silage. Beans are a favorite crop. Potatoes are quite widely planted, mostly in tracts of 2 to 4 acres. The minor crops are cabbage, vegetables, canning-factory crops, fruit, and small fruit. Dairying is an important industry on some farms and a side line on others.

The yields of crops on this soil equal or exceed the average for the county. Hay commonly yields from 1 to 2½ tons per acre, corn 35 to 100 bushels, wheat 15 to 30 bushels, oats 25 to 65 bushels, potatoes 100 to 200 bushels, beans 10 to 20 bushels, cabbage 8 to 12 tons.

The farms are, as a rule, well cared for. A rotation of crops is practiced, consisting of sod for hay for 2, 3, or 4 years, followed by a tilled crop for 1 to 2 years, then by oats or wheat and seeding to grass, or by oats, and then wheat and seeding to grass. The rotation is varied to meet the needs of the individual farms. Stable manure usually is applied to land intended for a tilled crop or for wheat, but little commercial fertilizer is used. It is a common practice to plow under a good stand of clover and timothy in changing to a cultivated crop.

Land of this type sells for \$80 to \$100 or more an acre, depending upon the location and character of improvements.

PALMYRA FINE SANDY LOAM.

The surface soil of the Palmyra fine sandy loam is a light-brown fine sandy loam, 6 to 8 inches deep. It is usually light in texture, moderately loose in structure, and carries some rounded gravel. Typically the subsoil consists of a few inches of light-brown to yellowish-brown loamy fine sand underlain at 10 to 15 inches by a bed of gravel and sand extending to a depth of 3 feet or more. The substratum, to a depth of several feet, is a mass of assorted coarse material. The gravel content consists of waterworn fragments of sandstone, limestone, and other rocks. In places it is cemented into a hardpan and much of it, even where not cemented, has a white coating of lime. The gravelly material normally forming the lower subsoil may immediately underlie the soil, in which case the latter contains more gravel than typical; or it may be found at a depth of as much as 2 feet, in which case the soil is commonly lighter in texture and color and contains little or no gravel. In some places the texture of the soil is sandy loam instead of fine sandy loam, and in others there is enough gravel present to give a gravelly fine sandy loam.

The type occurs in small areas on terraces or represents eskers or kames, mainly in the southwestern part of the county. One area

lies 3 miles northwest of Savannah. The surface is level or undulating to ridged, and the drainage is good to excessive.

The Palmyra fine sandy loam is inextensive and thus agriculturally unimportant, although all of it is cleared and under cultivation. It seldom covers any considerable part of individual farms. The soil has a rather low content of organic matter, is well located, moderately productive, and better adapted to special than to general farm crops. It can be tilled under a wide range of moisture conditions.

This type is handled in practically the same way as the more extensive types of the series. Potatoes, beans, and hay are the chief crops. Medium yields are obtained. The sale value is determined by location and the desirability of the adjoining types.

The Palmyra fine sandy loam should be used as much as possible for special crops. Green-manure crops should be turned under to increase the amount of organic matter and thus make the soil more retentive of moisture.

Palmyra fine sandy loam, gravelly phase.—The Palmyra fine sandy loam, gravelly phase, includes ridged to hummocky areas of fine sandy loam carrying large quantities of gravel in the surface soil. The soil profile otherwise is about the same as that of the typical soil. Nearly all of this type is too rough for cultivation.

A few small areas of the phase are developed in the southwestern part of the county, and one lies about $1\frac{1}{2}$ miles north of Newark. The topography is characteristic of kames and eskers and eroded terraces. Drainage is excessive.

The phase is of little agricultural importance. Nearly all of it is cleared and most of it is used for pasture. A small part is farmed, but with unsatisfactory results. In places sweet clover grows wild. The price of land of this kind is based on that of the surrounding types.

PALMYRA LOAM.

The Palmyra loam consists of a friable brown loam about 8 inches deep, underlain by a light-brown compact loam which at 15 to 20 inches rests upon a bed consisting of rounded gravel and some interstitial fine-earth material. A coarse gravelly substratum underlies the type. Usually the surface soil and the upper subsoil carry some rounded gravel and cobblestones. The coarse material is made up of waterworn fragments mainly of sandstone but to some extent of limestone and other rocks. The surface soil in places has a reddish cast. In some areas the coarse gravelly material normally lying in the lower subsoil may lie directly beneath the surface soil.

The areas of this type, which are for the most part small, are associated with the other soils of the series in the southern part of the county. They have a level to very gently sloping surface and are well drained. In some cases they represent alluvial-fan or foot-slope material which has been deposited over other terrace types.

The Palmyra loam is inextensive and is agriculturally unimportant. All of it is farmed in practically the same way and to about the same crops as the gravelly loam of the series. It returns good average yields of crops and is held at about the same price as the other types of the series.

ALTON STONY LOAM.

The surface soil of the Alton stony loam is a brown to slightly reddish brown, light, friable loam carrying large quantities of rounded cobblestones and gravel. At a depth of 8 to 10 inches this grades into a subsoil of light-brown to yellowish-brown loose sandy loam, which contains about the same proportion of cobbles and smaller gravel as the surface soil and extends to a depth of 3 feet or more. The substratum is a continuation of the loose coarse mass, or is compact ice-laid material similar to that giving rise to the Worth loam. The cobbles and gravel consist of well-rounded fragments of sandstone and crystalline rocks, with a very small proportion of limestone. Small rounded boulders of similar material are common on the surface in places, but many have been removed from the land in cultivation.

In places the texture of the fine-earth material of the surface soil approaches a silt loam and elsewhere grades toward a sandy loam. Where the coarse mantle is about 3 feet deep, the lower part of the subsoil tends to assume a grayish color. While the greater part of the type has a depth of 3 feet or more, it thins out toward adjacent soils, so that it is necessary to include areas where the subsoil is partly or almost wholly of compact unassorted material. In places it occupies the slopes or margins of areas that have a core of more or less stony and poorly drained glacial till. A few included areas are on small deltas, terraces, or outwash plains, where the type more properly belongs in the Chenango series. The type as mapped includes some material belonging to the Worth series.

The Alton stony loam occurs in the northeastern part of the county in the towns of Sodus, Huron, Wolcott, Rose, and Butler, especially in sections adjacent to the villages of Joy, Sodus Center, South Sodus, Wallington, Alton, Wayne Center, North Rose, Wolcott, and North Wolcott. It is found in a belt two to six miles wide lying between the isolated hills of Worth loam on the north and the Ontario soils on the south. The associated types on or near the same level are the Westbury loam and the poorly drained phase of the Worth loam, and on levels from 5 to 25 feet lower, the soils of the Dunkirk, Tyler, and Granby series.

The surface of the type is undulating to gently sloping, sloping, or terraced. The greater part lies between elevations of 400 to 440 feet, with extremes of 380 and 450 feet above sea level. All of it is below the level of the old Lake Iroquois beach. The type has good to excessive internal drainage.

The Alton stony loam, whose level approximates that of the old glacial lake, appears in most places to consist of material derived mainly by the reworking by wave action of islands or areas of glacial till which were just below or projected only a little above the water. The areas occur where conditions were favorable for beach construction, and many of these low islands have been reduced to the lake level. Farther south, where the general level as well as the elevation of the hills is higher, the type is found at or near the base of the hills; while to the north, where the isolated hills, though seeming higher on account of the lower level of the lake sediments, seldom exceed 400 feet in elevation and were largely submerged, the type where it occurs at all extends well up on the hillsides. In this section

conditions were not as favorable for the development of such beaches as the Ridge where the expanse of water was greater.

Though limited in extent, the Alton stony loam is a fairly important soil in the section where it is found, and 90 per cent of it is cropped. Its location close to transportation and markets, the character of some of the associated types, and its adaptation to certain crops have been factors in its extensive development for farming. It occurs in a section where settlement is fairly thick and the farms rather small. With the exception of short steep slopes, it has a topography favorable for agriculture. In some seasons it does not hold enough moisture for late-maturing crops.

Probably more of the type is devoted to fruit than to any other crop. This is a result of its adaptation to fruit and to its occurrence on farms including other soils better adapted to the production of hay and grain. Corn, hay, wheat, and oats are the leading field crops, followed by potatoes, beans, and berries. Hay yields are usually light, as this is not a good grass soil. Wheat and oats do fairly well in favorable seasons. Corn is a somewhat uncertain crop. Fruit, especially apples, small fruit, beans, and berries give the most satisfactory yields. Dairying is not important.

Many of the owners recognize that this type is best adapted to special crops, and there is at present a tendency to use it for orchards and other crops where methods of cultivation aid it in holding moisture. Short steep slopes not in orchard are kept in grass as much as possible. Some of the orchards are given clean cultivation and otherwise well cared for, while others are in sod. Cover crops are used in some cases. General farming is only moderately successful on this type.

Well-located farms with a small to moderate proportion of Alton stony loam sell for \$60 to \$100 an acre. Well-developed fruit tracts bring higher prices.

There should be an extension of the use of the type for special crops, such as apples, berries, and other crops that allow tillage. More attention should be given in many cases to the removal of stone in order that cultivation may be less difficult and more thorough. Methods should be adopted that will make the type more retentive of moisture, such as deeper plowing, the use of stable manure, and the turning under of green manures to increase the content of organic matter. The application of lime to green-manure crops before turning them under would be beneficial.

ALTON GRAVELLY LOAM.

The Alton gravelly loam consists of a brown to slightly reddish-brown light loam of friable structure, carrying large quantities of fine to medium gravel, underlain at 8 to 10 inches by a light-brown gravelly sandy loam, which gives way to 24 inches to a light-brown to grayish-brown gravel with some interstitial sand and other fine-earth material. The substratum is a bed of assorted sands and gravel several feet in thickness. The gravel is made up of well-rounded sandstone and crystalline rock fragments, with a very little limestone. In places there is a white coating on the surface of the gravel in the lower subsoil. The surface soil has

a moderate content of organic matter and the type has a rather porous structure.

A few variations occur. Thus in some places there is a surface layer of fine sand, a few inches thick, which, when mixed with the underlying gravelly material by cultivation, gives a gravelly fine sandy loam surface soil. A consistent difference related to the topographic position is notable, on well-defined ridges the soil material being made up of deep well-assorted material, while in areas on footslopes of steep ice-laid hills it is slightly heavier in texture, carries some cobbles, and is not so well assorted. In the latter case the soil material is not as deep and in places is underlain by ice-laid material within the 3-foot section. When this condition exists the deeper subsoil may show some mottling.

The Alton gravelly loam covers the greater part of a narrow ridge (a beach of Glacial Lake Iroquois), from 500 feet to one-fourth mile wide, extending from the Monroe County line to Sodus, a distance of more than 15 miles. Other areas occur southeast of Sodus and 2 miles south of Sodus Center. Several small areas are located on the lake plain in the towns of Williamson and Sodus.

This is a locally important soil type, though not extensive. All of it is cleared. The part of the Ridge not taken up by the Ridge Road, by the yards and buildings of farms lying to the north and south, and by villages and other centers of population, is intensively cultivated to fruit and small fruit. Other areas are utilized, in addition to fruit growing, for the production of wheat, potatoes, hay, and minor crops, all of which give moderate yields. It is probably the most thickly settled type in the county.

Farming methods are good. It is generally recognized that the type is better adapted to special than to general farm crops. Frequent cultivation, the use of cover crops, stable manure, and green-manure crops would greatly increase its organic-matter content and power to hold moisture.

TYLER FINE SANDY LOAM.

The Tyler fine sandy loam consists of a light brownish gray, friable fine sandy loam, underlain at 8 inches by a mottled pale-yellow and gray, moderately compact fine sand. Fine-textured sediments, compact in structure and deep, comprise the substratum. The type is free from stones and is noncalcareous.

Two areas, embracing nearly a square mile, from 1 to 2 miles northeast of Wayne Center, consist of a variation closely related to the Caneadea fine to very fine sandy loam. The surface soil of these areas is a gray to dark-gray, fine to very fine sandy loam in the surface 2 to 3 inches, underlain by a gray subsurface layer of the same texture. The subsoil is a gray or gray faintly mottled with yellow very fine sandy loam of compact structure. These are tracts of virgin soil and have small mounds whose surface soil has a brownish color and whose subsoil is a bright yellow without mottling. The texture grades rather light. There is a forest cover.

Areas of the typical Tyler fine sandy loam occur in Sodus and Williamson Towns immediately north of the Ridge. One lies about 1 mile southeast of Savannah. The surface of these areas is level, and drainage is almost entirely by percolation.

The Tyler fine sandy loam is inextensive and of little agricultural importance. About 75 per cent of it is farmed to the crops common to the region. Its value depends largely on the selling price of the associated types.

Below are given the results of mechanical analyses of samples of the soil and subsoil of the Tyler fine sandy loam:

Mechanical analyses of Tyler 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.	<i>Per cent.</i>
162971.....	Soil.....	0.0	0.3	0.2	66.6	16.2	9.6	6.9
162972.....	Subsoil.....	.0	.4	.2	78.5	11.6	4.6	4.4

TYLER VERY FINE SANDY LOAM.

The surface soil of the Tyler very fine sandy loam is a brownish-gray, friable, very fine sandy loam 8 inches deep. The subsoil is a mottled yellow, gray, and rusty-brown compact very fine sandy loam, the proportion of gray increasing with depth, so that between 24 and 36 inches the color is usually a gray mottled with yellow. The substratum consists of fine lake-laid sediments many feet deep. The type is free from stone and gravel and is noncalcareous.

Variations of the type include areas which grade toward the loam or the fine sandy loam of the series. In places where the material is lighter than typical in texture and the surface somewhat hummocky fields have a spotted appearance of alternating light and dark soil, and the subsoil, ranging from a bright yellow to a highly mottled yellow, gray, and brown, usually has a stratum, from 15 to 20 inches below the surface and averaging 4 or 5 inches in thickness, of dark-brown compact to indurated material locally known as hardpan. Areas of this description, if of sufficient extent, would be in the Saugatuck series. There are also slight variations in the color of soil and in the intensity of the subsoil mottling as the type grades on the one hand toward the better drained Dunkirk very fine sandy loam and on the other toward the more poorly drained soils of the Granby series.

The greater part of this type is included within a triangular-shaped area bounded by lines connecting the villages of Sodus, Wolcott, and Clyde, which area comprises much of the southern extension of the lake plain. Other areas of importance lie within a short distance of the Ridge Road in the towns of Sodus, Williamson, and Ontario. Associated with it on the same level are other types of the Tyler series, the Dunkirk very fine sandy loam, and types of the Granby and Caneadea series. The Alton stony loam occurs at a slightly higher level.

The type has a flat surface with practically no drainage courses, and the internal drainage is retarded by the compact structure of the subsoil and substratum.

The Tyler very fine sandy loam, though one of the most extensive of the many types on the lake plain, is a minor type in the county as a whole. It lies comparatively close to transportation and in a rather

thickly settled section. Its agricultural importance is not as great as that of some less extensive types that are better adapted to the production of crops. Nevertheless, at least 90 per cent of it is cleared and nearly all the cleared area is under cultivation. The soil has a fair content of organic matter, and tillage is possible within a fairly wide range of moisture conditions. Plowing and planting are retarded, however, in many seasons by inadequate drainage.

General farming is the common type of agriculture. The more important crops are hay, oats, corn, wheat, and potatoes. A small acreage is in commercial orchards. Fruit and vegetables are grown generally for home use. Dairying is followed on a small scale on a number of farms and a considerable acreage is used for pasture. In some seasons buckwheat is grown.

Hay yields from three-fourths to $1\frac{1}{2}$ tons, oats 30 to 60 bushels, wheat 15 to 20 bushels, and potatoes average about 100 bushels per acre. Corn gives fair average yields in favorable seasons.

The general practice is to keep as much of the type as possible in grass, mainly timothy with some alsike clover, for hay and pasturage. Sod land is plowed for the tilled crops, which are followed by either oats or wheat and a seeding to grass. Orchards are set on only the best drained tracts and even there artificial drainage is necessary in most cases. Many of the areas are traversed by open ditches.

The Tyler very fine sandy loam is usually sold with adjoining types, and prices range from \$75 to \$100 an acre.

Artificial drainage is the first requisite in the general improvement of the type. In many cases this is not difficult, while in others a fairly extensive system will be required and may be accomplished only by cooperation among the landowners. Drainage will tend to eliminate the late planting of crops, the decrease in yields caused by wet spring seasons, and also the damage by excessive summer or fall rains. Improved drainage, the use of lime, and the growing of leguminous crops as a step in the crop rotation, will greatly increase the productiveness of the type.

Tyler very fine sandy loam, stony phase.—The Tyler very fine sandy loam, stony phase, consists of a grayish-brown very fine sandy loam, about 8 inches deep, underlain by a mottled pale-yellow, gray, and brown very fine sandy loam to fine sandy loam extending to a depth of 3 feet or more. It carries on the surface, and to some extent in the soil material, fragments ranging in size from gravel and cobblestones to medium-sized bowlders of sandstone and crystalline rock. In a few places the stones are more or less angular. A feature of the stony phase is the almost stone-free character of the subsoil and substratum, the latter consisting of fine-textured stratified deposits underlain in turn by compact, unassorted ice-laid material. In places the surface soil grades toward a loam and in a few places toward the fine sandy loam of the series. Other variations are mainly in the proportion of surface rock.

The largest area of this phase lies east, northeast, and northwest of Sodus. Several other areas lie immediately north of the Ridge Road west of Sodus. One tract is situated about 1 mile east of Wayne Center. The areas have a practically level surface and are poorly drained.

The stony phase is inextensive and unimportant. It is nearly all cleared of forest, but less than one-fourth is cleared of stones so that it may be used for crops. The rest is in permanent pasture. The flat boulder-strewn fields of this phase are quite conspicuous from the Ridge Road. Low average yields of hay, oats, corn, and buckwheat are ordinarily obtained. Because of its usefulness for pasture the phase does not greatly decrease the sale value of farms composed in part of other types.

Drainage is necessary for the development of this phase. In a few cases this is practicable on a small scale, but as a rule in order to obtain satisfactory results there is need of concerted action by the owners of this and other rather poorly drained types. Its best use in its present condition is for pasture.

The following table gives the results of mechanical analyses of samples of the soil, subsurface, and subsoil of the typical Tyler very fine sandy loam:

Mechanical analyses of Tyler very 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.	<i>Per cent.</i>
162974.....	Soil.....	0.2	0.4	0.3	6.9	61.7	21.6	8.3
162975.....	Subsurface.....	.0	.8	.8	2.7	78.1	15.2	2.3
162976.....	Subsoil.....	.3	.6	.2	1.5	72.4	16.4	8.5

TYLER LOAM.

The Tyler loam consists of a light brownish gray to very light brown friable loam to a depth of 8 inches, underlain by a mottled yellow, gray, and rusty-brown compact loam, which either extends to a depth of 3 feet or more or is displaced by a mottled yellow and gray fine sand at 24 to 30 inches below the surface. As a rule the type is free from stones and rests upon a substratum of fine-textured sediments usually 10 feet or more thick. The material is noncalcareous.

Prominent areas of the Tyler loam are located west and northwest of Clyde and west and northwest of Rose. Smaller areas occur in the lake plain and in the upland sections of the county.

The surface of the type, as well as that of many of the adjoining soils, is level. Only a few streams traverse the areas, and the natural drainage, almost wholly internal, is restricted by the compactness of the underlying material. In places the type is waterlogged after periods of heavy rainfall, and seepage water from higher lying soils collects on some parts of it.

The Tyler loam is of small extent. Nearly all of it is farmed to hay, oats, wheat, potatoes, buckwheat, and corn. A small, very poorly drained acreage is set to basket willows. A few home orchards are located on the best-drained tracts, adjacent to well-drained soils. Some of the type is used for pasture. In seasons of normal or low rainfall crops usually return satisfactory yields, but the average for a series of years is rather low on account of the delays in preparing and planting the land and the injury of crops by excess of

moisture. The yields are probably slightly lower than on the very fine sandy loam of the series.

The soil is moderately high in organic matter and is easily cultivated under a good range of moisture conditions. It holds moisture fairly well, and when drained and otherwise improved is a desirable type for all the general farm crops common to the region.

The areas of this type lie relatively close to markets. The land has about the same sale value as the Tyler very fine sandy loam, the price ranging from \$75 to \$100 an acre.

Drainage is the greatest need of this type. The extension and the deepening of the existing ditches, which form in their present condition a more or less inefficient system, and the construction of lateral drains, either open or tile, would enable better management of the soil and give more profitable crops. The use of lime would be beneficial.

Below are given the results of mechanical analyses of samples of the soil, subsurface, and subsoil of the Tyler loam:

Mechanical analyses of Tyler 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.	<i>Per cent.</i>
162987.....	Soil.....	0.7	2.1	3.0	31.7	26.4	22.1	13.8
162988.....	Subsurface.....	1.3	2.9	4.3	41.9	24.5	14.7	10.3
162989.....	Subsoil.....	.0	1.7	2.8	62.6	21.2	5.8	6.0

TYLER SILT LOAM.

The surface soil of the Tyler silt loam is a brownish-gray silt loam about 8 inches in depth, carrying a moderate proportion of organic matter. The subsoil is a pale-yellow, rather compact silt loam, mottled with gray and rusty brown. It is free from stone, is noncalcareous, and has a compact substratum of horizontally stratified silt and clay of considerable depth.

This type grades on the one hand toward the darker colored, more poorly drained Granby soils and on the other toward the lighter colored better drained Dunkirk soils. It has a fairly wide distribution in the lake plain, or that part of the county having an elevation of 400 feet or less. The areas are mostly small and scattered. The type also occurs in basinlike areas in the uplands. A typical position is between the Dunkirk silt loam and the upland soils.

The areas have a level surface, and both the run-off and the internal drainage are deficient. In certain positions the drainage is still less satisfactory as the result of seepage from higher land. The material giving this soil is practically identical with that from which the Dunkirk silt loam is derived, except for differences due to the presence of more organic matter and to incomplete oxidation resulting from poor drainage.

The Tyler silt loam, though one of the most extensive types of the series, has such a scattered distribution that it has no marked agricultural importance in any one section. All of it is cleared and most of it is in cultivation. It has a favorable location, is easily

tilled when in the proper moisture condition, and is regarded as a productive and desirable soil for certain crops. Hay, corn, oats, and wheat are the leading crops, with potatoes, cabbage, beans, fruit, and vegetables of minor importance. A considerable acreage is in pasture. Much of the type occurs on farms in the fruit belt where the associated better drained soils are partly or wholly devoted to fruit, and this soil is used for the production of grain and forage crops. In a few cases the orchards extend onto the better drained parts of the type.

Hay yields from 1 to 2 tons, oats 25 to 50 bushels, wheat 15 to 20 bushels, and corn 35 to 80 bushels per acre. Orchards are moderately productive, but in some cases show the results of poor drainage. The planting of crops, as well as their maturity, is often delayed by too much moisture.

The rotation generally practiced consists of plowing sod for tilled crops, followed by oats and seeding to grass. In some cases a crop of wheat is included. Fields are left in sod for several years according to the stand of grass. Grass seeding consists of mixed timothy and clover, the latter usually in part alsike. Timothy commonly predominates after a year or two.

Land of this type of soil brings \$75 to \$100 an acre, the prices being determined by the location, the character of the associated types, and the kind of farming.

Much of the type needs artificial drainage to bring it to its highest productiveness. Open ditches are used to some extent, but these should be deepened and supplemented by more laterals. Tile should be used wherever practicable. Artificial drainage is especially necessary for tracts in orchards. The size and position of the areas are usually favorable to drainage with relatively little outlay. The use of lime would prove beneficial in growing most crops on this soil.

TYLER SILTY CLAY LOAM.

The Tyler silty clay loam consists of a light brownish gray sticky silty clay loam, about 8 inches deep, underlain by a pale-yellow stiff silty clay loam, which at 15 to 24 inches rests upon a mottled gray, yellow, and rusty-brown silty clay loam extending to a depth of 3 feet or more. The upper subsoil in places also shows faint mottling. Fine-textured material of rather impervious character underlies the type material to a depth of several feet. Both soil and subsoil are free from stones and gravel, and do not contain sufficient lime to effervesce with acid. The soil contains only a small proportion of organic matter.

The largest areas lie east and south of Rose. Several others occur in association with the Dunkirk and Tyler soils in the lake plain. The surface is flat and seldom exceeds 400 feet in elevation. The natural drainage is poor on account of the rather impervious character of the subsoil and substratum. The surface soil absorbs moisture very slowly, though holding it in fairly large quantities.

The Tyler silty clay loam, though well situated, is of small extent and little agricultural importance. It is productive when improved, but under natural conditions is difficult to handle. It clods and

bakes when plowed too wet and breaks into lumps when too dry, so that it is difficult to obtain a good seed bed. Practically all of it is cleared and in cultivation, hay, oats, corn, and buckwheat being the leading crops. Some of it is used for pasture and a few acres are in orchard. Medium yields are obtained.

The general practice is to keep land of this character in grass as much of the time as possible. Timothy and alsike clover are commonly sown for hay and pasturage. Farms are located only in part on the type, so that its cultivation is not as great a problem as if it were found in extensive areas. Its sale value depends largely upon the character of the associated soils.

The type needs drainage, organic matter, and lime. The use of tile and open ditches to carry off the excess water would permit the earlier planting of crops and also result in more certain yields. The structure of the type requires that the ditches be placed relatively close together. The incorporation of organic matter, together with applications of lime, would improve the physical condition and insure better crops.

SCHOHARIE STONY VERY FINE SANDY LOAM.

The surface soil of the Schoharie stony very fine sandy loam, to a depth of 8 inches, is a brown very fine sandy loam, on the surface of which are numerous small to medium-sized angular fragments of red sandstone and a few boulders of crystalline rock. The subsoil is a pale-yellow to pinkish very fine sandy loam, containing few if any stones, underlain at 20 to 24 inches by a reddish very fine sandy loam to fine sandy loam. Faint grayish mottlings are present in the subsoil in places. The fine-textured sediments are usually rather shallow and are underlain by glacial till or by bedrock. The till is encountered here and there in the lower part of the subsoil, especially in the northernmost areas of the type.

The type is found in Williamson and Ontario Towns within a belt about 2 miles wide just offshore from the old lake beach and is associated mainly with the Lockport loam. It represents a shallow deposit of lake-laid sediments derived in part from the red Medina sandstone and modified by the inclusion of offshore material from icebergs and shore ice.

The surface of the type is flat, with a very slight slope toward the north and an elevation of 400 to 420 feet above sea level. The streams that traverse it have few branches, and internal drainage is slow, so that the drainage is inadequate for the successful production of crops in all seasons.

This type is comparatively inextensive and is confined to a small section of the county. It is well situated with respect to transportation and markets. Nearly all of it is cleared and approximately 60 per cent is in crops, with the rest in permanent pasture. Hay, corn, and oats are the leading crops. A small area is in apple and pear orchards. The crop yields range from low to medium. Fields are kept in grass as much of the time as possible. Farms wholly or largely on this type are not as a rule in a very thriving condition.

Based on present agricultural value, the selling price of this type should be rather low. The location tends to increase its value.

GRANBY LOAM.

The Granby loam has a surface soil of dark-gray to black, friable, fine-textured loam, 6 to 8 inches deep. The subsoil is a gray compact loam to silt loam, mottled with pale yellow, the mottling in places increasing below a depth of 24 inches. Stratified fine material forms the substratum.

The type includes a number of comparatively unimportant variations, owing to its wide distribution as small areas in nearly all parts of the county and its association with many different soil types. The soil ranges from a fine sandy loam or very fine sandy loam to a silt loam, with a subsoil of similar though usually lighter texture. The wide variation in texture is accounted for by the inclusion in the type of local areas outside of the lake plain. Though typically associated with soils derived from sandstone and shale, areas of fine-textured dark-colored soils, occurring in association with the Ontario series, and in some cases calcareous in the lower part, have also been included.

Although the Granby loam has an exceptionally wide distribution, it is a relatively unimportant type. It occurs in practically all parts of the county, in areas ranging from a few acres to 200 acres or more in extent. It is found not only among the old glacial-lake soils but in the more or less recently filled basins in the uplands and along or near the heads of streams, where there has been little or no deposition of recent-alluvial material.

The type occupies troughs between hills and ridges, glades near the heads of streams, and depressions. The surface is flat, and both surface and internal drainage are so poor that, where not artificially drained, water stands on the surface or the material remains saturated for a considerable period after rains. From 50 to 65 per cent of the type has been cleared and is either cropped or is in permanent pasture. As a rule some attempt has been made to improve the drainage of most of the cleared and some of the forested areas by open ditches. Hay and oats are the leading crops, with corn, potatoes, and buckwheat of less importance. Yields range from low to good, according to the season and the effectiveness of the artificial drainage.

The type seldom has sufficient local acreage to directly influence the sale value of farms.

This is a good grass soil and makes fine permanent pastures, but for other crops improved drainage is essential to insure profitable annual yields. The application of lime in places would prove beneficial.

The following table gives the results of mechanical analyses of samples of the soil, subsurface, and subsoil of the Granby loam:

Mechanical analyses of Granby 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.	<i>Per cent.</i>
1629100.....	Soil.....	0.0	1.5	0.8	8.9	34.3	42.5	12.0
1629101.....	Subsurface..	.0	.0	.4	2.7	39.6	47.1	10.2
1629102.....	Subsoil.....	.0	.0	.0	4.5	64.1	25.1	6.3

GRANBY SILTY CLAY LOAM.

The Granby silty clay loam, to a depth of 8 to 12 inches, consists of a dark-gray to black heavy silt loam to silty clay loam, underlain by a gray to drab silty clay loam, which usually shows some mottling with yellow and rusty brown and extends to a depth of 3 feet or more. The substratum is made up of fine-textured, compact sediments. Gravel and stone are lacking. The soil is sticky when moist and the subsoil ranges from stiff to plastic in structure.

As the type includes all the dark-colored lake-laid soils heavier than a loam in texture, it is subject to some variation. In places the surface soil is quite mucky and the dark color does not give way to gray until near the lower part of the soil profile. In other places the subsoil has a greenish cast. The material is typically noncalcareous, but it is probable that certain areas occurring in association with the Ontario soils carry in the lower part of the soil section sufficient lime to effervesce with acid.

The Granby silty clay loam covers the valley floor of the old glacial stream channel, extending with only one break from about 3 miles east of Palmyra to near Lyons and then continuing eastward in old channels and on the upland side of the wide valley floor of the Clyde River. Other areas are located 2 miles southeast of Clyde, $1\frac{1}{2}$ miles south of Sodus Center, and 3 miles north of Red Creek.

The type occupies flat, poorly drained areas which have the lowest elevations in the section of the county where they occur. In places there are poorly defined stream channels, but as a rule there is little or no run-off, the water standing on the surface or the soil remaining in a saturated condition for long periods. The construction of the Barge Canal has restricted the drainage in places both by raising the level of the ground water and by interrupting natural drainage courses. The type receives seepage water from higher lying soils.

The Granby silty clay loam is rather inextensive and unimportant. Areas between Palmyra and a short distance east of Lyons are mostly cleared and, with the exception of a few acres, are in permanent pasture. Other areas are for the most part quite heavily forested with maple, elm, ash, and other trees. In a few places there are rushes and cat-tails. Hay is practically the only farm crop grown.

The sale value for farming purposes is low. A considerable proportion of the best located areas is taken up by the rights of way of steam and electric railroads and of the Barge Canal.

Improvement of the drainage is difficult on account of the level surface and low position of the type and the water received from the upland soils. The best use of the land under present conditions is for pasture and the production of forest trees.

DUNKIRK LOAMY FINE SAND.

The surface soil of the Dunkirk loamy fine sand consists of a light-brown loose loamy fine sand, low in organic matter, with a depth of 8 inches. The subsoil is a yellowish-brown loose, porous fine sand, continuing to a depth of 3 feet or more and underlain by fine-textured material, also of open structure, several feet deep. It contains no stones. In areas on the Ridge the soil rests upon gravelly material, which usually comes within the soil profile.

The largest area lies $1\frac{1}{2}$ miles south of Red Creek. Several areas occur on or near the Ridge west of Sodus, east and northwest of North Wolcott, and near South Sodus. The surface of the type is smooth and undulating. The areas lie at elevations between 400 and 450 feet, the highest position of any of the lacustrine soils. They are well to excessively drained.

The Dunkirk loamy fine sand covers a relatively small total area and has little agricultural importance in the county. The part on the Ridge is used for orchards and small fruit, and the rest for general farm crops, which give low to moderate yields. It is a naturally good soil for growing tree fruits, small fruits, and early truck crops, and nearly all of it is close to transportation facilities. The price of this land varies widely, depending upon location and state of development.

The intensively farmed area should be extended to cover all of the type. Vegetation should be turned under to increase the content of organic matter, thus enabling the type to hold more moisture within the reach of growing crops. Legumes should be grown to add nitrogen, and stable manure should be applied liberally.

DUNKIRK VERY FINE SAND.

The Dunkirk very fine sand consists of a light-brown, loose very fine sand, low in organic matter, underlain at 6 to 8 inches by a yellowish-brown loose very fine sand which extends to a depth of 3 feet or more. Stratified fine material continues to a depth of many feet.

Several small areas of this type are situated on the lake plain between Alton and North Rose, one about 2 miles south of Wolcott, and another 2 miles south of Pultneyville. The surface, which is level to billowy, has an elevation of approximately 400 feet above sea level. Drainage is good, and in places excessive.

This type is inextensive and unimportant, though all of it is in cultivation. Fruit and berries are the chief crops, and some grass and wheat are grown. The areas are well situated with respect to markets. The land is adapted to the production of fruit, small fruit, and early truck crops.

The Dunkirk very fine sand has practically the same selling price as the adjoining soils; the less desirable areas are held for about \$75 an acre.

Stable manure or green-manure crops should be incorporated in this light soil, to improve its fertility and to increase its moisture-holding capacity.

DUNKIRK FINE SANDY LOAM.

The Dunkirk fine sandy loam consists of about 8 inches of brown fine sandy loam, underlain by a loose yellow loamy fine sand to a depth of 3 feet or more. The type has a loose structure throughout. The substratum is of stratified fine material several feet deep. The type is free from rock fragments, although a very little rounded gravel is found on some areas.

The type, though inextensive, is widely distributed. The more prominent areas are located 1 mile north of Sodus, 3 miles north-

east of Williamson, 1 mile southwest of Wallington, 3 miles south of Lyons, 2 miles south of Alton, 1 mile west of Red Creek, 2 miles east and $2\frac{1}{2}$ miles northeast of Savannah, and one-half mile west of North Wolcott.

The surface is level to very gently undulating, with short, steep slopes where traversed by streams in narrow, V-shaped valleys. Its elevation is from 300 to 400 feet above sea level. The drainage is good.

The Dunkirk fine sandy loam, considering its small total area, is a comparatively important soil, as all of it is farmed, and some of it intensively. The location of much of the type in or near the fruit belt and close to railroads and markets, and its adaptation to special crops, add to its agricultural value. It is easily tilled under a wide range of moisture conditions and holds moisture fairly well with proper cultivation.

Apples, hay, and grain are the leading crops. Orchard fruits, small fruits, corn, and potatoes are crops of secondary importance. Hay yields an average of 1 ton per acre, wheat 15 to 20 bushels, and potatoes 100 to 200 bushels. Fruit and small fruit do especially well with proper culture. More than half of the type is used in the production of the general farm crops. It is farmed in the same way as the heavier types. The special crops as a rule receive careful attention.

Little land of this type changes hands; prices range from \$75 to \$150 or more an acre.

The acreage in special crops should be extended, and attention should be given to methods that will enable the type to hold more moisture, such as the incorporation of organic matter and the frequent shallow cultivation of intertilled crops.

Dunkirk fine sandy loam, rolling phase.—The Dunkirk fine sandy loam, rolling phase, consists of a light-brown, rather loose, light fine sandy loam, underlain by a loose yellow loamy fine sand to fine sand to a depth of 3 feet or more. Waterworn gravel is present on the surface and within the soil profile in varying quantities, some areas being sufficiently gravelly to be classed as a gravelly fine sandy loam if the areas had been numerous enough to warrant the mapping of a separate type.

The rolling phase is confined almost wholly to the northeastern part of the county, occurring as small knolls or ridges in association with the Worth and other Dunkirk soils. Its surface is undulating to rolling, and drainage is usually excessive.

The phase is inextensive and unimportant. Nearly all of it is in cultivation, some of it being set to orchards. Hay, grain, and potatoes are also grown. The phase is not of sufficient extent in any locality to have a separate sale value.

DUNKIRK VERY FINE SANDY LOAM.

The surface soil of the Dunkirk very fine sandy loam is a light-brown friable very fine sandy loam, with a depth of 8 inches. The subsoil is a moderately compact yellowish-brown very fine sandy loam, extending to a depth of 3 feet or more. Horizontally stratified very fine sand, silt, and clay form the substratum. The presence of

stone or gravel is not typical. The surface soil grades light rather than heavy in texture. Material of a very fine sand texture may occur in the lower part of the 3-foot section. In places, especially adjacent to soils of the Tyler series, the lower subsoil has a light-yellow to grayish-yellow color and here and there shows faint gray mottlings.

The type has the widest distribution of any member of the Dunkirk series, occurring in practically all parts of the lake plain, though seldom near the present lake or bay shore. It is most extensively developed in a belt on each side of a line drawn from a point about 2 miles north of Sodus to North Rose. Other areas are situated northwest of Sodus, north of Williamson, north and northwest of Ontario Center, and northwest, southwest, and south of Red Creek.

The surface of the type is level to very gently undulating. Only a comparatively few steep slopes are included, most of the wider areas of such topography along V-shaped draws and stream valleys being included in the steep phase of the Dunkirk silt loam. The greater part lies at or near an elevation of 400 feet above sea level, though attaining an elevation of only 300 feet in some of the northernmost areas. Some of the streams which traverse bodies of this type are quite deeply entrenched in narrow, V-shaped valleys. Drainage, though largely internal, is excellent, with a tendency in places to be excessive.

The very fine sandy loam is the second largest type of the Dunkirk series and is of considerable agricultural importance in the county. It is located in a thickly settled, well-developed section, close to markets and shipping points. Practically all of it is in cultivation. The soil contains a moderate amount of organic matter and is easily tilled under a good range of moisture conditions. It is fairly productive, holds moisture well when properly handled, and is regarded as a desirable soil for both general and special farm crops.

General farming and fruit growing, separate or in combination, are practiced, the general farming prevailing on areas in the eastern part of the county, the fruit growing in the western part, and a combination of the two in the vicinity of Sodus Bay. Dairying is also practiced on some of the farms devoted to general crops. Fruit, small fruit, wheat, and potatoes are cash crops. Hay is grown for farm use and the surplus sold. Oats and corn are fed on the farm. A number of minor crops are grown for home use.

Tame hay yields from three-fourths ton to 2 tons or more per acre. Oats yield 25 to 40 bushels, wheat 15 to 20 bushels, and potatoes from 75 to 200 bushels per acre. Good yields of fruit of excellent quality, mainly apples and peaches, with some cherries, are obtained under proper care and management.

The greater part of the Dunkirk very fine sandy loam is fairly well to well farmed. A general system of crop rotation, similar to that in use on the silt loam of the series, is practiced. The available supply of stable manure is applied to fields intended for inter-tilled crops or for wheat. Sod is usually plowed under before the stand of grass becomes poor. Some commercial fertilizer is used. Orchards are given fairly good care, summer cover crops being commonly used.

Land of this type sells for \$75 to \$200 or more an acre, according to its location, the improvements, and the type of farming practiced.

The type should be utilized more extensively for special crops. Attention should also be given to the production of leguminous crops to gather nitrogen and to add humus to the soil.

Below are given the results of mechanical analyses of samples of the soil, subsurface, and subsoil of the Dunkirk very fine sandy loam:

Mechanical analyses of Dunkirk very 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.	<i>Per cent.</i>
162965.....	Soil.....	0.0	1.2	0.4	4.2	71.2	15.9	7.0
162966.....	Subsurface..	.1	.2	.2	2.3	73.7	18.1	5.1
162967.....	Subsoil.....	.0	.3	.2	2.2	69.5	21.8	6.5

DUNKIRK SILT LOAM.

The soil of the Dunkirk silt loam is a friable light-brown to brown silt loam about 8 inches deep. The subsoil is a light yellowish brown friable silt loam, which becomes more compact and slightly lighter in color with depth below 20 inches and extends to a depth of 3 feet or more. The substratum is usually a deep bed of stratified silt and clay. The material is typically free from gravel and stones, and is markedly uniform in texture throughout its extent.

In places the color of the surface soil is slightly lighter than typical, and upon drying has a grayish cast. This is especially noticeable in that part of the type lying west of Sodus Bay. In the more level tracts the subsoil has a tendency to become somewhat lighter in color and mottled with gray in the lower part of the 3-foot section. Practically the only variation in texture is a graduation toward a loam in a narrow strip adjacent to areas of Worth loam in the eastern part of the county. In general the soil material in the part of the type lying west of a line due north of Sodus is comparatively shallow, being only 5 to 15 feet over bedrock or glacial till; over the rest of the type it is moderately deep.

The type occurs in all of the northern tier of towns except Ontario. It is continuous from a point on the lake shore north of Sodus, eastward around the southern end of Sodus Bay to the Cayuga County line. West of the bay the belt is from 1 to 2 miles wide, while east of the bay it is the dominant type over a belt from 6 to 8 miles wide. Here it is associated with the Worth loam, covering the isolated hills, and with soils of the Dunkirk and the Tyler series on or near an equal level. Several areas occur along Wolcott Creek in Butler town.

The surface is level or very gently undulating to gently rolling. Here and there are short steep slopes, but most of these have been mapped as the steep phase of the type. Near the lake the type has an elevation of 300 feet or less, but it rises gradually toward the south until an elevation of 400 feet above sea level is attained near its southern limits. The drainage of the greater part of the type is good, but in places it is slow because of the topography and the compactness of the subsoil and substratum.

The Dunkirk silt loam is the most extensive type of the series and the third largest in the county. It is a relatively important soil, especially in the northeastern part of the county. Practically all of it is utilized for farm crops. It is well located, has a topography favorable to the use of modern farm machinery, is deep and free from bowlders and other rock fragments, and retains moisture well. Settlement is fairly thick, and the farms, which are small to medium in size, are in a prosperous condition.

The soil has a moderate content of organic matter and is easy to till when handled under proper moisture conditions, but if worked when too wet it clods and bakes. It is a productive and desirable soil adapted to a wide range of crops which seldom suffer either from the effects of drought or of excessive rainfall.

West of Sodus Bay fruit growing predominates, some farms being devoted wholly to it, and others to a combination of fruit and general farming, with the income mainly from the sale of fruit. East of the bay general farming prevails on the majority of the farms, general farming combined with fruit growing on quite a number, and fruit growing on comparatively few, the farm income being from a variety of sources. On some farms having only a small commercial orchard or none at all, dairying on a small scale is one of the commoner activities. On general and combination farms hay is the leading crop, followed by corn. Oats and wheat are the grain crops, the former leading in acreage. The minor crops include potatoes, beans, buckwheat, vegetables, and small fruit. Apples are grown on 90 per cent of the area in orchards, the rest being in peaches, cherries, and pears. The hay is timothy and mixed timothy and clover, the latter on the more recently seeded fields. Very little alfalfa is grown. A large part of the hay is used to feed work stock, dairy cattle, and other stock on the farm, and the surplus, usually timothy, is sold. Oats are seldom sold. Wheat is a cash crop. Corn is grown mainly for grain but to some extent for silage. The minor crops are produced for home use and only the surplus is sold. The sale of live stock and poultry products also provides an income on these farms.

The yields for the type are among the highest in the county. Hay yields from three-fourths ton to $2\frac{1}{2}$ tons, corn upward of 100 bushels, oats 30 to 60 bushels, wheat 15 to 25 bushels, and potatoes 100 bushels per acre. Profitable yields of fruit of good quality are usually obtained under careful management.

This is one of the best farmed soils in the county. The general practice is to plow sod land for the tilled crops of corn, beans, and potatoes, which are followed either by oats and seeding to grass, or by oats and then by wheat and seeding to grass. Hay is cut from the fields for two or more seasons and some of the fields are pastured for one or more years before being plowed again. The frequency of plowing depends upon the stand of grass, the size of the farm, and the type of farming. Stable manure is applied to the fields to be used for wheat or for cultivated crops. A good stand of grass is usually obtained, which after two or three years is mainly timothy. Light applications of commercial fertilizers are used for corn and wheat. On a few farms ground limestone is used, 1 ton per acre being the usual application.

Orchards on this type are as a rule well cared for. Many of them are plowed in the fall and harrowed in the spring and early summer, and then seeded to a cover crop. This reduces the amount of cultivation and also provides a crop to turn under. Very few of the commercial orchards are in sod. Pruning and spraying are generally practiced. Some of the small home orchards show neglect.

Farms composed largely of this type of soil and devoted partly or wholly to general crops sell for \$75 to \$100 or more an acre. Those on which fruit is a special crop command higher prices.

Local areas would be benefited by artificial drainage, especially if in orchard. The type is adapted to the production of alfalfa, which should be more extensively grown. The chances of success with this crop would be greatly enhanced by applications of finely ground limestone or burnt lime and also by inoculation. Liming would also assist in increasing the yields of clover. Fields should be plowed when there is still a good sod to turn under, so that as much organic matter may be returned to the soil as possible.

Dunkirk silt loam, steep phase.—The Dunkirk silt loam, steep phase, consists of about 6 inches of grayish to light-brown silt loam underlain by a compact yellowish-brown silt loam extending to a depth of 3 feet or more. Some areas of loam to very fine sandy loam texture are included, and in places the soil is slightly heavier than a silt loam. The surface soil is somewhat lighter in color than that of the typical Dunkirk silt loam, but the chief difference is in topography.

The phase is located mainly along streams tributary to Sodus Bay in Sodus and Huron Towns. Some also occurs along Wolcott Creek. It is found along streams traversing areas of Dunkirk silt loam and very fine sandy loam.

The areas consist of steep slopes along draws and facing narrow stream valleys. Most of the slopes are smooth, though where an area includes a series of such slopes the surface may be gullied and irregular. The phase is well to excessively drained. It has been formed by the erosion of the horizontally stratified deposits giving rise to the Dunkirk series.

The Dunkirk silt loam, steep phase, is small in extent and unimportant. Part of it is still in forest; the rest is cleared and in sod and used mainly for pasture. The greater part of the phase is too steep for successful farming.

LUCAS SILTY CLAY LOAM.

The Lucas silty clay loam consists of a light brownish gray heavy silt loam to silty clay loam, underlain at a depth of 8 inches by a tough pale-yellow silty clay loam faintly mottled with gray and grading into a mottled pale-yellow and gray silty clay loam of fairly tough structure. Below the 3-foot section grayish lake-laid sediments continue for several feet. Gravel and stones are typically lacking, but in places there are a few scattered glacial erratics, and where the underlying unassorted material projects through or is only thinly covered, angular fragments of sandstone occur. The sub-soil material is calcareous, the upper part in places more so than the lower. Toward the east the type grades into a rather light colored variation of the Dunkirk silt loam.

The type is confined to a belt nearly a mile in width and about 6 miles in length along the lake shore in the northwestern corner of the county. It has an undulating to sloping or very gently rolling surface and drains rather slowly on account of the dense character of the subsoil and substratum.

The Lucas silty clay loam is a comparatively inextensive and unimportant soil in the county, though practically all of it is in cultivation, the only forested areas being in small farm woodlots. The soil is deficient in organic matter and to avoid clodding must be tilled only within a narrow range of moisture conditions. It is moderately productive and is regarded as a good soil for grain and grass crops.

Hay, oats, and wheat lead in acreage. Corn, buckwheat, and fruit are minor crops. Hay, usually timothy after the first season, yields from 1 to 2 tons; oats, 30 to 50 bushels; and wheat, 12 to 20 bushels per acre. Fruits, mainly apples and pears, do only fairly well on the best drained parts of the type.

A part of the Lucas silty clay loam is very poorly farmed, some of the farms being apparently in an almost abandoned condition; others produce profitable crops. General farming prevails.

Land of this type is valued at \$50 to \$75 an acre.

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

Mechanical analyses of Lucas 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.	<i>Per cent.</i>
162994.....	Soil.....	0.5	1.8	1.8	9.0	20.4	47.5	18.9
162995.....	Subsurface..	.4	1.4	1.8	10.0	15.4	40.0	31.1
162996.....	Subsoil.....	.5	1.7	1.3	6.9	12.2	46.2	31.1

HOMER SILTY CLAY.

The surface soil of the Homer silty clay is a light-gray to gray silty clay, with a depth of 6 inches. It is sticky when wet and compact and hard when dry. The upper subsoil, to 15 or 20 inches, is a pale-yellow to gray tough silty clay, usually faintly mottled, and the lower subsoil, to 36 inches, a gray silty clay, which is slightly more friable or brittle than the material above. The substratum consists of lake-laid deposits several feet in depth. In places the soil has a faint bluish to greenish cast when moist. It is typically free from gravel and other stones, except for a few glacial boulders scattered on the surface. The lower subsoil and substratum are moderately calcareous.

The type is situated north and northwest of Ontario, where it covers a flat, poorly drained area of approximately 1 square mile. It has practically no surface drainage, and underdrainage is restricted by the impervious character of the underlying strata.

The Homer silty clay supports a growth of native grasses and is used mainly as pasture. A small acreage is in grain and tame grasses. The content of organic matter is low, and the soil is difficult to handle

on account of its heavy nature and poorly drained condition. It is not regarded as a desirable soil and has a low selling value.

CANEADEA SILTY CLAY LOAM.

The surface soil of the Caneadea silty clay loam consists of 6 inches of light-gray to gray sticky silty clay loam. The subsoil is a silty clay loam to silty clay, mottled gray, yellow, and rusty brown in color and plastic to tough in structure, which in most places gives way to a mottled yellow and gray fine sand at a depth of 24 to 30 inches. The substratum consists of stratified fine-textured sediments. The soil material is free from gravel and other coarse fragments and is noncalcareous.

Areas of virgin soil in places have a surface layer, 2 to 3 inches thick, of dark-gray to black silty clay loam underlain by an ashy-gray subsurface layer, which gives way abruptly to the typical subsoil. Upon cultivation these different layers are mixed to form the light-colored surface soil, which becomes still lighter with continued cultivation. In places the heavy subsoil layer is continuous to a depth of 3 feet.

The largest area of this type lies northwest of Clyde. Other areas of considerable extent border in places the Montezuma Marsh and its northern arms and the swampy flats along Black and Butler Creeks. An area occurs between Lock Berlin and Clyde, and others northeast and southeast of Lyons. A body 3 miles in length is located east and southeast of Rose. Practically all the type, it will be seen, lies in the southeastern part of the county in association with other lake-laid soils of the Tyler and Granby series and with Muck and Marsh areas.

Nearly all of this soil lies at an elevation of about 400 feet and as low or lower than the associated soils except Muck and Marsh. The surface is level, there are few natural stream courses, and the natural drainage is very imperfect. The drainage has been improved by the construction of a number of large ditches.

The Caneadea silty clay loam is a type of moderate extent. Ninety per cent of it is cleared and in farms, the rest being in forest. It is situated near markets and shipping points. The soil is low in organic matter and is difficult to handle as it clods and bakes unless handled when the moisture conditions are favorable.

The leading crops are hay and osiers (basket willow), with a smaller acreage devoted to corn, oats, wheat, and buckwheat. A considerable acreage is included in pastures. The farms usually contain considerable areas of other soils and farmhouses are seldom built on the Caneadea silty clay loam.

Grass for hay ordinarily consists of timothy and alsike clover, the larger clovers rarely being grown. The yields of hay range from 1 to 1½ tons per acre. Wheat is a very uncertain crop, yielding from 5 to 25 bushels. Osiers give yields of 2 to 6 tons per acre.

Land of this character is valued at \$50 to \$75 an acre, the price depending to a considerable extent on the character of the associated soils.

Drainage, the first requisite in improving this soil, is best handled in a cooperative way on a large scale. Liming is also essential.

Methods which will increase the content of organic matter should be adopted.

Below are given the results of mechanical analyses of samples of the soil and subsoil of the Canadea silty clay loam:

Mechanical analyses of Canadea 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.	<i>Per cent.</i>
162992.....	Soil.....	0.3	0.8	0.4	2.5	10.1	60.9	25.0
162993.....	Subsoil.....	0	.8	.8	13.0	21.9	39.3	24.0

GENESEE LOAM.

The Genesee loam consists of a grayish-brown to brown friable loam, 8 inches deep, underlain by a more or less compact fine sandy loam, ranging in color from light brown or yellowish brown mottled with gray to mottled yellow, gray, and rusty brown, and extending to a depth of 3 feet or more. The soil material is usually free from gravel and stones and overlies either glacial till or bedrock at comparatively shallow depths. The type in this survey grades toward the more poorly drained Papakating soils and to this extent is not typical of the Genesee series. Areas too small to map are included with the upland soils.

Small narrow areas of the type cover parts of the first bottoms of streams in Palmyra, Walworth, and Macedon Towns in the southwestern part of the county. The streams flow in shallow channels and are normally fed by springs and seepage from the adjacent uplands. The areas are level, poorly drained, and subject to overflow.

The Genesee loam is inextensive and unimportant agriculturally. About half of it is cleared, but its chief use is for pasture. Hay is cut from a small acreage and fields are occasionally planted with corn and grain.

Land of this character usually comprises only a small part of individual farms and has no separate sale value.

GENESEE SILT LOAM.

The Genesee silt loam consists of 8 to 10 inches of light-brown friable silt loam, underlain by a light-brown to yellowish-brown compact silt loam which extends to a depth of 3 feet or more. Stream-laid deposits, several feet in thickness, comprise the substratum. In places there are pockets or lenses of fine sandy material, but gravel and stone are absent. The lower subsoil may be slightly mottled on the upland side of certain areas.

The type is inextensive, occurring only along the Canandaigua Outlet between Lyons and the Ontario County line and in places along Red Creek between Marion and the junction of this stream with Ganargua or Mud Creek.

The Genesee silt loam has a flat surface lying from 4 to 10 feet above the normal stream level. Drainage is adequate, except during periods of heavy rainfall and during infrequent periods of overflow.

The original heavy forest growth was removed early in the agricultural development of the county, as the productiveness of the type was quickly recognized. At present only a few willows and elms stand along the stream channels. The soil is fairly well supplied with organic matter, is mellow, and easily cultivated. It is all in cultivation to grass, oats, wheat, and corn, giving good to excellent yields, which are seldom reduced by overflow.

This is one of the more valuable soils of the county. It is held at \$75 to \$100 an acre.

GENESEE SILTY CLAY LOAM.

The surface soil of the Genesee silty clay loam consists of 10 inches of light-brown to brown silty clay loam, which is somewhat sticky under average moisture conditions and is compact and hard when dry. The subsoil consists of a light-brown, compact to rather tough silty clay loam to silty clay, which grades at about 24 inches into a light grayish brown, sticky to somewhat plastic silty clay loam to silty clay, in places faintly mottled with gray, extending to a depth of 3 feet or more. The substratum of fine-textured sediments is usually several feet in thickness. Both soil and subsoil are free from gravel and stones, and rarely contain lenses or strata of fine and very fine sand.

Variations from the typical profile consist of gradations toward a grayish-brown color of surface soil and an increase in the mottling of the subsoil, mainly over parts adjacent to the upland soils.

The type occurs along Ganargua Creek in a continuous area, one-fourth to one-half mile in width and over 20 miles in length, extending from near the southwest corner of the county to Lyons. It also occupies parts of the bottoms of Canandaigua Outlet and Clyde River.

The Genesee silty clay loam has a level first-bottom position, from 5 to 15 feet above the streams. Overflows of short duration occur infrequently, and, except in a strip near the stream courses, the drainage is slow. Springs and seepage from the adjacent uplands add to the soil water. Nevertheless the drainage is sufficient to allow successful cultivation in ordinary seasons.

The Genesee silty clay loam is the most extensive and important first-bottom soil in the county. All of it is cleared and nearly all of it has been farmed for many years. It has the advantage of being close to Newark, Palmyra, Lyons, Clyde, and Macedon, and to steam and electric railroads, whose rights of way, as well as those of the Barge Canal and old Erie Canal, cover a large part of the type. The surface soil has a moderate content of organic matter, and though heavy, is not difficult to till when handled under favorable moisture conditions.

Hay, oats, and corn lead in acreage. Wheat is a minor crop. The adaptation of the type to forage crops has resulted in the development of the dairy industry. Hay, mainly timothy, yields from 1 to 2 tons per acre, oats from 25 to 60 bushels, corn from 50 to more than 100 bushels per acre. With the exception of a part of the hay, practically all the feed crops are consumed on the farms where grown. A considerable acreage is utilized for pasture.

Fields are kept in grass for hay and pasture as much of the time as possible, probably occupying three-fourths of the type at the present time (1919). Some of it is in permanent pasture. Sod is plowed for corn, which is followed by oats with seeding to grass. In some seasons sod land is plowed in the fall. Fertilizers are seldom used.

Farms partly or wholly on this type sell at prices ranging from \$75 to \$100 or more an acre.

The most essential step in the improvement of this type is drainage. Prevention of overflow by levees is probably not practicable, but the risk of loss would be decreased by removing obstructions from the streams and straightening their channels in places. Liming would also prove beneficial in the production of legumes, which should be more extensively grown.

HOLLY SILT LOAM.

The surface soil of the Holly silt loam is a light grayish brown friable silt loam, with a depth of 8 inches, containing a fair proportion of organic matter. The subsoil is a compact silt loam to very fine sandy loam, mottled yellow, gray, and rusty brown. Gravel and stone are lacking, but occasional thin strata of fine sandy texture occur in the subsoil. Variations in material consist of gradations toward a very fine sandy loam in the surface soil and a fine sand to fine sandy loam in the subsoil. In places areas associated with the Lockport soils have a reddish-brown color, and those associated with the deep lake-laid material a lighter color than typical.

This type is confined to narrow stream bottoms, mainly in the northern tier of towns, and is composed to a large extent of reworked material from the Dunkirk and Tyler soils. The greater part of it is found along Salmon, Sodus, Wolcott, and Red Creeks.

The surface is level and the drainage poor. The land is all subject to overflow.

The Holly silt loam, though a minor type, is more extensive than any other first-bottom type except the Genesee silty clay loam. All of it was originally heavily forested, but at present more than half of it is cleared and used for the production of hay, oats, and wheat, which return medium yields.

Farms composed in part of this type frequently also contain rolling to rough land and do not command as high prices as those of more favorable topography.

PAPAKATING SILT LOAM.

The Papakating silt loam consists of a dark grayish brown to black silt loam to loam, underlain at 6 to 8 inches by a gray to drab loam, in places mottled with yellow and rusty brown. The subsoil material continues below 36 inches to form the substratum and rests upon unassorted material at depths of 6 to 10 feet. Stones and gravel are absent. In places the surface material approaches the nature of Muck, and in spots appears to rest directly upon a glacial-till subsoil. In local areas it represents rather a transition between either Muck or the Granby loam and typical dark-colored

recent-alluvial soil material. The texture in some places grades toward a loam or fine sandy loam, and in others toward silty clay loam.

No extensive areas are found, though it has a fairly wide distribution along the smaller streams, especially in the central and southern parts of the county. Its practically flat surface, the accessions of water by springs and seepage from the uplands, and the sluggish current of the streams, which flow in poorly defined channels, combine to render its drainage very poor. Some of it remains in a saturated condition for long periods.

A little of the type is used for crops. Some of it is in cleared permanent pasture, but the greater part still supports a stand of maple, ash, elm, and other trees. Until drained and otherwise reclaimed, it has a low agricultural value.

MUCK.

Muck consists of a dark-brown to black, smooth, finely divided and more or less thoroughly decomposed mass of organic matter, with an admixture of mineral matter in the form of silt and clay. In the upper 12 to 18 inches it is quite well decomposed and nearly all evidence of organic structure has disappeared, but below this depth decomposition is not so far advanced, and in places the material has a somewhat coarse to fibrous structure and a brown to dark-brown color, sometimes approaching Peat in character.

There is some variation in the depth of the Muck and in the character of the underlying material. Nearly all of it exceeds 3 feet in depth and much of it extends to a much greater depth. The thickness of the beds is less near the margins of the areas than in the interior, but this belt is usually very narrow and more pronounced in areas occupying basinlike depressions in the uplands than in those lying in old channels or valley troughs and along stream courses. The underlying material varies with the position in which the Muck has been developed. In the uplands it may consist of a bluish compact glacial till or a blue clay; in some of the valley troughs it may consist of bedrock; while elsewhere fine-textured lake-laid or stream-laid deposits form the substratum. A bluish material containing small shells and resembling marl occurs in a few places. Material of a sandy nature is seldom associated with Muck in this county.

Muck is the most widely distributed soil in the county, occurring to a greater or less extent in all the towns of the county. It is least extensive on the lake plain, especially in the towns of Wolcott and Huron, only one area of sufficient size to be mapped occurring on that part of the lake plain north of the Ridge. There is also very little in the vicinity of Newark. It is most extensive in the north-central part of the county, south of Williamson and Sodus. Areas of some size are found along Black, Butler, and Crusoe Creeks in Galen and Savannah towns. These are arms of the Montezuma Marsh and are rather swampy.

Areas of this soil from 10 to several hundred acres in size occupy basinlike depressions on the uplands or in valleys and stream bottoms where conditions have been favorable for the growth and decay of water-loving vegetation. The surface is practically flat. Along

well-defined streams it has an almost imperceptible slope in the direction of stream flow. The greater part lies between elevations of 400 to 500 feet above sea level. It is very poorly drained, being naturally in a saturated condition during the greater part of the year, and water frequently stands on the surface for long periods. The streams traversing it, where channels are at all developed, have a sluggish current.

In its natural state Muck supports a fairly heavy growth of maple, elm, and black ash, and in places some tamarack. There is also a rather dense undergrowth of alder and other shrubs and brush, together with wild grasses and other water-loving plants where the forest growth is not too thick. There are only a few places where rushes and cat-tails grow, the greater part of the treeless areas being classed as Marsh.

More than half of the Muck has been cleared and reclaimed, for the most part in a rather thorough manner, by the use of large open main ditches and numerous small laterals. The size and position of some areas allow this to be done by individual owners, and in other cases it has been done through cooperative arrangement among the landowners. In places ditches are blasted in bedrock for some distance in order to afford an outlet. Much of the Muck is well situated with respect to railroads, markets, and storage facilities. Sodus and Williamson are the chief centers for the handling of products grown on this soil. Some of the areas have been in cultivation for a long time, others are more recent clearings.

Muck is an important soil in the agriculture of the county. It is used almost wholly for truck crops, which are grown under intensive systems. The leading crops are celery, onions, lettuce, and spinach. Carrots, cabbage, potatoes, corn, and hay also are grown. Some cleared or partly cleared areas are used for pasture.

Celery yields average 200 crates per acre, each crate containing 7 dozen bunches. Onions average 400 to 500 bushels per acre; a maximum of 1,000 bushels has been reported. Lettuce yields from 500 to 600 boxes per acre. Good yields of all other crops are obtained. There is quite a range in the yields of all crops, according to the methods of farming, the thoroughness of the drainage, and the season. Farming on Muck is more hazardous than on the upland soils, but at the same time there is opportunity for larger returns.

This soil is often farmed in conjunction with upland soils, on which feed and forage crops are grown. In other cases the whole income is derived from truck crops. The expense for labor in growing these crops is high. Many of the truck farmers are specialists in their line, so that the methods are up to date and efficient. Lettuce is followed by either lettuce or celery. Spinach is followed by spinach, by lettuce, or by celery. From 1,500 to 2,000 pounds of a mixture of phosphoric acid and potash are applied for onions, with an addition of nitrogen for lettuce and a slightly greater proportion of nitrogen for celery. A large part of the produce is hauled to market by motor trucks.

Muck, well improved and located near markets, has been sold for as much as \$1,000 an acre. Less desirable tracts sell for a considerably lower figure.

PEAT.

Peat consists of an accumulation of partly decomposed organic matter which contains little or no mineral matter. It is a brown, more or less fibrous mass, several feet in depth. It is flat and very poorly drained, and has no present agricultural value.

Two areas are mapped in the county. One area, lying about 2 miles south of Westbury, near the Cayuga line, is treeless, and the material is made up of the remains of sphagnum moss. The other area, located $3\frac{1}{2}$ miles west of Newark, is in forest and is composed of coarser, more woody material.

MARSH.

Marsh consists of low-lying, treeless areas that are covered with a growth of cat-tails, rushes, and other water-loving vegetation and are in a water-logged condition during the greater part of the year. The largest areas cover several square miles and include the parts of the extensive Montezuma Marsh lying within the county. Here the soil consists mainly of Muck, which has a mass of roots and other undecomposed material on or near the surface and is in places underlain by marl. The depth of the mucky layer ranges from 8 to 36 inches or more. It lies only slightly above the level of the Seneca and Clyde Rivers which traverse it. Water either stands on the surface or the material is saturated during much of the year. The cat-tails, which grow to a height of 5 to 10 feet, are harvested to some extent and shipped to furniture and other factories. Marsh lies at an elevation of 380 to 382 feet above sea level. An arm of the Montezuma Marsh, the soil of which is mapped as Muck, extends northward, passing just west of South Butler and continuing with one short break to Wolcott Creek, which flows northward into Lake Ontario. The floor of this valley trough nowhere attains an elevation of more than 400 feet, according to the United States Geological Survey topographic map, and therefore has possibilities of being utilized as the location of a drainage canal for the reclamation of extensive areas of valuable land now occupied by the type mapped as Marsh.

Besides the large area just mentioned, Marsh also covers small to fairly large areas between Sodus Bay and the Cayuga County line, and separated from Lake Ontario by wave-built beaches of gravel and sand. Some of these areas extend up the stream valleys for 2 to 4 miles. A few areas are found around Sodus Bay. The material in these areas ranges from Muck to Peat, with a relatively high percentage of silt and clay. They are covered with a growth of small bushes or brush, or of cat-tails and rushes. The reclamation of these areas near the lake would be difficult, as they lie at practically the same level as the lake itself and also receive considerable drainage water from adjoining upland soils.

Marsh in its present state has no agricultural value. It is sold only as a part of farms.

COASTAL BEACH.

Coastal beach comprises the sandy and gravelly material forming beaches or bars from Sodus Point eastward along the shore of Lake

Ontario. It consists mainly of an assortment of gravel, cobbles, and sand, and to a much smaller extent of grayish fine sand from 1 to 2 feet deep over the gravel base. Conspicuous among its areas are the bars which nearly inclose Sodus Bay. Other areas connect bodies of upland and intervene between the lake and the marsh on the inland side, or nearly or wholly inclose East, Port, and Blind Sodus Bays. The beaches are from 3 to 10 feet above the normal level of the lake and range from 200 to 500 feet in width.

Coastal beach is composed of material washed from the wave-swept bluffs of upland soils and built up by the combined action of waves, shore currents, and wind. It has no agricultural value.

MADELAND.

Madeland as mapped in this county includes areas composed of material dredged from the Barge Canal and material reworked in the mining of iron ore. The former consists of a mixture of fine earth, gravel, boulders, and shale covering areas of 10 to 100 acres or more in extent from Macedon eastward along the Barge Canal. These have been superimposed over other soils and are from 10 to 25 feet deep, with a smooth to hummocky surface. The overburden removed in mining iron ore consists of a mixture of fine earth and fragments of limestone and shale, and has an uneven, ridged surface. It occurs north of Ontario and Ontario Center. Vegetation in the form of weeds, grasses, and sweet clover is gradually spreading over the surface of land of this character. Areas too small to indicate on the soil map are included with the adjoining types. Madeland has no agricultural value at present.

SUMMARY.

Wayne County is situated in the north-central part of New York, nearly midway between Rochester and Syracuse. It has an area of 599 square miles, or 383,360 acres.

The surface of the county is undulating to rolling, with elevations ranging from 250 to 700 feet above sea level. The county comprises two distinct physiographic divisions; the drumlin region with its systematic arrangement of elongated hills and valley troughs, and the lake plain, a level to undulating or rolling region which was wholly or partly submerged by lake waters during glacial times.

Lake Ontario receives the drainage of the entire county, that of the northern part directly through a number of northward-flowing streams and that of the southern part indirectly through the Oswego River system. The county is on the whole well drained, only local areas being poorly drained, the largest of which is the Montezuma Marsh, in the southeastern part.

The population is largely made up of descendants of the early settlers and is 71.8 per cent rural.

Railroad transportation facilities are adequate, no part of the county being more than 10 miles distant from marketing and shipping points. The system of public roads is extensive and includes about 75 miles of State macadam and concrete roads.

Local and near-by outside markets are available for the crops produced in the county.

The climate is characterized by long, rather severe winters and short, pleasant summers. The mean annual precipitation of 34.27 inches is rather evenly distributed throughout the four seasons. There is a range of temperature from an absolute maximum of 101° F. to an absolute minimum of -14° F., with a mean annual temperature of 47° F. The length of the growing season is approximately 170 days in the northern part, with a gradual decrease southward across the county.

Agriculture has been not only the foremost but practically the only industry of Wayne County from its earliest settlement to the present time. In the last 40 years there has been an increase in the acreage devoted to fruit and other special crops and in the dairy industry.

General farming, dairying, and fruit raising, separate or in combination, are commonly practiced. The leading crops are hay and forage crops, cereals (mainly wheat, oats, and corn), fruit, and vegetables.

The fruit industry is most extensively developed in the northern part of the county. Orchards are not confined to any particular soil type, but are located on well-drained loamy soils favorably situated with respect to transportation and markets.

There is a general recognition of the adaptability of soils to crops, and crop rotation is commonly practiced. On the whole the farm buildings are commodious and well kept; the farms present a good appearance; modern farm machinery is in general use; and all crops, stock, and machinery are housed.

Out of a total of 4,980 farms in 1919, 78 per cent were operated by owners, 19.9 per cent by tenants, and 2.1 per cent by managers. Land values in general range from \$75 to \$125 an acre, and from \$250 to \$1,000 an acre where devoted to special crops.

The soils of the county are classed on the basis of derivation and processes of accumulation into seven groups: Soils derived from glacial till, from the decomposition of the underlying rocks, from terrace and beach deposits, from lake-laid sediments, from recent-alluvial material, from accumulations of organic matter, and miscellaneous material. Twenty soil series, embracing 37 soil types, 13 phases, and 5 kinds of miscellaneous materials, have been recognized in this survey.

The glacial-till soils are the most extensive, covering about three-fourths of the county, followed by the terrace and lake-laid soils. The residual, recent-alluvial, cumulose, and miscellaneous soils are of minor extent and importance.

The Ontario loam, composed of more or less calcareous, well-oxidized material, is the most extensive and important of the glacial-till soils. It has several phases and is the dominant soil in the southern two-thirds of the county. The Ontario soils are adapted to farming, dairying, and fruit growing, are almost wholly in use for farm crops, are productive, and comprise the best farming sections of the county.

The Worth series, with two types and four phases, is the next in extent and importance among the glacial-till soils. The material is derived from sandstone and shale and is fairly well oxidized. The soils are moderately productive and are adapted to a variety of crops. A high percentage of the total area is in cultivation. The loam is the most important member of the series.

The Westbury loam consists of unassorted very poorly drained material of sandstone and shale derivation. It is unproductive in its present state, and its chief use is for pasture.

The Lordstown silt loam, derived from shallow glacial till, is in-extensive and unimportant.

The Lockport loam and stony loam are shallow, reddish-brown soils, with a high stone content and smooth surface features. They are better adapted to special than to general farm crops. A considerable acreage is in fruit.

The residual soils belong to the Allis and Livingston series, represented by one type each and derived from limestone and shale or from shale alone. These soils cover small local areas of minor agricultural importance.

The Palmyra soils, of which four types and one phase are mapped, occupy terraces, are well drained, and are almost wholly in cultivation. They are productive and adapted to a variety of crops.

The Alton stony loam and gravelly loam are made up of porous, imperfectly assorted material of noncalcareous character. A considerable proportion of the area occupied by these soils is in orchards.

The Tyler soils, represented by five types, are derived from imperfectly drained lake sediments. A large proportion of their area is in cultivation to a wide range of crops. The types are better adapted to general than special crops.

The Schoharie stony very fine sandy loam is of minor importance and is farmed in the same way as the Tyler soil, with which it is associated.

The Granby loam and silty clay loam have dark-colored soils and a mottled subsoil. They are noncalcareous, and require artificial drainage to make them adapted to the production of crops.

The Dunkirk soils are derived from well-drained and oxidized lake sediments. The five types, of which the very fine sandy loam and silt loam are the most important, occur within the lake plain, mainly in the northern part of the county. They are productive and adapted to a variety of crops, especially fruit.

The Lucas silty clay loam is calcareous, and is better adapted to grain and grass than to other crops. It is nearly all in cultivation.

The Homer silty clay is a poorly drained, rather impervious type of small extent and little agricultural importance.

The Caneadea silty clay loam consists of poorly drained, light-colored lake sediments, has a rather impervious structure, and is utilized only in part for farm crops.

The Genesee, Holly, and Papakating soils comprise recent-alluvial material, ranging from fairly well to very poorly drained. They are subject to overflow. The types are utilized in part for farm crops, and in part for permanent pasture, with the rest of their area in forest.

Muck and Peat are poorly drained accumulations, mainly of organic matter. Muck is quite extensively reclaimed in places and is used for special crops, such as onions, celery, lettuce, and spinach.

Marsh, Coastal beach, and Madeland are miscellaneous soils which are at present mainly nonagricultural.

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