

The general physiographic features of the county fall into two natural divisions—the comparatively level lowlands of the lake plain and the rolling to hilly uplands. The latter is much the larger, and consists of a former high plateau region badly carved by preglacial erosion. It is now made up of high, broad hills and more or less narrow valleys, the largest of which have been partly filled with glacial debris. The elevation of this upland section varies greatly. The valley floors lie about 1,000 to 1,200 feet above sea level, while the hills exceed 2,000 feet in a few places, the highest point being 2,160 feet in Georgetown Township.

The main valley enters the county at Earlville and extends northward across the county. At Earlville a branch extends in a northeasterly direction through East Hamilton, Hubbardsville, and North Brookfield Station. At Randallsville a narrow branch passes a little west of north through Eaton and Morrisville, and at Pecksport another branch extends to the northeast by Bouckville and Solsville. These valleys have an average width of about 1 mile. There are several other narrow valleys which dissect the uplands.

The smaller of the two physiographic divisions occupies the northern end of the county, and constitutes a part of the bed of glacial Lake Iroquois. Its elevation varies from 370 feet above tide, the present level of Oneida Lake, bordering it on the north, to about 450 feet. Allis Hill and another hill between Chittenango Station and Sullivan, which attain a height of from 500 to 600 feet, appear as islands in this otherwise nearly level lake-bed plain. There is no other important variation, as the Erie Canal, which is approximately the dividing line between this and the uplands, has a uniform level across the county from east to west. This is a part of the "60-mile level," which extends from Syracuse to Utica. Narrow valleys extend from this plain southward into the upland region, the principal ones being those occupied by Chittenango, Cowaselon, and Oneida creeks. The latter valley forms the northern end of the main valley of the upland section.

Madison County lies on the watershed between the Great Lakes-St. Lawrence basin and the Chenango-Susquehanna-Chesapeake basin. The drainage of the county is about equally divided between these two drainage systems, although some portion of it reaches the Mohawk-Hudson system by way of Oriskany Creek and a system of canal feeders.

The Chenango River has its source in the vicinity of Morrisville and flows southeastward, leaving the county at Earlville. From its source to this point it receives the waters of several small branches from the uplands on each side. At Earlville it is joined by the East

Branch of the Chenango River, which occupies the valley extending northeastward from that point. The Unadilla River, which forms the extreme eastern boundary of the county, is also a branch of the Chenango. The drainage of the southwestern corner of the county is accomplished by branches of the same system, the Otselic, Tioughnioga, and East Branch of the Tioughnioga creeks. That part of the area lying in the Great Lakes-St. Lawrence basin is drained by streams flowing into Oneida Lake. The largest and most important of these are Oneida, Cowaselon, and Chittenango creeks. Oneida and Chittenango creeks form the east and west boundaries, respectively, of the lowlands, and receive but few tributaries from this county. The former has its source in a swamp near Peterboro, and for the first few miles of its course flows in an easterly direction, then northward until it reaches the lowlands, and thence northwest to the head of the lake. Cowaselon Creek rises in the uplands near Siloam, and after flowing a little west of north reaches the lowlands at Wampsville. North of Canastota it enters a large area of Muck and flows through Douglas ditch, emptying into the lake at Lakeport. This stream formerly flowed in a tortuous course the entire length of this body of Muck, then known as Cowaselon Swamp, and emptied into the Chittenango Creek a few miles above Bridgeport, but drainage ditches have established its present mouth. Chittenango Creek is the outlet of Cazenovia Lake and also drains a large part of the townships of Cazenovia, Nelson, and Fenner of the uplands. The upper part of its course is rapid and formerly was utilized extensively for water power. At Chittenango Falls it plunges over a ledge of limestone something over 100 feet in height. The Deruyter reservoir, which lies in the northwestern corner of Deruyter Township, is drained by Limestone Creek of Onondaga County.

In that section of the uplands around Hamilton and west of Eaton are numerous reservoirs and lakes whose drainage would naturally be by the Chenango River and its branches, but whose outlets are led around the foothills and into the Oriskany Creek near Solsville, so that eventually their waters find their way to the sea through the Mohawk and Hudson River valleys. These lakes and reservoirs, with their modified outlets, were formerly feeders for the Chenango Canal, but since the abandonment of that waterway in 1876 they have been used as a system of feeders for the Erie Canal, as is also the Erieville and Deruyter reservoirs and Cazenovia Lake.

The county was settled by pioneers emigrating from the eastern counties of the State and from the New England States. A few of the early settlers were Dutch and Scotch emigrants who sought homes in the new land. Practically all of these emigrants were home seekers who bought the land on which they located, built

homes, and at once cleared the land and engaged in agricultural pursuits. The settlement of the county began shortly after the close of the Revolutionary war. From 1790 to 1800 many families moved in and bought land at prices varying from \$1 to \$6 an acre, and in March, 1806, the State legislature passed an act forming a new county from the northern part of Chenango County. Thus Madison County came into existence just a century ago, receiving its name from President Madison. The development of the county has been at all times steady. The streams furnished water power, which was early used for gristmills and sawmills. Many tanneries, distilleries, asheries, etc., were also built at an early date and flourished for a long time, but subsequently the opening of more advantageous routes for travel and shipping caused them to decline and they were abandoned one by one until now none are left.

The growth of the county in population was rapid at first. In 1810, four years after its formation, the population was 25,144. In the next ten years there was an increase of over 7,000. This was followed by a period of gradual growth until 1835, when there was a considerable decline for a few years. The increase was again steady, though slow, until the opening of the civil war, when there was another short period of decline, followed by a small increase up to 1870. Since that date there has been a constant loss in population until 1905, when the population of the county was only 39,690 (State census), or 3,988 less than the maximum reached in 1855. Since 1890 there has been a loss of 3,202, and for the period since the last Federal census in 1900 a loss of nearly 150 each year. The only explanation for this recent decline in population is the development of the near-by cities of Syracuse and Utica in manufacturing.

The present population is made up largely of descendants of the early pioneers, and many of them still live on and operate the farms taken up and brought under cultivation by their forefathers. About 60 per cent of the present inhabitants live in the rural districts and 40 per cent in the villages and towns. It is likely that at least nearly half of those living in the towns are either directly or indirectly engaged in agricultural pursuits, so that approximately 75 per cent of the people are agriculturists.

The largest towns are in the northern part of the county. Oneida had in 1905 (State census) a population of 8,420, an increase in five years of 882. It is a thriving manufacturing town; one of the best of the small cities along the line of the New York Central Railroad. Canastota, 6 miles west of Oneida, is a prosperous village of about 4,000 inhabitants, and considerable manufacturing is also carried on there. Cazenovia, in the western part of the county, is a thriving village located at the foot of Cazenovia Lake. At this

place many city people have their summer homes. Hamilton, in the southern part, is the home of Colgate University, formerly Madison University. Morrisville, the county seat, is a small village near the geographical center of the county. Other towns are Chittenango, Deruyter, Eaton, Madison, Brookfield, and Leonardsville, and there are several smaller villages located on the various railroads.

Transportation facilities were early provided for the exports of this region. In 1790 a wagon road was opened from Oneida Castle westward across the county, following the Indian Trail by Wampsville, over Quality Hill, and by Canaseraga (Sullivan) and Chittenango. In 1794 and 1795 and again in 1797 this highway was improved by the State. In 1800 the Seneca Turnpike Company was chartered and further improved the road. This later became the old Genesee Turnpike, a famous mail route between Albany and Buffalo. Many other roads were built in the early part of the century, and at a later date, from 1848 to 1852, many plank roads were laid down. The establishment of these roads meant much to the settlers, though travel by them was slow and difficult at the best. In recent years many of the public highways have been improved by grading and surfacing with crushed stone. Some of the townships own stone crushers, and the highway improvement is being extended considerably each year.

The section of the Erie Canal crossing Madison County was completed in 1820, and a line of packets which carried both freight and passengers was operated, but through traffic was not established until 1825. This waterway furnished a cheap method of transportation for the products of the county and largely robbed the old turnpikes of their freight. The Chenango Canal (now abandoned) was completed from Utica to Binghamton in 1836. It crossed the county from near Solsville to Earlville, following up Oriskany Creek, and thence down the Chenango Valley. Its greatest elevation was in Madison County, near Bouckville. This canal aided greatly in the development of the country adjacent to it for many miles on each side.

Railroads were built early. In 1839 the Syracuse and Utica Railroad, now the New York Central and Hudson River Railroad, was completed. This robbed the old turnpike of its passenger traffic, as the canal had of its freight. Thirty years later, in 1870, the Midland Railroad, now the New York, Ontario and Western Railway, was completed across the county from Oneida to Earlville. The same year the Cazenovia and Canastota Railroad, now a branch of the Lehigh Valley Railroad, was completed between these two towns, and two years later it was extended to Deruyter. The other railroads of the county were built at about the same time, and all are in operation

at the present time except a branch of the Midland which crossed the southwestern corner of the county.

Transportation facilities are now of the best. All of the railroads maintain fast and efficient schedules, and as they are independent systems competition keeps charges at a fair rate. This is also aided by the low rates for slow-moving freight by canal. The West Shore Railroad is being electrified across the county and to Syracuse and Utica for passenger traffic.

Home markets consume large quantities of the products of the county. Syracuse is only 12 miles west of the western border and Utica 26 miles east of the eastern border. Both are good markets. Boston and New York are easily reached, and both receive shipments of the various products exported. New York, however, is the great market for this county.

CLIMATE.

The climatic conditions prevailing in that section of the State in which Madison County is located are characterized by a wide range in temperature between the summer and winter seasons. The winters are usually about four or five months long, and very often extremely cold weather and heavy snows are experienced. Sometimes the winters are mild and open, and often such weather prevails for short periods during an otherwise severe winter. The summers are usually warm, with occasional periods of extreme heat. During this season severe thunder storms often occur and occasionally a hail storm.

There is some difference in the temperature conditions between the lowland lake plains and the uplands of the county. The lowlands experience the greatest heat in summer, while as a rule the uplands have more severe cold in winter and a greater abundance of snow. There is also probably some difference between the uplands proper and the broad valleys occurring in that section, due to the differences in altitude.

The precipitation is quite evenly distributed throughout the year, but periods of drought sometimes occur late in the summer season, and the rains are often very heavy in the springtime and frequently retard planting. The annual precipitation varies considerably, the amount for the wettest years being nearly 70 inches, or about 50 per cent greater than the mean, and that of the driest years about 30 inches, or from 25 to 30 per cent less than the mean. About one-fourth of the precipitation falls in the form of snow.

Below is given a table compiled from records of the Weather Bureau stations in this section of the State, only one of which, Bouckville, is located within the area. This table gives the normal monthly and annual temperature and precipitation:

Normal monthly and annual temperature and precipitation.

Month.	Rome.		Cooperstown.		Bouckville. ^a	
	Temper- ature.	Precipi- tation.	Temper- ature.	Precipi- tation.	Temper- ature.	Precipi- tation.
	° F.	Inches.	° F.	Inches.	° F.	Inches.
January.....	20.6	3.39	20.4	2.59	13.4	5.39
February.....	20.8	3.69	20.9	2.46	13.3	3.24
March.....	29.8	4.49	28.0	2.81	27.8	2.68
April.....	45.0	2.83	42.2	2.66	39.2	3.80
May.....	56.6	4.04	54.5	3.58	59.0	2.49
June.....	66.2	4.52	64.0	4.16	64.6	2.35
July.....	69.5	4.84	68.1	4.47	66.2	8.85
August.....	67.3	4.33	65.5	4.35	64.3	4.79
September.....	59.7	3.81	58.3	3.35	58.2	3.28
October.....	48.4	3.15	46.7	3.30	45.6	3.06
November.....	33.4	4.51	35.1	3.10	38.2	1.11
December.....	24.6	4.21	24.6	2.82	18.2	3.88
Year.....	45.2	47.81	44.0	39.65	41.9	44.92

^a The figures for Bouckville represent the temperature and precipitation for the year 1904, without departures from the normal.

The following table gives the dates of the latest killing frosts in spring and the earliest in fall. From this table it is seen that immunity from frost can not be expected earlier than the middle of May in the spring nor after September 20 in the fall. The average length of the growing season, as deduced from the records at Bouckville covering the seven years 1898 to 1904, inclusive, is 149 days:

Dates of first and last killing frosts.

Year.	Rome.		Cooperstown.		Bouckville.	
	Last in spring.	First in fall.	Last in spring.	First in fall.	Last in spring.	First in fall.
1898.....	Apr. 26	Oct. 16	Apr. 27	Oct. 10	Apr. 3	Oct. 10
1899.....	May 16	Oct. 2	May 15	Sept. 16	May 15	Oct. 3
1900.....	May 11	Sept. 19	May 11	Oct. 17	May 11	Oct. 17
1901.....	Apr. 13	Oct. 7	Apr. 17	Sept. 20	Apr. 13	Sept. 20
1902.....	May 29	Oct. 10	May 16	Sept. 15	May 16	Sept. 6
1903.....	May 2	Oct. 22	May 1	Oct. 22	May 2	Sept. 30
1904.....	May 12	Sept. 23	Apr. 23	Sept. 22	May 12	Sept. 22
Average.....	May 7	Oct. 6	May 3	Sept. 30	May 2	Sept. 28

AGRICULTURE.

The beginning of agriculture in Madison County dates back to before the advent of the white settlers. When they first came the Indians were growing corn in an opening of the forest near Madison Lake and apples in several localities. Long before the white settlers came they had an orchard on Stockbridge Hill. The early settlers

were practically all home seekers and took up land, cleared it, and at once began to grow wheat and corn and garden vegetables. At first the wheat and corn had to be taken on horseback to some other settlement for grinding, and often the corn was cracked and ground by a pestle of wood working in a hollowed block of wood, after the Indian fashion. However, this state of affairs did not continue long, as gristmills were soon built where the water power of the streams could be utilized. Many of the settlers brought a cow or two and some a few sheep. Flax for making linen for home use was also grown from the first, but in later years the cultivation of flax was abandoned. Wheat and corn were the chief crops and continued to be so for many years, but since the opening of the great wheat country of the West wheat production in this section has declined. Corn has always held its place as one of the staple crops of the county and has probably increased in acreage since the larger development of the dairy industry, it being grown for ensilage as well as for grain. In the early days much of the corn was consumed by the local distilleries, now long since abandoned. The wool was carded and spun and sometimes woven in local mills and the linen was worked up at home by the housewife.

In 1816 the first commercial crop of hops was marketed in New York by James D. Cooledge. Eight years before this date Mr. Cooledge began their culture on a somewhat extensive scale by securing of his neighbors all the roots they could spare from their gardens. For several years, while his crop was small, it was consumed by the local breweries, but in 1816 he took his crop to New York. A few years later a neighbor of Mr. Cooledge grew a crop of 2 tons, which he took to New York and sold for \$1,000 a ton. Since that time hops have been one of the chief crops of the county. They have, of course, had their ups and downs, as have other crops. The maximum acreage was grown about ten years ago. Since that time there has been a marked though gradual decline in the acreage. This decline has not been on account of poor yields, although the yield is not so large as formerly, but rather on account of low prices and the consequent development of other branches of agriculture. The quality of Madison County hops has always been high. Barley was much grown in the early days, a variety known as Hess barley being originated in the township of Fenner. Fruit was also considerably grown from the first. The famous fall apple, the Strawberry, was originated in the southern part of the county at an early date.

In 1824 118,061 acres were classed as improved land, or about 25 per cent of the total area of the county. In 1875 this had increased to 301,916 acres, or 70 per cent, and in the next twenty-five years it increased to 90 per cent.

For a long time there was no market for dairy products and their production was limited to home use and a small local demand, but with the establishment of transportation facilities an outlet was furnished to market and the industry began to increase in its proportions. About the time of the civil war, and for many years after, large quantities of cheese were manufactured. Since about 1890 the manufacture of cheese and butter has declined, and at the same time the production of milk has increased largely, and about ten years ago the farmers began shipping milk to New York City. At that time the buyers would receive only limited quantities and at their own prices and the farmer had to seek the buyer. Now the conditions are the reverse, the buyer seeks the farmer and is willing to pay a fair price for all the milk he can get. Every station has a milk station and all the railroads run special milk trains. Practically all of the milk is shipped to New York, the nearby cities receiving but little of that produced in the county.

With this change in the market conditions of dairy produce the management of dairy herds has changed. Formerly nearly all of the milk was produced in the summer season, but with the shipping it must be produced every month of the year. The change in the management of the herds to bring this about necessitated a change in feeding, and now nearly every farm has one or more silos for the storage of ensilage for winter use. This results in large quantities of stable manure to be returned to the soil and consequent better yields, and many farmers report that their farms are constantly growing more productive under this system. A large proportion of the dairy herds are Holsteins and many of them are thoroughbreds.

The successful introduction of alfalfa growing in the county several years ago has added greatly to the value of the agricultural income in that part of the county in which it is grown. It makes possible the keeping of a larger number of stock and consequently an increased amount of stable manure to return to the soil.

At several of the towns there are canning factories for peas, beans, beets, corn, etc., and a large acreage is devoted to producing these crops. The yields are good and prices satisfactory. The greatest difficulty in growing these crops is in securing help to care for and harvest them.

The agriculture of the present can be summed up and classed as dairy farming and the production of canning crops and the special crops of hops, alfalfa, onions, and celery. The value of farm products not fed to live stock in 1900 was \$3,510,532. Deducting from this the expenditures for labor and fertilizers leaves a net surplus to the farmer of \$2,870,722 on an investment of \$15,681,022.

The principal money crops are hops, celery, onions, and dairy products. In 1900 grass led in extent of acreage and an average

yield of $1\frac{1}{2}$ tons per acre was harvested. Oats were second in acreage, there being 24,798 acres planted, with a yield of nearly 1,000,000 bushels, or about 40 bushels per acre. Corn was third, with 11,778 acres and a yield of 374,060 bushels, or slightly less than 32 bushels per acre. Wheat was credited with a yield of 21 bushels per acre and an acreage of 6,671 acres. Hops occupied an acreage of 4,932 acres and produced 3,284,100 pounds, or about 666 pounds per acre. Potatoes, buckwheat, and miscellaneous vegetables were each credited with between 4,000 and 5,000 acres. Alfalfa was given an acreage of 588 acres and a yield of 1,607 tons. The acreage of this legume is increasing each year. Onions were credited with a yield of 244,169 bushels from 620 acres. Orchard and forest products were produced to the value of about a quarter of a million dollars, and the grand total value of all products outside of those fed to the live stock amounted to \$3,510,532, or \$86.56 for each inhabitant of the county.

In a large measure many of the farmers have recognized the adaptation of the soils to crops. The celery and onions are grown only on the Muck, the only soil of the county adapted to them. Corn is grown most largely on the Miami stony loam and the Dunkirk gravelly loam, the two best soils for its production. Dairy and general farming are also most largely developed on soils adapted to those lines of farming, while hops are largely confined to the soils best adapted to them, and wheat is not grown to any extent, except on a soil which is as well adapted to its production as any in the county. Alfalfa is confined almost exclusively to the Miami stony loam, which is the best soil in the section for its production, many of the soils being so little adapted to it that a stand can not be secured.

Rotation of crops is not as universally practiced as it should be. One of the most prominent farmers rotates as follows: Wheat one year, corn one year, oats one year, meadow for a few years, and then pasture until broken again for wheat. Another farmer uses this rotation, but on an entirely different soil from that of the first: Corn one year, oats one year, wheat one year, and then meadow for several years. The celery and onion fields are generally alternated between the two crops as much as possible. The growing of alfalfa and hops, which are perennials and occupy the same fields for from ten to fifteen years, interferes with a regular rotation on lands used for these products.

Modern methods adapted to present conditions are in use on the better soils of the county, but there seems to be an utter lack of method or management on most of the farms of some of the poorer soils. In the valleys and on the more productive soils of the uplands nearly every farmer is supplied with modern, improved tools for the various kinds of work. These include plows, harrows, cultivators, mowers, side-delivery hay rakes, patent hay loaders, and other ma-

chinery needed on an up-to-date farm. The soil is usually plowed sufficiently deep and then well prepared for the seeding. Most fields are well cultivated, and at harvest time the farmer reaps his reward in increased yields. On the hill farms of the Volusia silt loam, however, the methods and management are lamentably poor. This accounts in a large measure for the poor, unproductive condition of many farms of that type of soil.

The conditions in the hill lands of Madison County can be improved materially and permanently only by the substitution, gradually of course, of some other type or types of farming than that which has prevailed in the past. Grass and grain, produced for sale as such, can no longer be grown profitably, except by a few farmers of more than average ability. The expenditures for fertilizers, necessary where no form of animal husbandry is combined with farming, reduce considerably the returns from these hill farms. The use of lime is not common and turning under of green manuring crops seldom practiced, and the land is given only a limited quantity of barnyard manure or commercial fertilizer. On the other hand, these hill farms offer an excellent opportunity for men of small means, but versed in methods of farming needed to restore these lands to their natural productiveness. The soil still produces good yields of buckwheat and moderate yields of oats and hay—about 1 ton to the acre—and many of the farms are improved with fair buildings and neglected orchards. A change from grass and grain farming, which is becoming unprofitable, to dairying and stock raising is imperative.

Madison County, like many other sections, is badly crippled for labor. The near-by cities and towns and the railroads absorb much of the available labor. There is a tendency among the laboring classes to think that it is degrading to work on a farm, and they seek employment in the city factories and shops at perhaps a smaller net return from their labor than could be secured in the country. Much of the labor secured is not to be depended upon and is also inefficient. Farm hands receive from \$20 up to \$40 or more a month, according to their efficiency and whether they receive board or board themselves. Hop pickers are now usually recruited from among the poorer classes of the near-by cities and are neither as easily secured nor as efficient as formerly. They receive about 30 cents a box and board for picking. Local pickers receive 60 cents a box and board themselves. The help used in the onion and celery fields is mostly Italian. Whole families are employed, and the adults can earn \$1.50 a day. Sometimes the Italians grow onions on shares. When this is done the owner of the land prepares the field, furnishes all fertilizer and seed, and the tenant cares for and harvests the crop for one-half.

The average size of the farms of the county is 93.8 acres, although many of them are much larger. Of the total number only about 60 per cent are operated by the owners. The remainder are run by tenants on shares.

Farm lands differ in value with their location. The highest priced land in the county is probably the well-drained areas of Muck cleared and under cultivation. The cheapest lands are located in the Volusia silt loam areas. Farms also vary in price with the condition of cultivation and the matter of improvements. The value of farm lands exclusive of buildings in 1900 was given as \$6,754,610, or an average of about \$17.50 per acre. If we add the valuation of the farm buildings the total value of the farms is \$12,117,170, or an average of a little more than \$30 an acre.

Looking to improvement in the agricultural conditions of the county, probably the most important question is the possibility of the hill lands of Volusia silt loam. Their present condition is far below their natural value and productivity, for similar soil, usually not more favorably located, in other sections is in a high state of cultivation. The soil, the location, and the surface condition are admirably adapted to stock raising, but it is not used to any extent for this purpose. The farms of this type should be stocked with a good grade of beef cattle and sheep. The fields should be plowed deep, a good sod secured, rotation of crops introduced, and more modern methods generally adopted. Another important matter is the drainage of that part of Muck now in a swampy condition, which would add thousands of acres of the most valuable land in the county to the cultivated area and increase the annual income from farm products proportionately. The gradual extension of the acreage of alfalfa on all soils to which it is adapted and a more liberal use of clover in rotations would also bring constantly increasing returns. The drainage of some of the level portions of the lowlands is also recommended as feasible from an economic standpoint.

There are plants for canning vegetables located at Oneida, Canastota, Cazenovia, Hamilton, and Lenox. These consume large quantities of sweet corn, peas, beans, beets, etc. There are also two extensive plants for the making of cider vinegar—one at Canastota and one at Bouckville.

SOILS.

The separation and classification of the soils of Madison County present an extremely interesting study. Their origin and formation vary in the different parts of the county as greatly as do their texture and structure. Some of them are the results of feeble glaciation, some of heavy glaciation, some of glacial wash, some of reworked and water-deposited material, some from accumulations of organic matter, and still others are the residual products of rocks weathered in place.

With reference to the derivation of the main part of the soils the county can be divided into three sections. The whole southern part is a broad belt of high plateau, badly eroded and then covered over by a thin deposit of glacial till, or, in other words, a region of feebly glaciated uplands. This deposit of till is comparatively shallow and made up largely of local materials derived from the shales and thin beds of limestone which underlie it. These rock formations are what have been known as the Hamilton shales, now subdivided into three groups, the Tully limestone—a thin stratum occurring on some of the higher hills—and the Ithaca shales and sandstones, which overlie the Tully. These all belong to the Devonian period. The soils derived from the weathering of the shallow till of this part of the county belong in the Volusia series, a series which includes all those soils of light color formed through feeble glaciation over sandstone and shales. They occur in a wide belt extending eastward from northeastern Ohio.

In the broad valleys of this section of the county there has been deep filling. In some places borings of several hundred feet in depth do not reach bed rock. The soils formed from this filling are alluvial or lacustrine deposits, contain large quantities of gravel and beds of sand, and occupy terraces. They are characterized by their gravel content, and belong to the glacial wash and water deposited, or the Dunkirk series of soils. They were very likely laid down during the Champlain epoch in glacial lakes.

The second section is a broad belt extending across the county from west to east just north of the feebly glaciated section. The boundary between the two is an irregular line and marks the southern limit of one of the later advances of the ice sheet. This section is characterized by a comparatively thick till, and the soils are very different from the Volusia soils, owing to differences in the character of the rocks from which the material is derived. Local rocks have contributed to these soils, as is evidenced by some of the stone fragments and by their coloration from the Salina red shales; however, much of the material is of foreign origin. Along the southern edge of this belt the underlying rocks are the Hamilton shales, but they are so deeply buried beneath the drift that they do not influence the soils at all. In the central section the bed rocks are largely Silurian limestones, and they contribute very largely to the stone content of the soils and also probably exert considerable influence over the soil solutions through the slow dissolving of the lime. Along the northern edge of the belt or along the foothills the underlying red and light-colored Salina shales outcrop in many places and contribute to the color of many of the soils and also modify the soils where the till is thin over them. The soils formed from this heavy mantle of till

and material washed out at the ice front belong to the Miami and Dunkirk series, which are of wide occurrence in the glaciated section of the country.

The third division, lying in the northern part of the county, is the lowlands, or the bed and shore of the old glacial Lake Iroquois. The soils are reworked and water-deposited glacial material and belong in the Dunkirk and Clyde series. The rocks underneath this region are the Niagara limestone and Salina shales of the Upper Silurian.

Most interesting of all, however, is the occurrence of distinctly residual soils in this many-times glaciated section of the country. The weathering in place of the Salina shales has formed two distinct types of soil seldom found in glaciated regions. One of these types, the Upshur clay, is derived directly from the weathering of the red shales, and the other, the Allis clay, is derived in the same manner from the light-colored shales of the same formation. The occurrence of these soils is accounted for by the ice having scoured the rock itself and yet left no deposit of till. The Allis shale loam is another residual soil. These soils, though uncommon in this section, are found extensively developed in the unglaciated portions of the Appalachian Mountains and Allegheny Plateaus.

As in all regions, there is alluvial wash along the streams, which varies both in texture and color. A resulting soil type, the Huntington loam, is a recent formation found here and also in many sections of the country.

Muck is another type of importance in this area. This soil is most commonly found in glaciated sections, but is also found in other sections.

Erosion has formed some and modified many of the soils of Madison County. All of the lowland soils have resulted either directly or indirectly from this agency. Some of the soils are badly cut by erosion, and their present agricultural value is affected thereby.

Below is given a table which shows the relative and actual extent of each soil type occurring in the county:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Volusia silt loam	137, 920	33.3	Miami fine sandy loam	6, 848	1.6
Miami stony loam	98, 048	23.6	Clyde fine sandy loam	4, 736	1.1
Volusia loam	49, 216	11.8	Upshur clay.	4, 096	1.0
Dunkirk gravelly loam	23, 296	5.6	Allis shale loam	2, 368	.6
Huntington loam	19, 392	4.7	Allis clay	2, 304	.6
Muck	18, 944	4.6	Dunkirk silt loam	2, 048	.5
Dunkirk clay	16, 576	4.0	Miami fine sand	832	.2
Dunkirk fine sandy loam	13, 632	3.3	Clyde fine sand	320	.1
Dunkirk fine sand	7, 424	1.7	Total	415, 168	
Dunkirk clay loam	7, 168	1.7			

MIAMI STONY LOAM.

The surface soil of the Miami stony loam is a brown loam, varying in depth from 7 to 12 inches, with an average depth of about 10 inches. The soil quickly grades into a subsoil of brown or reddish clay loam or clay. While this is the description of a typical section, there are areas where the soil is more nearly a fine sandy loam and the subsoil is lighter in texture and browner in color. The till from which this soil is formed is usually of considerable thickness, but there are many places where the bed rock comes close to the surface in that portion overlying the shales. Also, in the region where the local limestone outcrops there are areas of shallow soil. These areas have been indicated on the map by symbols as rough stony areas. Along the foothills the red and olive colored shales also lie near the surface and modify both soil and subsoil to some extent. There are other areas where beds of consolidated glacial gravels form the deep subsoil.

There is always present in both soil and subsoil a large percentage of rock fragments varying in size from small gravel to those weighing several tons. The larger ones are, however, not very numerous, except near the horizon of the limestone outcrop. These rocks are quite largely of limestone from local sources, although many are from rocks occurring only to the north of the survey and are rounded in outline. In many places they have been removed from the fields and made into fences. The heavier phase of the type is quite similar to the Dunkirk clay loam, except for the occurrence of the stones in it.

The Miami stony loam occurs in a wide belt crossing the county from east to west and extending from the base of the foothills southward an average distance of 10 to 12 miles. The larger part of it lies in the townships of Cazenovia, Fenner, Smithfield, Stockbridge, Lincoln, the northern part of Madison, and southern parts of Sullivan, Lenox, and Oneida. It occupies high, rolling hills and gentle slopes, varying in elevation from a little over 400 feet to nearly 1,900 feet. This variation in elevation insures good natural drainage for practically all of the type. There are many streams fed by springs and all have steep courses and rapid currents. Tile drainage would be of advantage only on some of the more gently sloping areas. The heavy subsoil acts as a storage reservoir for soil moisture, making this type less susceptible to droughts than is usual for soils occupying similar topography and having like drainage conditions.

The Miami stony loam is derived from the weathering in place of a comparatively heavy mantle of glacial material, deposited as a terminal moraine by one of the later advances of the ice sheet at

about the close of the Glacial epoch in this section. It is not likely that the hard local limestones have contributed any considerable amount of material to the formation of the till, but that the soft red shales outcropping along the foothills have contributed to it is evident from its reddish color. However, it is quite probable that the limestone now contributes to the soil or soil solutions, which will be discussed later. The whole section of typical areas consists of a true till, with no evidence of reworking or stratification by aqueous agencies. The soil is weathered quite deep and is friable and mellow, while the subsoil shows no weathering in newly made cuts.

The Miami stony loam is the best general farming soil of the county, and is generally utilized for that purpose, although not to its fullest extent. The crops grown are corn, alfalfa, and other grasses, oats, potatoes, wheat, cabbage, sweet corn and peas for canning, apples, and other fruits, etc. It is well adapted to all of these crops, as well as to dairy farming, for which it is also much used. It excels all other soils of the area for fruits, especially apples, and the extension of the orchards on the gentle, well-drained slopes is recommended. The rough, stony areas are suitable only for grazing and to furnish fuel and timber.

Alfalfa is a most successful crop. Many large fields are seen, and nearly all of them look thrifty. A few years ago the largest fields in the State owned by a single individual were located on this soil type near Chittenango. One reason for the successful use of this soil to the exclusion of all others is the presence of the limestone rocks. The slow solution of these keeps the soil alkaline and sweet, the ideal condition for alfalfa culture. Many fields are growing where the soil is exceedingly thin, bed rock of limestone being almost at the surface. Three cuttings are generally secured, and yields vary from three-fourths of a ton to $1\frac{1}{2}$ tons per acre for each cutting, with an average of 3 tons per acre for the season. The fields remain in sod for about ten years. Wheat is more generally grown on the Miami stony loam than on any other soil, and yields about 20 bushels per acre. Oats will average about 40 to 60 bushels, and potatoes about 100 bushels. Corn is grown largely for ensilage in connection with the dairy farming, and yields from 10 to 15 tons of ensilage and about 75 bushels of ears. Timothy and clover hay makes from $1\frac{1}{2}$ to $2\frac{1}{4}$ tons per acre. The yield of cabbage is about 15 tons. The fruit grown is of excellent color and quality.

The adaptation of the type as a whole has been generally recognized and practiced by the farmers owning it, and the agricultural conditions prevalent are the best in the county. Farm buildings are commodious and in good repair, and the fields do not show the lack

of care or decline in productivity^a common in some sections of the area. One farmer reports that instead of being less productive than formerly, his farm is growing better crops each year, without the use of any commercial fertilizer to speak of. He attributes this to the keeping of large numbers of stock and to growing alfalfa. In price the Miami stony loam varies greatly with the location, with reference to shipping points and their accessibility. Some choice farms are offered for from \$30 to \$40 an acre, but those nearer shipping points with good improvements are held at a much higher figure.

Below is a table which shows the average results of mechanical analyses of the fine earth of both soil and subsoil of the Miami stony loam:

Mechanical analyses of Miami stony loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>				
15746, 15752.....	Soil	1.4	3.7	3.4	13.8	11.0	48.5	17.5
15747, 15753.....	Subsoil.....	1.8	4.7	3.5	13.2	9.9	43.5	22.4

The following samples contain more than one-half of 1 per cent of calcium carbonate (CaCO₃): No. 15746, 4.54 per cent; No. 15747, 8.44 per cent; No. 15753, 10.71 per cent.

MIAMI FINE SANDY LOAM.

The surface soil of the Miami fine sandy loam is a light-brown fine to very fine sandy loam to a depth of about 12 inches. The subsoil of a typical section is a light-brown to yellow fine sandy loam, slightly heavier than the soil. There is some variation in the character of the subsoil, and in local places it may be either a yellow fine sand or brown clay loam.

Areas of the Miami fine sandy loam occur only in the upland, partially filled valleys, and along the northern margin of the uplands. The topography of the type is rolling and broken, although there is no great variation in altitude. The tops of the low elevations are

^a Results of a test by the wire-basket method to determine the manurial requirements of this type indicate that the mineral fertilizers will not give enough increase to warrant a recommendation for their use. The adoption of a systematic rotation of crops, arranged to include a green-manure crop, preferably a legume, with proper methods of tillage and the application of such stable manure as may be had on the farm, seems the most direct and simple plan of keeping this type at its present high state of productiveness.

While strictly applicable to the field from which the sample was taken, the results of this test will probably hold good for this type of soil throughout the county.

always well drained, but some of the depressions are wet and often colored dark by accumulated organic matter.

The origin of the Miami fine sandy loam is due to the weathering of kame and kettle and glacial outwash material or to morainal deposits. Its derivation and method of deposition accounts for its varied topography and texture.

This soil is used for general and dairy farming, with some hops and fruit. It should be carefully managed to conserve moisture and to increase the humus content.^a Yields of the general farm crops grown are not large, and the conditions are susceptible of considerable improvement.

The following table gives the mechanical analysis of a typical sample of both soil and subsoil:

Mechanical analyses of Miami fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>				
14966.....	Soil	0.6	3.5	4.2	25.0	28.2	19.0	20.0
14967.....	Subsoil.....	.2	3.5	4.6	26.8	21.7	25.4	17.4

MIAMI FINE SAND.

The Miami fine sand consists of a brown fine to very fine sand to a depth of about 8 inches, underlain by a loose, incoherent, fine to very fine sand of yellow color.

This type is represented in Madison County by only one important area, which occurs in Oneida Township west of Kenwood. Its topography is rough and hilly, reaching a height of nearly 700 feet. It occupies a kame and kettle region and is decidedly uneven, and was likely formed either at or under the ice front at the close of the forward movement of the glacial ice sheet. The interior of these kames is shown by cuts to be a mass of sand, gravel, and stones, sometimes assorted, cross-bedded, and stratified, and sometimes a heterogeneous mass.

The Miami fine sand is light, open, and warm, making it an early soil and suitable for the production of garden truck crops. The

^a The greatest increase in plant growth in wire-basket tests of this soil was obtained by the use of stable manure and cowpea vines with lime. The application of fertilizers had but little effect. This emphasizes the value of systematic rotation, including crops to be plowed under.

surface soil is greatly in need of organic matter, which would aid in retaining moisture and have a binding effect on the soil grains.^a

Below are given the results of mechanical analyses of typical samples of the soil and subsoil:

Mechanical analyses of Miami fine sand.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.
15738.....	Soil	0.1	0.6	1.2	37.4	41.7	14.3	4.0
15739.....	Subsoil.....	.1	.2	1.2	40.6	39.9	13.5	4.1

DUNKIRK GRAVELLY LOAM.

The soil of the Dunkirk gravelly loam is usually a heavy loam or silty loam varying in depth from 6 to 15 inches, the average depth being about 10 inches. It is uniformly brown in color and the interstitial material varies but little in texture, though those areas representing old beach formations are generally more sandy and lighter than those occupying the terrace formations. Scattered on the surface and intermingled with the soil is a high percentage of rounded, waterworn gravel of various sizes. The stones of this gravel are usually not more than a few inches in diameter and are mostly foreign to the underlying strata of the section. The quantity present varies, but gravel is never entirely absent. The subsoil is a lighter brown in color and varies considerably in texture. It is generally about the same texture as the soil to a depth of 36 inches, but is sometimes heavier as well as lighter, depending upon the proximity to the surface of the underlying beds of gravel and sand, which usually are found beneath it. The subsoil also contains large quantities of gravel, the percentage usually increasing with the depth. The larger part of the type, all that portion occurring as a terrace formation, is usually underlain by beds of gravel and sand. This material is usually crossbedded and interstratified, but it often occurs in an unsorted heterogeneous condition. The stones seldom interfere with

^a For the purpose of determining the manurial requirements of this soil type a study was made of a large sample by the wire-basket method. The largest increase in plant growth, over that obtained in the untreated soil, followed the use of stable manure, and the next greatest the use of cowpea vines with lime, showing the necessity of maintaining the supply of organic matter in soils of this character. The increases from chemical fertilizers used singly and in various combinations were very variable, the greatest being obtained by the use of a complete fertilizer to which lime was added. While held only to apply to the field from which the sample was taken, these results coincide with the experience of cultivators of light sandy soils generally, and will doubtless hold good for all soils of this type in this area.

cultivation and, except for the larger ones, are rarely removed. They exert a great influence over the soil atmosphere and moisture. The radiation of heat from them warms the soil and induces a more rapid growth and earlier maturity of crops. They also aid in the free movement of the soil moisture.

A phase of this soil in which the gravel content is of smaller sized rock fragments occurs in the upland section north of Deruyter reservoir and in the vicinity of Constine Bridge and the Erieville reservoir. This phase is derived from the outwash of morainic material from the front of the ice sheet of one of the later advances of the glacial ice. It sometimes occurs in the form of an esker, which was formed by water currents underneath the mantle of ice. One of these, several miles in length, extends from near Constine Bridge nearly to the Erieville reservoir. This esker has been modified by post-glacial erosion so that it is not now continuous for the whole distance.

The Dunkirk gravelly loam is found most extensively and most typically developed in the valleys of the Chenango River and its tributaries in the townships of Madison, Hamilton, Eaton, and Lebanon. It also occurs in other parts of the upland section and on the lake plain lowlands, but to a much smaller extent. It represents old beach lines in the northern or lake bed section of the county, wash material along some of the streams, small delta or alluvial fan formations, and terraces in the broad valleys.

The topography varies somewhat with the mode of formation, but typical areas occupy the flat tops of terraces and are found at the same level on both sides of the valley. There is sometimes an escarpment of several feet to the level of another terrace, and again the general level may be broken by shallow depressions or slight elevations.

The drainage of the type is excellent. The open character of the deep subsoil readily permits the withdrawal of any excess of water at the surface, while the close texture and structure of the interstitial material of the soil holds enough moisture for the growing crops, except during prolonged dry weather.

The Dunkirk gravelly loam is the result of deposition by swiftly moving currents emptying into narrow lakes. This probably took place immediately following the recession of the masses of glacial ice, the large volume of water coming from the melting of the ice. The present valleys were then deep gorges. They must have been obstructed at some point, perhaps by the ice, and thus long, narrow lakes were formed. The melting of the ice front gave rise to torrential streams, which in their rapid course downward carried immense quantities of the unconsolidated morainic material and deposited it in the valley lakes, where their currents became slower. The currents later not being so voluminous or rapid carried a pro-

portionately greater percentage of the finer sediments and less of the coarser, or gravel, thus making the surface deposit of a heavier and more loamy character. At a still later time the drainage of these valleys became established, the then shallow lakes ceased to be, and the present streams began cutting their channels through the mass of water-deposited materials, leaving it in its present form of terraces. The narrow strips of this soil mapped in the northern part of the county are old beach lines formed in a temporary glacial lake. Besides these, as before mentioned, there are also areas of Dunkirk gravelly loam formed by swiftly moving waters and deposited as wash material or left as deltas or as alluvial fans by the currents reaching gentler slopes which decreased their velocity to such a point that they could no longer carry their burden.

The Dunkirk gravelly loam is better adapted to the production of corn and hops than any of the other soils of the county. Hops were first grown on this soil, and on it are found all of the finest and largest hop yards of the county. It is also an excellent soil for oats, grasses, small fruits, and heavy truck crops. It is most used at present for hops and, in connection with the hill land of Volusia loam or Volusia silt loam, for general farming and dairying. Corn is the one crop which exceeds all others except hops. It is grown for both ensilage and the grain, and will yield from 10 to 15 tons of the former, with an average of about 15 tons, and an average of about 100 bushels of the latter in the ear to the acre. Timothy and clover will yield about 2 tons of hay year after year if the sod is in good condition. Oats yield from 30 to 75 bushels, with an average of from 40 to 50 bushels. Wheat will average from 20 to 25 bushels, but is not grown to any extent. Potatoes are grown for home use and yield from 100 to 200 bushels. Some fields of alfalfa located on the Dunkirk gravelly loam do not seem to be thriving as well as those on the Miami stony loam. The reason for this may be acidity or it may be some function of the water table. Hops are more generally grown on this type than on any other. Yards in good condition will yield from 700 to 1,500 pounds dry weight per acre, with an average of about 1,000 pounds. To secure the best yields fertilizer of some kind is always used. The largest proportion of this is, however, stable manure, though some commercial brands are used.^a

^a Studies made by the wire-basket method to determine the manurial requirements of this soil confirmed the experience of the farmers of this region that it is naturally one of the most productive soils of the area. But little increase over the untreated soil followed the use of fertilizers in any of the forms used, stable manure producing heavier plants than any other treatment.

While these results are held to apply strictly only to the field from which the sample was taken, they are doubtless applicable to much of this type in this area, and especially in those fields where the same admirable methods of cultivation have been followed.

The Dunkirk gravelly loam is from ten days to two weeks earlier than the adjoining hill land and is more generally cultivated, the farmer using his hill land for pasturage.

The farm buildings located on this type of soil are of the best to be found in the county and are usually well painted and cared for. The farms are kept in good condition and are well cultivated. The type is held in high esteem, and practically none of it is on the market. When sold farms containing this soil always bring high prices. A conservative estimate would not be far from \$75 to \$100 an acre where the improvements are good.

Below is given a table showing the average result of mechanical analyses of the fine earth of typical samples of both soil and subsoil of the Dunkirk gravelly loam:

Mechanical analyses of Dunkirk gravelly loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>				
14723, 15732.....	Soil	3.8	10.6	4.3	5.5	7.0	46.9	21.2
14724, 15733.....	Subsoil.....	3.3	10.5	4.3	4.7	6.7	45.1	24.7

DUNKIRK FINE SAND.

The soil of the Dunkirk fine sand is a fine brown or yellow sand varying in depth from a few inches to 1 foot, with an average of about 9 inches. It is uniform in texture and usually contains very few stones or gravel. It is the lightest and loosest soil of the county. The subsoil consists of an orange, gray or yellow fine sand. It nearly always has a loose, incoherent structure and seldom contains much medium or coarse sand. Very often in depressions the surface soil is dark colored with organic matter and quite loamy, while the subsoil may contain brown and red iron crusts.

This type occurs in the lake plain lowlands, the largest body being several square miles in extent and lying just north of the Chittenango Creek, where it first becomes the boundary between Madison and Onondago counties and bends to the west. Other areas are scattered about the lowlands.

The topographic features of the Dunkirk fine sand vary from nearly level to billowy. The areas of this type have an elevation of from 400 to 420 feet. In the large area north of the western bend of Chittenango Creek there is a distinct dune topography, the sand being piled up in little hillocks of various sizes and shapes. A few of the highest of these are shown by contour, they being nearly 20 feet in height above the surrounding sands, but the larger number

of them do not attain a sufficient elevation above the general level to be represented on the map by contour lines, although they give rise to an uneven or billowy topography. The western end of this area is nearly level. Drainage features of the type are good, except for some of the small depressions. The open character of both the texture and structure of the soil and subsoil gives ample movement to all water received. The dunes are seldom sufficiently watered on account of their elevation and loose character.

The Dunkirk fine sand is the result of the reworking and distributing of water-deposited glacial sands. It sometimes occurs as an ancient beach and again as lake sediments redistributed by wind action.

Many of the areas of this type in pasture have a natural growth of brakes and ferns and support very little feed. The most of the type was originally covered with a forest growth of chestnut and white pine.

The light porous character of the Dunkirk fine sand makes it an early, warm soil especially adapted to early truck crops. However, it is but little used for this purpose. It is undoubtedly the earliest soil of this whole section and such crops as lettuce, radishes, peas, etc., could be grown and placed on the market in the late spring and early summer while prices are high. A similar soil in Onondaga County is the best tobacco soil of the section. This type is also adapted to the production of early potatoes, strawberries, raspberries, blackberries, etc. The vine crops, as canteloupe, muskmelon, and cucumbers should also do well. It should also be an excellent soil for peaches. Corn makes a good growth on the more level portion, and in wet seasons fair yields are secured. Potatoes do well if fertilized, and yield from 100 to 200 bushels per acre. At present the type is devoted to general farming, for which purpose it is not well adapted. Better results could be secured if it was used for special crops which must be heavily fertilized and forced to an early maturity. The character of this type of soil is particularly suitable for such a method of farming.

The following table gives the result of mechanical analyses of a fine-earth sample of both soil and subsoil of the type:

Mechanical analyses of Dunkirk fine sand.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>				
14962.....	Soil	0.3	0.4	2.4	66.0	13.3	8.5	9.1
14963.....	Subsoil.....	.0	.2	2.6	74.7	8.2	4.4	11.1

DUNKIRK FINE SANDY LOAM.

The surface soil of the Dunkirk fine sandy loam varies from a light loam to a fine sandy loam. It has a depth of about 10 inches, and is generally light brown in color, though often yellowish and in wet depressions dark gray or black. The subsoil is a compact sandy loam, perhaps a little coarser than the soil, having a brown, gray or yellow color. Both soil and subsoil of typical areas contain a considerable quantity of small gravel and glacial stones. This type occurs on the lake forelands in the northern part of the county.

The topography of the Dunkirk fine sandy loam is nearly level where most typically developed. The natural drainage is generally good. There are a few small streams traversing the areas, and the texture and structure are such that the surface water when in excess is easily removed. On the other hand, the subsoil makes an excellent reservoir for soil moisture.

The origin of the Dunkirk fine sandy loam is attributed to the weathering of reworked glacial material.

The Dunkirk fine sandy loam is used largely for general and dairy farming. The crop yields are usually satisfactory. Hay averages about $1\frac{1}{2}$ tons per acre, wheat from 15 to 20 bushels, oats from 40 to 50 bushels, and buckwheat about 25 bushels. Corn will yield from 40 to 70 bushels in the ear and give a number of tons of forage or ensilage. Potatoes are said to yield poorly, but this soil should produce good yields with careful management. It is also well adapted to the small fruits. Peaches, pears, plums, apples, etc., should all do well, but, excepting apples, are not much grown. The soil is very similar to the best fruit soil of the Ontario fruit belt in Niagara, Orleans, Monroe, and Wayne counties, and occupies a similar position with relation to climatic influences from near-by bodies of water.

The agricultural methods are as a rule progressive. Stable manure is utilized, and in many fields of corn soy beans are planted, thus enriching the soil in nitrogen. Their use is to be commended.^a The condition of farms and farm buildings is usually good and in general agricultural practices are of the best. The value of farms of this type of soil varies with the improvements, but some sales of badly run-down land without buildings have been made at about \$12 an acre.

^a In wire-basket tests, applications of various fertilizers, used singly and in combination, all gave increased plant growth over that obtained with the untreated soil, nitrate of soda with sulphate of potash being somewhat better in this respect than the complete fertilizer. The response to stable manure and to cowpea vines was marked, the former being equal and the latter superior to the complete fertilizer. These results, while held to be strictly applicable to the field from which the sample was obtained, appear to indicate the needs of this type in this region.

The greater part of the type, however, is held at from \$25 to \$35 an acre, the assessed value being from \$20 to \$25.

Below are given the average results of mechanical analyses of fine earth samples of this soil type:

Mechanical analyses of Dunkirk fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Me- dium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>
14964, 15736.....	Soil	0.8	4.6	5.5	21.1	20.5	29.9	17.8
14965, 15737.....	Subsoil.....	1.1	5.1	5.1	23.7	24.2	22.7	17.9

The following sample contains more than one-half of 1 per cent of calcium carbonate (CaCO₃): No. 15737, 13.26 per cent.

DUNKIRK SILT LOAM.

The soil of the Dunkirk silt loam has an average depth of about 10 inches. It is a mellow silt loam of light-brown to yellowish-brown color. It is friable and easily tilled. The subsoil is similar to the soil in texture, but lighter in color and more compact, the color being usually a pale brown or light yellowish brown, though it is sometimes mottled with brown, yellow, and gray. Sometimes the soil covering is more shallow and lighter in color.

This type of soil is found only in the northwestern corner of the county, in the vicinity of Bridgeport. The elevation is slightly less than 400 feet above sea level and about 10 or 15 feet above the level of Oneida Lake. The topography is slightly undulating and drainage is generally good. The type is not as susceptible to drought as the more sandy soils, as its texture and structure make it an excellent reservoir for the storage of soil moisture.

The formation of this soil is the result of the deposition of fine sediments in quiet water. It is used for the production of general farm crops, and fair yields are obtained. Hay yields from 1 to 1½ tons, corn about 40 to 50 bushels, and oats from 30 to 50 bushels per acre. The type is adapted to the general farm crops and to late heavy truck crops.

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

Mechanical analyses of Dunkirk silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Me- dium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>
15740.....	Soil	0.1	1.0	0.3	0.8	2.1	83.3	12.2
15741.....	Subsoil.....	.1	.8	.3	.6	6.1	81.1	10.4

DUNKIRK CLAY LOAM.

The surface soil of the Dunkirk clay loam consists of a heavy dark-brown or reddish-brown clay loam, with a depth of about 8 inches. It is sometimes quite silty, but usually heavy and clods if worked when either too dry or too wet. Occasionally small pockets of fine sand occur. The subsoil of a typical section is a stiff, plastic clay of a bright reddish-brown color, extending to depths greater than 3 feet. Glacial gravel and stones occur sparingly in a few places, but as a rule both soil and subsoil are entirely free from rock fragments.

Areas of this type of soil are found in the vicinity of Pratts Hollow, on the watershed between Oneida Creek and the Chenango Valley, along the Oneida Creek Valley, principally at Munnsville and Bennetts Corners, along the valley of Chittenango Creek, and in two other small areas, one at Merrillsville and the other on the western boundary near Union.

The topography varies from rolling to hilly. The area at Pratts Hollow is very rough, occupying a kame and kettle formation, which accounts for some variation in the texture of the soil. The type as a whole is very much eroded, excepting some of that area around Bennetts Corners. Drainage is generally good, though depressions due to the rough topography are sometimes wet.

The Dunkirk clay loam was formed in part from morainic material washed out at the front of the ice sheet during Glacial times, and in part consists of terraces of extremely fine sediments laid down in temporary finger lakes and subsequently eroded. The reddish color, which is one of the chief characteristics of the type, is due to the incorporation of material from the red Salina shales which outcrop at the base of the uplands to the north.

The rough, broken topographic features of the type as a rule prevent its extensive cultivation. Its heavy character makes the gentler rolling areas adapted to grass and grain crops and to dairy farming. Grass yields from 1 to 2 tons of hay, and wheat from 15 to 20 bushels per acre. Some alfalfa is grown, but it is difficult to secure an even stand. Hops are grown to a limited extent, but it is not considered a desirable soil for this crop. Its best use is for the production of grain and for dairying.^a

^a Samples of the Dunkirk clay loam were submitted to laboratory tests by the wire-basket method to determine the manurial requirements of this soil. The increase derived by the addition of sulphate of potash exceeded those obtained from any other of the mineral fertilizers applied singly and its effect was also strongly marked in all combinations. The results from the use of stable manure and cowpea vines were also marked. The most rational treatment, at least in the field from which the samples were taken, would seem to be the growing of legumes or other crops in the rotation for green manuring and the application of some of the forms of potash salts.

The general conditions are fair, but not so good as on other types whose topographic features are more favorable for cultivation. For the same reason it is lower in price and not much sought after.

The following table gives the average results of mechanical analyses of typical samples of both soil and subsoil of the Dunkirk clay loam:

Mechanical analyses of Dunkirk clay loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>				
14862, 15754	Soil	0.1	1.1	0.9	4.7	15.4	48.9	28.8
14863, 15755	Subsoil	Tr.	.6	.5	2.5	5.0	42.1	48.4

DUNKIRK CLAY.

The Dunkirk clay is a drab silty clay loam or clay with a depth varying from 4 to 10 inches, the average being about 7 inches. It is comparatively free from stones and gravel, but clods badly if worked at the wrong time. The subsoil is a mottled brown, gray, and yellow clay, very dense and compact. Poorly drained areas and most of the small areas mapped in the uplands are apt to have a dark-colored surface soil and a bluish clay subsoil. In some of these poorly drained areas the surface soil often consists of a few inches of Muck. The texture and structure of both soil and subsoil make the type refractory and difficult to till, but if plowed and cultivated when the moisture conditions are favorable a good tilth is secured. Sometimes the soil covering is very thin and shallow and plowing turns up the hard, refractory, mottled clay subsoil.

The Dunkirk clay is typically developed in Sullivan Township, in an extensive area lying on the lake foreland between the lake and a large area of Muck. There are also other typical areas of smaller extent in the lowland division of the county and many isolated areas of various sizes and shapes in the uplands and valleys. These small areas of the uplands are not as typical as the lowland areas, the surface soil being darker in color.

The areas of this type of soil have a level to slightly undulating topography, and there is never any great difference in elevation in any individual area. Its low-lying position with reference to the other soils and its level surface features, together with its heavy texture and dense close structure, tend to make the drainage inadequate. Consequently it is naturally a cold, wet soil and badly in need of tiling.

The Dunkirk clay is the result of deposition of fine glacial materials in quiet lacustrine waters. These sediments have been but little altered by natural processes of weathering since deposition, as is shown by the thinness of the soil in many places. Cultivated areas

usually show a deeper soil, for here the surface has been loosened, allowing atmospheric agencies to act more freely.

The Dunkirk clay is an ideal grass and grain soil when brought into the proper condition for tillage. It is also well adapted to general and dairy farming, for which purpose it is largely used. The yields of hay vary from 1 to 3 tons, with an average of 2 tons per acre on the best managed farms. Both red and alsike clover are grown, the latter doing especially well in the low, wet places where the red does not thrive at all. Corn is grown either for ensilage or grain, yielding close to 100 bushels of the latter and from 12 to 18 tons of the former per acre. Oats are another important crop and yield from 30 to 60 bushels, with an average of about 40 bushels per acre. The soil is too heavy for potatoes, and none are grown except for home use. The present use of the Dunkirk clay is that of general and dairy farming, and many of the large yields reported can be attributed to that fact, as large amounts of forage crops are fed and much stable manure is returned to the soil each year.^a It is a difficult soil to handle on account of its heavy texture and dense structure, and crop yields depend as much on management as on the soil itself. The general condition of farms located on this soil type is good. Nearly every farm has good buildings and the fields are well cared for and intelligently farmed. The assessed valuation of the Dunkirk clay is from \$30 to \$35 an acre, or about 85 per cent of its estimated value. One of the best farmers operating on it gave it a valuation of from \$40 to \$50 an acre, according to location and improvements.

The table given below shows the average results of mechanical analyses of samples of both soil and subsoil of this type:

Mechanical analyses of Dunkirk clay.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>				
14960, 15742.....	Soil	0.4	2.8	1.1	7.5	4.6	42.0	41.4
14961, 15743.....	Subsoil.....	.2	.7	.6	2.8	3.2	45.7	46.1

The following samples contain more than one-half of 1 per cent of calcium carbonate (CaCO_3): No. 14961, 2.54 per cent; No. 15743, 5.18 per cent.

VOLUSIA LOAM.

The surface soil of the Volusia loam is a brown to yellowish-brown silty loam or loam, with a depth of about 10 inches. The subsoil is a

^aThis soil, in a test by the wire-basket method, proved responsive to the various fertilizers applied, the greatest increase from any single element being derived from nitrate of soda. Lime used singly was highly beneficial and was an improvement to the complete fertilizer when added to it. The growth of leguminous crops and the use of lime would seem to be advisable.

light-brown to gray glacial till. It is sometimes more sandy than the soil, but generally consists of a heavy loam. Both soil and sub-soil contain a high percentage of gravel and stones. These consist of flat pieces of shale from the underlying rocks, as well as a large quantity of rounded glacial rocks varying in size from gravel to boulders of considerable size. There are also, in many places toward the northern limit of the type, blocks of limestone from local outcrops to the north, and in some sections, notably south of Madison, there are huge blocks of sandstone which come from a ledge of Oriskany sandstone, also outcropping to the north of the type.

The Volusia loam occurs most extensively developed in the townships of Nelson, Eaton, Madison, Georgetown, Lebanon, and Hamilton, with scattered areas in other sections of the southern part of the county. The topography is rolling to hilly, the type occurring most generally on the lower slopes of the hillsides. It is usually well drained, owing to its inclined topographic position.

The Volusia loam is derived from the weathering of glacial till in place. This till is the result of a degree of glaciation not so heavy as that which formed the Miami stony loam and somewhat heavier than that which formed the Volusia silt loam. It was very likely deposited by an early advance of the ice sheet, and is composed of both local and foreign material, as is evidenced by the presence of both local shale rock and rounded stones from rocks found only to the north.

The Volusia loam is one of the best soils of the area for general farming. Its rolling, well-drained character makes it well adapted to the production of hay, corn, oats, buckwheat, etc. While the soil is not quite so early or productive as the valley soils, satisfactory crops are usually grown. Grass will make an average yield of $1\frac{1}{2}$ tons of hay per acre, oats about 30 to 40 bushels, and corn 50 to 60 bushels of ears or from 8 to 15 tons of ensilage per acre. Hops were formerly much grown on this type of soil, but in recent years the uncertain prices received for that crop have reduced the acreage materially, though it probably now holds second place. The yield from a good yard is about the same as for the Dunkirk gravelly loam or perhaps slightly less. The decline in the production of hops on this type of soil is not attributed to any decrease in the productivity of the soil, for good yields are still secured where the vines are well cared for. With the decline in the acreage of hops, dairy farming increased, which is the chief use of the type at present. Not much commercial fertilizer is used, but the stable manure from the dairy is all utilized.

The value of the Volusia loam, while not high, is considerably higher than its companion type, the Volusia silt loam. It is held at

prices ranging from \$20 to \$60 an acre, depending upon the buildings and other improvements. The farms located on this type are usually well cultivated and exhibit a degree of prosperity not seen on the Volusia silt loam. The farm buildings are generally in good repair and fine herds of Holstein and other cattle are seen on nearly every farm. Most all the farms are also provided with silos for storing the corn fodder in the form of ensilage, as much milk is produced during the winter season when prices are higher. One reason for the general satisfactory condition of farming on this type is its utilization for the purpose to which it is so well adapted—namely, dairy farming.

The table given below shows the average results of mechanical analyses of samples of fine earth of both soil and subsoil of the Volusia loam:

Mechanical analyses of Volusia loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>				
15760, 15762	Soil	1.9	4.8	3.0	9.4	8.6	55.3	16.9
15761, 15763	Subsoil	2.3	5.8	3.5	11.6	9.1	43.6	23.8

The following sample contains more than one-half of 1 per cent of calcium carbonate (CaCO_3) No. 15763, 5.23 per cent.

VOLUSIA SILT LOAM.

The soil of the Volusia silt loam to an average depth of 9 inches is a yellow or light-brown silt loam, usually mellow and easily tilled. The subsoil is a yellow or frequently a gray compact silt loam or silty clay, the gray color being found more often in the lower depths. Both soil and subsoil contain a varying, but usually high, percentage of flat shale fragments of various sizes. There is also present in many places a small quantity of rounded glacial stones. Sometimes the content of shale gravel is so large that it seriously interferes with cultivation and in other places the bed-rock shale is near the surface. The surface soil often nearly approaches a loam in texture, there being in some areas a higher content of fine and very fine sand. Local areas on steep slopes, where the shale rock outcrops or comes near the surface, are shown by symbol as rough stony areas.

The Volusia silt loam occurs in a broad belt extending across the southern part of the county. The northern edge is very irregular, being indented by other soils. Areas of this type occurring in this broad belt are completely separated by the alluvial soils of the broad valleys and they are also modified by the occurrence of the Volusia

loam. The silt loam reaches its greatest and most typical development in the townships of Brookfield, Georgetown, and Deruyter.

The topographic features of the Volusia silt loam are very marked. The elevation varies from about 1,200 feet to over 2,000 feet in its highest place. The surface is hilly, the hills in general being broad and rather flat topped with steep slopes. This uneven topography gives good natural surface drainage. However, in spite of its rolling position and the many rapid streams that traverse it there is a large part of the type which is wet and in need of tile underdrainage. It can never be worked as early in the springtime as the valley soils, largely on this account, and in wet seasons crops are sometimes seriously injured by excess of moisture. Many springs come up through the joint planes of the underlying shale, and these, with seepage from higher levels, make much of the type cold and wet. Its texture and structure are also such as to make the type very retentive of moisture.

The Volusia silt loam is the result of feeble glaciation. The till of which it is composed is formed largely of local material intermingled with some brought from the north by the ice. It was laid down by the ice sheet during one of the first advances of the glacier, which here deposited but little material foreign to the locality. In a few places it is quite likely that the soil is also modified by residual material from the underlying shales and in other places by local wash from steep slopes and hillsides.

The original forest growth was sugar maple, beech, white pine, hemlock, etc., most of which was long ago removed. Pasture lots are covered with a natural growth of wild grasses. White daisies and Devil's paint brush are very troublesome, the fields in June being white and red with the blossoms of these weeds.

Owing to the difficulty in getting the products grown on the type to shipping points its use for any special crop or for general farming is not desirable. It would, however, make an excellent soil for grazing and stock raising. There is plenty of water and the land is low priced. With the raising of cattle and sheep the difficulty of hauling over the rough hilly roads would be largely overcome, as the stock could be driven to points of shipment. The future of the type would seem to lie either in the production of live stock or of some high-priced products of small volume. A factor in favor of stock raising is that all forage, crops of large volume, can be fed on the farm, thus returning each year much stable manure to the soil, thereby restoring and maintaining its productivity. The type should produce good crops of oats, hay, buckwheat, and potatoes. The rough stony areas should be reforested.

The crops now grown are oats, buckwheat, some corn, and a few

hops. Formerly hops were grown to a large extent, but in recent years with the decline in the prices of that staple the acreage on this type of soil declined much more than that of the other hop soils. Buckwheat is one of the best crops grown, and with light fertilization yields from 25 to 35 bushels per acre. It is the only crop which will compare favorably in yield with the other soils. A good grass sod will yield from 1 to 1½ tons of hay per acre, but most of the meadows are of poor sod, not having been plowed and reseeded in several years, and the average yield per acre will not exceed three-fourths to 1 ton. Many meadows, as well as pasture lots, are filled with white daisies and Devil's paint brush to the exclusion of the tame grasses. Oats do fairly well, yielding from 20 to 30 bushels per acre. The elevation and character of the soil are both unfavorable for the production of corn, but some is grown and small yields are obtained. Potatoes do well if given good care and fertilization. They yield from 75 to 100 bushels per acre.

The methods in vogue on the hill farms of the Volusia silt loam are the poorest in the county. Fields are allowed to remain in sod until they produce almost nothing, and then when broken up are generally poorly cared for. Many farms are seen with several years' accumulation of stable manure piled around the outbuildings and the fields producing poor or almost no crops at all. All this manure should be spread on the fields, plowed under, and worked into the soil, and then a liberal amount of good seed used in seeding. In this way a good sod could be secured, and after not more than two cuttings this should be plowed under, thus preparing the way for a better sod and consequently more productive fields. All this could be done by a proper rotation of crops with a profit over and above that now received, and at the same time the soil would be improved in its productive power each year.^a Soiling crops should be introduced and the keeping of as large a herd of stock as possible otherwise provided for. The feeding of all forage grown and the return of the waste material would all aid in the restoration of productivity. By good modern methods and management this soil, now supposed

^a A study was made of the manurial requirements of this soil type by the wire-basket method, developing the chief need of the soil to be a restoration of its organic content, which has become greatly depleted through the system of cropping to which it has been subjected.

In no case did applications of commercial fertilizer give sufficient increase to warrant their use, the largest, however, following the use of nitrate of soda and sulphate of potash in combination. There seems to be but little doubt that by the use of legumes for green manuring with the addition of potash substantial improvement could be made in the productiveness of the soils used in the test. These samples being representative of the type, these observations will no doubt apply to this soil throughout the area where the same system of cropping has been followed.

to be largely exhausted of its fertility, could be restored to its former productive state, which has declined, not through loss of its inherent fertility, but through poor methods and management.

Like the methods, the agricultural conditions on the Volusia silt loam are the poorest in the county, many of the farmhouses being abandoned and fast going to ruin and the farms often growing up to weeds. Fences on many of them are not worthy of the name, and an utter lack of thrift is apparent on all sides. The chief reason assigned for this condition is as follows: During and immediately following the period of the civil war many of these farms were sold at prices commensurate with the market price of farm produce at that time, which was based on an inflated currency. With the resumption of specie payment at a later date the price of produce sought a new level in accordance with the new monetary values, but the purchase price of the land and mortgages given of course remained stationary at the higher level and many of the farmers could not free themselves from debt. The farms have since been worked by tenants, and not having any personal interest in them they have been poorly cared for and farmed in a desultory manner, the productivity, naturally not so high as that of the valley soils, growing less and less each year through this method of operating.

The price of land of this soil type is much lower than that of the other principal types of the county. Farms can be bought for from \$10 to \$15 an acre, and in some instances probably for considerably less. But little of the type is changing hands.

Below is given a table showing the average results of mechanical analyses of typical samples of the fine earth of the Volusia silt loam:

Mechanical analyses of Volusia silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Me- dium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>
14725, 15768.....	Soil.....	1.8	3.1	0.8	2.2	8.9	56.3	26.0
14726, 15769.....	Subsoil.....	2.8	4.9	1.7	3.6	12.1	52.5	22.6

ALLIS SHALE LOAM.

The Allis shale loam, to a depth of from 7 to 10 inches, consists of a heavy loam or clay loam, dark drab or brown in color, resting upon a subsoil of heavy loam or clay loam similar to the surface soil except that it is a little lighter in color. Both soil and subsoil are filled with small thin shale fragments, which vary in size up to 1 or 2 inches in diameter, but the most of them are about the size of a penny or smaller. They are thin and brittle, easily broken, and in color they are similar to the soil. On some of the steeper slopes occupied by this

type of soil a phase exists where the subsoil is entirely wanting, the soil resting directly on the rock. In these areas the percentage of shale fragments is greatly in excess of that on the gentler slopes and consists of larger pieces.

The Allis shale loam occurs only in the western townships of the county—Deruyter, Cazenovia, and Sullivan. It occupies steep slopes and is consequently well drained. The weathering of the shale rock on these hillsides has given rise to this type of soil. The alternate freezing and thawing has loosened and broken off the shales and in their creep down the slope they have been still more broken up, forming the fine heavy material of the soil. The soil is derived in this way from the local shale rock and formed by the creep of the loosened material downward. On the lower part of the slopes it is deep, it being built up of talus debris, while the upper part is only thinly covered. In the ordinary usage of the term this soil is a purely residual type.

The Allis shale loam is well adapted to grasses and grains and excellent yields are obtained, but on account of its topographic position some of it is difficult to till. Probably its best use is as pasturage, for which it is now utilized. Some of it is forested and furnishes firewood.

Below are given the average results of mechanical analyses of fine-earth samples of this soil:

Mechanical analyses of Allis shale loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>				
15770, 15772.....	Soil.....	2.8	5.9	1.9	4.6	4.8	52.1	27.5
15771, 15773.....	Subsoil.....	2.4	7.3	2.7	5.5	5.1	53.4	22.5

ALLIS CLAY.

The surface soil of the Allis clay consists of a gray or olive-colored silty clay or clay loam, extending to a depth ranging from 6 to 10 inches, with an average depth of about 8 inches. The subsoil is a silty clay or clay slightly heavier than the soil and lighter in color, sometimes being a mottled gray. There is no distinct dividing line between the soil and subsoil, the one grading into the other. The subsoil very often passes into bed rock in the lower part of the section, also without any change in color. Both soil and subsoil are of close structure and break up into hard clods if cultivated when too wet or too dry. However, if handled when the moisture content is favorable a good tilth is secured without difficulty. This soil is quite similar

to the Upshur clay except for color, although it is more silty and not so heavy and refractory to handle.

The Allis clay is found capping Allis Hill and two other elevations east of Chittenango and along the foothills of the northern limit of the uplands. Its topography varies from level to rolling and steep, hilly slopes. Drainage is generally good, and yet the heavy character of the soil makes it capable of retaining a fair degree of moisture during droughts, unless they are of protracted length.

Like the soil associated with it, the Upshur clay, it is a distinctly residual soil. It is formed by the weathering in place of the light-colored Salina shales. The structure of the shales from which it is derived is often preserved in the subsoil. As before stated, it grades from the surface to the parent rock, and small fragments of soft, weathered shale are found sparingly in the whole section. Sometimes there are a few glacial stones at the surface, but no considerable quantity of other glacial material. The steep slopes are often bare of soil covering, the soft shales outcropping.

The Allis clay is adapted to the general farm crops of the section and to dairy farming. Corn makes an excellent growth and yields from 10 to 15 tons of ensilage, or from 50 to 70 bushels of grain in the ear per acre. Oats do well and yield on the average from 30 to 40 bushels per acre. Wheat is not much grown, but yields of 15 to 20 bushels per acre are secured. Hay yields from 1 to 2 tons per acre and is excellent in quality.^a

The soil at present is largely used for general farming and dairying, and the agricultural conditions indicate satisfactory results. Farm buildings are generally good and other evidences of prosperity are numerous. The price of desirable farms on this type would probably vary from \$40 to \$75 an acre, according to improvements.

The following table gives the average results of mechanical analyses of samples of this soil type:

Mechanical analyses of Allis clay.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>				
15718, 15720.....	Soil	0.2	2.2	1.5	6.7	6.1	44.8	37.8
15719, 15721.....	Subsoil.....	.3	2.2	1.7	5.7	6.7	34.2	48.1

^a The chief needs of this soil, as indicated by the wire-basket method, appear to be nitrogen and potash, applied in this test in form of nitrate of soda and sulphate of potash. There is little doubt, however, that by including a legume in the rotation, and by applying potash salts in any form, a marked improvement in the productiveness of this soil can be developed. Much of the soil of this type, including the fields from which samples were taken, is used as pasture and for hay, being in grass the greater part of the time. The mowing lands would no doubt be greatly benefited by top dressing with nitrate of soda and potash salts.

UPSHUR CLAY.

The Upshur clay consists of a surface soil of heavy Indian-red clay having a depth of 6 or 8 inches. The subsoil is a stiff, red clay similar to the soil, which often grades into bed rock at depths varying from 15 to 36 inches. The subsoil is usually more brilliant in color, not being modified by organic matter or the effect of cultivation as the surface soil has been. The coloration of both soil and subsoil is also often a modified red and again becomes mottled with yellow, bluish-gray, and red. On steep slopes, where it is subject to severe erosion, the soil is often much more shallow and sometimes absent entirely. These slopes are sometimes nothing but bed rock or fine particles of the soft, red shales themselves. On the more level areas the material forming the soil has accumulated to a greater depth and the typical section is found. These deeper areas are of course better adapted to agricultural purposes. The Upshur clay is plastic and sticky when wet and sun cracks when dry. It has a close, impervious structure and clods badly, making it a difficult soil to till. Shale fragments are not often found in any great quantity except on the steeper slopes, where erosion prevents any considerable accumulation of soil.

The Upshur clay occurs in isolated areas in a belt extending across the county from east to west along the line of the New York Central and Hudson River and West Shore railroads in the townships of Sullivan, Lenox, and Oneida. The topography varies from level and undulating to steep slopes. Noticeable occurrences are the small area found as an island in the eastern end of the large area of Muck in the lake plain and the area almost surrounding Allis Hill. In spite of its dense structure it has good drainage, excepting some of the level area northwest of Allis Hill.

The occurrence of the Upshur clay in Madison County is very interesting, it being a purely residual soil in a distinctly and heavily glaciated section of country. It is derived directly from the disintegration and weathering in place of the red Salina shales of Silurian age. There is no line of demarcation either between the soil and the subsoil or between the subsoil and the bed rock. One grades into the other directly, and the structure of the rock is plainly seen in the weathered product, where not broken up by cultivation. Occasionally a few glacial transported rocks are found on the surface, but usually there is no evidence of the presence of glacial material. It owes its occurrence here without a covering of glacial till to either the scouring effect of the ice sheet, with no deposition of its load, or to the removal of the morainic material by swiftly moving waters. The former action seems more probable, as much of the glacial till found immediately to the south is highly colored by material from the rocks from which the Upshur clay is formed.

The Upshur clay is an excellent soil for grass, pasturage, and grain crops, and fair returns are secured from them. Alfalfa has been tried on some of the shallower areas and is said to do well even where the soil covering is almost lacking, the roots readily extending downward into the soft shales. Owing to the difficulty in tilling, the type is not in much demand, though conditions on the farms having this soil are generally above the average for the county.

Below is given a table showing the average results of mechanical analyses of both soil and subsoil of the Upshur clay:

Mechanical analyses of Upshur clay.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>				
14968, 15758.....	Soil.....	0.1	1.4	1.5	4.2	6.1	31.2	55.2
14969, 15759.....	Subsoil.....	.1	1.6	1.7	5.7	6.9	31.6	51.7

CLYDE FINE SAND.

The surface soil of the Clyde fine sand is a dark-brown to black fine sand with a depth of about 12 inches. It is usually loamy in character, owing to the incorporated organic matter, which gives it its dark color. The subsoil is a sand of the same texture as the soil and extends to depths exceeding 3 feet. In its upper part it is a light brown in color, and in the lower depths of the section it becomes bluish. Sometimes the subsoil is gray in color throughout its whole depth.

The Clyde fine sand is limited in occurrence to two small areas—one in the northeastern corner of the county, at the head of the Oneida Lake and mouth of Oneida Creek, and the other a narrow strip near North Brookfield Station. Both areas occupy low, level plains. Their elevation is only a few feet above the water level, and consequently drainage is practically lacking. The only means of removal of the surface waters is by seepage; and as this can not be effected on account of the high position of the underground water table, water often stands on the surface, especially during wet times.

The drainage conditions are responsible for the formation of the Clyde fine sand. The mineral matter or body of the soil consists of reworked glacial sands. The swampy condition is favorable for luxuriant growths of aquatic vegetation, the decay of which has given the surface sands the organic matter and consequent dark color.

The type is not much cultivated, but if drained it would make an excellent soil for truck crops, though skillful management would be necessary to maintain its productivity.

Below are given the results of mechanical analyses of the soil and subsoil of the Clyde fine sand:

Mechanical analyses of Clyde fine sand.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>				
15722.....	Soil	0.4	2.0	15.1	58.0	10.4	8.4	6.4
15723.....	Subsoil.....	.3	1.5	8.5	47.7	33.0	6.5	1.9

CLYDE FINE SANDY LOAM.

The soil of the Clyde fine sandy loam consists of either a dark-gray or blackish fine-textured sand or compact sandy loam with a depth of about 10 inches. The soil grades into a subsoil of sticky, sandy loam mottled in color, the colors being brown, gray, drab, and red. Sometimes in the lower depths of the section the typical subsoil grades rather abruptly into a gray quicksand. Included in the type are small areas of the Dunkirk fine sand and also some small areas where there is a shallow covering of Muck. Much of the type was formerly covered by a thin deposit of Muck, but when it was cleared the Muck was burned off with the brush and logs. These burned areas are said to be less productive than the type as a whole.

The Clyde fine sandy loam occurs only in the lowland or lake-bed section of the county. The largest area lies west and northwest of Oneida. Another area lies in the vicinity of and east of Chittenango Station.

The topographic features of the type are very uniform. The surface is level to slightly undulating and drainage is poor. This soil lies along the base of the foothills and receives seepage from higher levels, which, with the low, flat surface and few streams, makes it wet a large portion of each season. It is swampy in many places, principally along the Erie Canal northwest of Oneida. The underground water table is always maintained at a high level. Where the quicksand subsoil is found the water table is also found even during droughts. A system of open ditches with laterals of well-laid tile drains would enhance the value of the Clyde fine sandy loam materially and make satisfactory results from farm operation more sure.

The native vegetation of the type is that of plants which thrive best on low, wet land. Rushes and wild grasses are common on uncleared fields and soon crowd out the tame grasses of the cultivated field. In many fields there is a brushy growth of poplar, willow, etc.

The Clyde fine sandy loam would make an excellent soil for grass if the surface was better drained, the moisture supply always present in the subsoil being easily available. If well drained, it would be

adapted to potatoes, beans, corn, and, in fact, to all of the general farm crops. A considerable portion of the type is in pasture, though but little grazing is afforded on account of the growth of brush and the swampy, wet condition. Some hay is grown, and when newly seeded yields of 2 tons per acre are often secured, though the average will probably not exceed 1 ton, as the tame grasses are soon crowded out. Alsike clover thrives in this moist soil. The yields of other crops are low and uncertain.

The agricultural conditions prevailing on this soil are far below the average for the county. Houses are few and small. The value of the land is much lower than that of the Dunkirk fine sandy loam, which lies just above in elevation. It is held at prices ranging from \$15 to \$20 an acre, according to drainage conditions and improvements.

The average results of mechanical analyses of typical samples of the Clyde fine sandy loam are appended below:

Mechanical analyses of Clyde fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>				
15724, 15726.....	Soil.....	0.2	2.7	6.8	55.1	5.3	16.4	13.7
15725, 15727.....	Subsoil.....	.1	5.3	18.9	35.4	5.8	15.7	18.7

HUNTINGTON LOAM.

The Huntington loam is a brown loam to silty loam, with a depth of 10 to 12 inches, resting on a subsoil consisting usually of a heavy light-brown loam, silty loam, or clay loam, which extends to considerable depths. Sometimes beds of gravel occur, and again the material approaches a fine sandy loam. This latter phase is especially true of all that part of the type mapped along Oneida Creek below a large body of Miami fine sand, from which it receives the wash. In some areas a blue clay is found in the lower part of the subsoil.

Areas of this soil type occur along the narrow bottoms of many of the streams, both large and small, in all parts of the county, and in small depressions in the uplands. The largest bodies are found southwest of Chittenango Station and north of Canastota.

The topography of the Huntington loam is nearly level, and occurring as it does as first bottoms it is often low and wet. Artificial drainage would in many cases be of benefit to the soil, although hard to accomplish. In the larger valleys of the uplands the type is associated with and often lies between terraces or higher bottoms of Dunkirk gravelly loam. In the narrow valleys and isolated areas it

grades into the upland soils. Along the streams it never rises above the flood plain and is subject to inundation. This makes it difficult to install efficient artificial drainage and unsafe for extensive cultivation, as freshets often occur. The liability of these overflows in the early spring prevents planting until the season is well advanced.

The Huntington loam owes its origin to recent deposits of alluvium and is still in the process of formation, as each overflow adds its contribution of fine sediments. This serves also to maintain the productivity of the soil.

Owing to its low-lying position and wet condition and to the fact that crops are liable to be damaged by overflow, only a small proportion of the type is under cultivation. It is used chiefly for pasturage, and only those portions less likely to be inundated are cultivated. Grass will yield from 1 to 2½ tons of hay, and corn from 40 to 80 bushels per acre. Some sweet corn and beets are grown near Canastota for canning, and large yields are secured in favorable seasons. It is an ideal soil for grass, late heavy truck crops, as sweet corn, cabbage, beets, turnips, etc., or for any crop which requires a large moisture supply and does not need to be planted early.

The average results of mechanical analyses of typical samples of both soil and subsoil are given in the following table:

Mechanical analyses of Huntington loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>				
14840, 15744	Soil	0.1	1.3	1.1	8.1	16.0	59.7	13.3
14841, 15745	Subsoil.....	.1	1.0	1.5	11.1	23.3	49.0	13.6

MUCK.

The Muck of this survey is one of the most important soils of the section. It consists of a heavy black or dark-brown fine-grained vegetable mold, varying in depth from 12 inches to several feet. It is uniform in color and texture from the top to the bottom of the profile. It is mellow and easily tilled, and cultivation is difficult only because of the rapid and vigorous growth of weeds and of its miry character when wet. The Muck surface soil, which sometimes includes the subsoil, is quite generally underlain by a bed of white to gray calcareous shell marl. Sometimes this marl is lacking, and the foundation is then a drab, bluish, or mottled plastic clay, similar to the subsoil of the Dunkirk clay. This clay is also usually found under the marl beds. These deep subsoil strata have no influence upon the soil from a cultural standpoint, although they influence the moisture and drainage conditions greatly. Practically every large area of Muck

is underlain by the marl at least in part. Sometimes the organic matter forming the soil is more like Peat than Muck—that is, a more fibrous and less decayed accumulation of vegetable matter.

The largest area of the Muck lies in the townships of Sullivan and Lenox, extending from near the western border of the county to the Lehigh Valley Railroad tracks, a distance of about 12 miles and about half way from the uplands to the lake. The average width of this area is about $1\frac{1}{2}$ miles. Other areas of considerable size occur in various parts of the county, the largest being a part of Ninemile Swamp, in the northwest corner of Brookfield Township, the swamp west and northwest of Peterboro, in Smithfield Township, and a swamp southwest of Nelson, in the township of the same name. Other small areas occur in various parts of both the uplands and lowlands of the county.

The topographic features of the areas of Muck are remarkable for their uniformity. There is no considerable variation in the elevation of individual areas, although the altitude of different areas varies from 386 feet, the level of the large body of the lowlands, to about 1,400 feet in some of the upland areas. The surface of each area is a level plain with no variation, except perhaps a slight elevation around its edge.

The natural surface drainage of the Muck is exceedingly poor. In its natural features each area is a veritable swamp, and artificial drainage has to be resorted to in order to bring any of it under cultivation. The soils surrounding it all lie at higher levels and it receives the run-off from them. This swampy and poorly drained condition is the primary cause of its formation. Where areas of Muck are now found there were formerly shallow lakes. In these the marl was deposited from clear water, as is taking place even now in a small pond or lake near Madison. The marl is the shell remains of a low order of fresh-water life which inhabits these clear lakes, forming its shell from the calcium carbonate held in solution. Following the period in which the marl was formed there was a long time of shallow waters and swampy conditions and a luxuriant growth of reeds, tules, and other aquatic vegetation. The partial decay of many successive growths of this vegetation in the presence of water has formed the covering of dark-colored vegetable mold or Muck.

This type is the most recent in formation in the county and is still in process of formation in the undrained areas or swamps. The large area of the lowlands was covered by a heavy forest growth of various species, principally black ash, but upon becoming partially drained the ash died. Many of the smaller areas, as well as the larger ones, in the upland section of the county are covered with a dense

growth of cedar and tamarack which furnish many fence posts and hop and telephone poles of excellent quality. There are also some white pine and other varieties of softwood.

Muck when well drained is the typical onion and celery soil of the county. It is also well adapted to the production of potatoes, cabbage, peppermint, and the root crops, as carrots, beets, turnips, etc. The greatest use of the type in Madison County is in the production of celery and onions. Large fields of these crops are grown north of Canastota. Onions will yield from 400 to 800 bushels per acre, with an average of from 500 to 600 bushels. An acre of celery requires from 18,000 to 20,000 plants and an average yield of first quality is 1,000 dozen "ones," or single plants. Hay will yield from 2 to 3 tons from good sod, but it is badly damaged by the heaving out of the roots by the frost. Some sweet corn is grown for canning and large yields obtained.

Fertilizers are universally used on the onion and celery fields after the first three years or so of cultivation.^a About one-half ton of high-grade fertilizer is the usual per acre application each year, but it is seldom applied all at one time. There is said to be an appreciable benefit by alternating the fields with celery and onions, and it seems that it would be advisable to give the soil a rest from both once in five or six years.

There are but few dwellings located on the Muck, and those are used almost solely by the Italian families employed in caring for the crops. The crops grown are usually shipped direct from the field, so that the only necessary outbuildings are tool houses and onion sheds. Some of the drained area is under intensive cultivation and shows every evidence of being profitable to the operator, while other portions of it grow up to weeds and show no care or thrift whatever.

Prior to the establishment of drainage this land could be bought for from \$2 to \$3 an acre. Immediately after the completion of the drainage ditch it was held at about \$15 an acre. At present

^a A large sample of this soil was obtained from a field which has been devoted to the production of onions for some years, and submitted to tests by the wire-basket method to determine its manurial requirements. While highly responsive to applications of all the fertilizers used, the greatest increase was obtained from the use of cowpea vines and lime, thus showing that notwithstanding the origin of this class of soils, they are, when continually grown to hoed crops, frequently benefited by the incorporation of decomposing vegetable matter. In this case the increase from green manure being more than double that observed from the use of chemical fertilizers used singly or in combination. While these results are held to apply strictly to the field from which the sample was taken, there is no doubt that the treatment indicated would greatly benefit many fields in this locality where the same system of cropping is carried on.

well-drained fields that are cleared and cultivated are held at from \$125 up, and areas capable of being easily cleared and brought under cultivation sell for from \$40 to \$60. In the township of Lenox the Muck land is assessed at about \$50 an acre if cleared and at about one-half that figure for the wild, uncleared part.

DRAINAGE.

As previously stated, the drainage of nearly all of the soils of the county is ample for agricultural purposes and they do not stand in need of artificial drainage. However, with the Muck areas it is different and none of them can be brought under cultivation without first being drained. In their natural condition the water table is either close to or above the surface and they are veritable swamps. One large area of the Muck has been reclaimed and is now producing large and valuable crops.

Formerly the waters of Cowaselon, Canastota, and Canasaraga creeks spread out over the large area of Muck of the lowlands and finally emptied into Chittenango Creek above Bridgeport. The Muck, then known as Cowaselon Swamp, was a vast swamp and absolutely worthless for agricultural purposes. In many places water stood several feet deep at all times, and where it was not so deep the bottom was so soft and miry that it was impassable except on the ice during the winter. About 1850 Douglas ditch was cut through the intervening high land between Oneida Lake at Lakeport and the swamp, but this did not prove to be of any practical benefit and in 1867 it was extended to the line between the townships of Sullivan and Lenox. A few years later it was further extended, and in 1875 the State appropriated \$35,000 for its extension and improvement. There was still a lack of drainage and considerable trouble from the large volume of water let out of the canal, and another appropriation from the State of \$30,000 completed it. Many lateral ditches and local extensions have since been constructed by private individuals from time to time. This artificial drainage has reclaimed thousands of acres of valuable land and made possible the production of large quantities of celery and onions. The immediate enhancement of the value of the swamp land, or Muck, upon the completion of the drainage system was about \$10 an acre, or more than the entire cost of construction of the drainage ditches, and there has been a subsequent increase in the price of the reclaimed land of from 300 to 600 per cent.

The drainage of the large areas of Muck occurring in the uplands presents difficulties no greater than those already overcome in the drainage that has been accomplished. The present drainage channels all have sufficient fall in the first few miles of their courses to

drain completely each area. The channels could be deepened and straightened, it is thought, at an expense not in excess of the increased value of the land reclaimed. If this were done, it would add thousands of acres of rich, valuable land to the cultivated area of the county.

The Muck land now reclaimed and under cultivation is mostly laid off in long fields with open ditches 15 rods apart. This did not prove efficient for the center of the fields, and many of the operators have installed tile drains half way between the open ditches.

SUMMARY.

Madison County is one of the central counties of New York State. There are two distinct physiographic divisions, the uplands of high rolling hills and broad filled valleys, and the lowlands—a lake-bed plain.

The climate is typical of the latitude in which it is located, cold winters with deep snow, and summers in which extremely hot weather is likely to occur. The rainfall is nearly always ample, though sometimes unevenly distributed. The drainage is both to the north and south; the former into the Gulf of St. Lawrence and the latter into Chesapeake Bay. A small area drains into the Mohawk and Hudson rivers.

The population is not dense and the agricultural resources are sufficient to support many more. About 75 per cent of the present population is engaged in agriculture, while only 60 per cent actually live in the rural districts. The most thinly settled districts occur in the Volusia silt loam area. About 90 per cent of the area of the county is classed as farm land and of this about 75 per cent is improved.

The chief products of export are dairy produce, hops, celery, and onions. The hops are sold to dealers. Milk and other dairy products are nearly all shipped to New York City. The celery and onions are shipped to various eastern New York and Pennsylvania points.

There is but little rotation of crops practiced. Hops occupy the same field for from ten to fifteen years, as does alfalfa. Some farmers grow first wheat, corn, oats, meadow, and then turn the field into pasture. Another uses the following rotation: Corn, oats, wheat, meadow without pasturing, and then corn again. Commercial fertilizers are not much used, except on the special crops and in the intensive farming; then high-grade brands are always used. On the dairy farms large quantities of stable manure are made and utilized. Labor is difficult to secure for any purpose and is often unskilled. Italians—men, women, and children—are employed in the onion and celery fields and where canning crops are grown. Hop pickers

are secured from the near-by cities, but are neither as reliable nor as plentiful as formerly.

There are eighteen types of soil mapped in the county. These soils occur as glacial till, as alluvial wash of the till in terraces and beaches, as reworked sediments, as swamp accumulations of organic matter, and as residual material resulting from the disintegration and decay of rocks in place. These soils vary from a light sand to heavy clay. Some of them are free from stones, while others are so stony as to warrant the use of the term "stony" in the type names.

The Miami stony loam is the most important soil of the area for general farming. It is especially adapted to grass, corn, cabbage, fruits, and dairying. It is preeminently the best alfalfa soil of the county, which gives three cuttings. The price of the type ranges from \$30 to \$40 or more an acre, according to location.

The Dunkirk gravelly loam is the principal hop soil and is also used for general and dairy farming. It is one of the most desirable soils of the county and well adapted to the use to which it is put. There is some alfalfa grown. The yields of all the crops grown are good. This soil is held in great esteem, and sales when made are always at high figures, \$75 to \$100 an acre being about the average range of price.

The Miami fine sandy loam has a rough topography and needs careful management to insure satisfactory results.

The Dunkirk fine sand and Miami fine sand are adapted to truck crops on account of being earlier than the other soils. They are now used for general farming, for which they are not well adapted, and rather poor results are obtained.

The Dunkirk silt loam and Dunkirk fine sandy loam are closely allied and their adaptations and interests are nearly the same. The crop yields are almost identical, and in general are fairly good. Both types are used for general farming, to which they are fairly well adapted. In price they also compare closely, bringing from \$25 to \$35 an acre.

Like other soils of the series, the Dunkirk clay loam and the Dunkirk clay are closely allied in their uses and adaptations. Both are excellent grass and grain soils and best fitted for general farming, for which they are used. The crops grown, the yields, and value of the soils differ some on account of the badly eroded condition of the clay loam.

The Volusia loam is used mainly for dairy and general farming, and while it is not considered as strong as the Miami stony loam, it is nevertheless a very good soil. Its adaptation to crops is quite generally recognized in the county. Hops were formerly much grown on this type, but dairying has replaced them in recent years. Farms of

this type of soil range in price from \$20 to \$60 an acre, according to location and improvements.

The Volusia silt loam is abandoned to some extent. Its productivity is supposed to be exhausted. Poor management and lack of care are responsible for this condition more than any real depletion of its fertility. It is admirably situated for stock raising, which, with a rotation of crops and the introduction of modern methods and good management, would in a few years restore it to its former productivity. Many of the farms are now producing practically nothing, and but little or no effort is being made to improve them. Buckwheat is the best crop in yield. It yields about 25 to 35 bushels. Corn does not do well, and hay yields only from three-fourths to 1 ton per acre. Better care and management would most surely increase these yields. In price the Volusia silt loam ranges from \$10 an acre up, and probably some farms can be purchased for less.

The Allis clay, Upshur clay, and Allis shale loam are all residual soils and similar in texture and structure. Their adaptations to grass and grain crops are also very similar. The topographic position of a part of each type is very unfavorable for cultivation, and it is therefore left as a woodlot or pasture.

The Clyde fine sand is of small extent, and on account of its low-lying position and wet condition it is scarcely cultivated at all.

The Clyde fine sandy loam is in many places swampy and of no agricultural value. Where it is cultivated the best crop is grass, and good yields are obtained. The establishment of drainage would make this a good soil for grass, grain, and general farming. In price it ranges from \$15 to \$20 an acre, according to the drainage conditions.

The Huntington loam is not much cultivated, because of its liability to overflow. Where it is cultivated good yields are the rule. It is adapted to late heavy truck, such as the canning crops of corn, beets, beans, etc.

Muck is utilized only where artificial drainage has been established. It is naturally in a swamp condition, but drainage has converted a part of it into one of the most important soils of the county. Most of the remaining area of the type now undrained is capable of being drained and brought into use. It is best of all adapted to the production of celery and onions. Many acres of these two crops are grown each year, but the possibilities of the type have not been one-tenth realized. Thousands of acres are either in pasture or growing up to weeds. Onions make an average yield of 500 to 600 bushels and celery 1,000 dozen "ones" of first quality per acre. Cleared and drained areas of Muck sell for \$125 or more an acre. Areas yet

uncleared, but capable of being drained, sell for from \$40 to \$60 an acre. Before the establishment of any drainage this soil brought only \$2 or \$3 an acre, which would probably represent the value of undrained areas at present except for the valuable timber they support.

The rough stony areas in the Miami stony loam and Volusia silt loam are of no agricultural value except as indifferent grazing land and for forests affording firewood, fence posts, and a small quantity of lumber.

Transportation facilities are excellent both by water, the Erie Canal, and by steam railroads which reach practically every part of the county. The railroads are competing systems, which, with the cheap transportation by canal, tend to keep rates fair to both the shipper and the carrier.

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