

U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF SOILS—MILTON WHITNEY, Chief.

IN COOPERATION WITH THE NEW YORK STATE COLLEGE OF AGRICULTURE,
CORNELL UNIVERSITY, BEVERLY T. GALLOWAY, DIRECTOR;
E. O. FIPPIN, IN CHARGE SOIL SURVEY.

SOIL SURVEY OF SCHOHARIE COUNTY,
NEW YORK.

BY

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CHARGE, AND G. L. FULLER, OF THE NEW YORK STATE
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U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS,
Washington, D. C., November 27, 1916.

SIR: Under the cooperative agreement with the State of New York, a soil survey was made of Schoharie County during the field season of 1915.

I have the honor to transmit herewith the manuscript report and map covering this work and to recommend their publication as advance sheets of field operations of the Bureau of Soils for 1915, as authorized by law.

Respectfully,

MILTON WHITNEY,
Chief of Bureau.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

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MAP.

Soil map, Schoharie County sheet, New York.

SOIL SURVEY OF SCHOHARIE COUNTY, NEW YORK.

By E. T. MAXON, of the U. S. Department of Agriculture, In Charge, and G. L. FULLER, of the New York State College of Agriculture.—Area Inspected by W. E. McLENDON.

DESCRIPTION OF THE AREA.

Schoharie County is situated in the eastern part of New York. It is bounded on the north by Montgomery County, on the east by Schenectady, Albany, and Greene Counties, on the south by Greene and Delaware Counties, and on the west by Delaware and Otsego Counties. The county embraces an area of 620 square miles, or 396,800 acres.

The northern part of Schoharie County consists of a strongly rolling plain lying at an elevation of about 1,200 feet. It is dissected by a few valleys cut to a depth of 500 to 600 feet below the upland and many small ones ranging from mere sags to valleys as deep as the main valleys. The dissection is neither minute nor sharp. Standing on this plain are a number of isolated roundish hills ranging in height to about 600 feet above the plain.

The southern three-fourths of the county consists of a high plateau lying a little above 2,000 feet, or about 800 feet above the northern plain. It is terminated on the north by a steep escarpment in which the surface drops to the level of the northern plain. The southern plateau is deeply dissected by large and small streams, the dissection being more thorough and more sharply incised than is that of the northern plain. There is a much larger proportion of steep slope in this region and a smaller proportion of smooth to rounded or rolling surface than in the northern plain. Along the extreme southern border of the county there are a number of prominent hills rising to heights ranging to more than 3,000 feet. These are outliers of a still higher plateau to which the surface rises a short distance south of the county line.

Practically the entire county, with the exception of the extreme northeastern part, is adequately drained. The principal streams are Schoharie and Cobleskill Creeks, which have numerous small tributaries rising in the uplands and flowing swiftly through narrow, deep-cut valleys. Schoharie and Cobleskill Creeks follow a north-easterly course, the former through the eastern part of the county

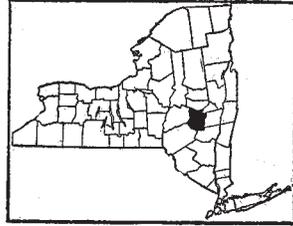


FIG. 1.—Sketch map showing location of the Schoharie County area, New York.

and the latter through the northern part. The drainage of most of the county is carried by Schoharie Creek into the Mohawk and Hudson Rivers. That of the southwestern part flows into the Susquehanna and Delaware Rivers. Nearly every stream in the county is utilized for water power during some part of the year.

The first permanent white settlement in Schoharie County was made near the site of Middleburg about 1713 by Germans. The rich lowlands appealed to these hardy pioneers and soon attracted many Germans and Dutch from the old country. These were followed by emigrants from the New England Colonies, Connecticut especially. The English soon established a colony on the southern border of the county, not far from Stamford, Delaware County, and other settlements were established along the watercourses. Following the early wars settlement was rapid, but during the last 50 years the population has gradually decreased. In 1880 the census reported a total population of 32,910, which in 1910 had decreased to 23,855, a loss of 9,055 in 30 years. This can probably be explained in large part by the fact that the younger generation has moved to the cities. About 75 per cent of the population is rural. The density of rural population is given by the census as 37.2 persons per square mile.

The present population is made up largely of descendants of the pioneers. Some of the abandoned farms in the eastern part of the county are being taken up by Swedes and Poles.

The largest towns in the county are Cobleskill, with a population in 1910 of 2,088; Middleburg, with 1,114; and Schoharie, with 996. Schoharie is the county seat. Little or no manufacturing is carried on in these places, the inhabitants being mostly retired farmers.

Most of the county has good transportation facilities. The Delaware & Hudson traverses the northern part of the county from east to west, with a branch line extending into the northwestern corner; the Middleburg & Schoharie traverses the eastern part in a southerly direction; and the Ulster & Delaware follows the southern boundary for a short distance. The main State road from Albany to Binghamton passes through the Cobleskill Valley. Other State roads are under construction or projected. The dirt roads in the northern part of the county are in good condition, and are much better than those in the southern part.

Schenectady, Albany, and New York are the principal markets for the products of the county.

CLIMATE.

The nearest Weather Bureau stations are located at Cooperstown, about 25 miles to the west, in Otsego County; and at Albany, about 30 miles to the east, in Albany County. The records for Coopers-

town, which has an elevation of 1,200 feet above sea level, are representative of the conditions over the greater part of Schoharie County, while the Albany records probably apply more closely to the region along Schoharie Creek, in the eastern part of the county.

According to these records, the mean annual temperatures at Cooperstown and Albany are 43.9° F. and 48.2° F., respectively. The winters are long and severe, while the summers are mild and pleasant. The average dates of the last killing frost in the spring at Cooperstown and Albany are May 5 and April 23, and of the first in the fall, October 3 and 17; while the latest dates on record of killing frosts in the spring are May 24 and 30, and of the earliest in the fall, September 15 and 23, respectively. The growing season is long enough to mature most of the crops grown in this general region.

The rainfall is ample and evenly distributed throughout the growing season. At Cooperstown the mean annual precipitation amounts to 39.82 inches, and at Albany 38.39 inches.

The following tables give the normal monthly, seasonal, and annual temperature and precipitation at Cooperstown and Albany:

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

Month.	Temperature.			Precipitation.			
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year (1905).	Total amount for the wettest year (1871).	Snow average depth, Dec. 1884-Feb. 1903.
	° F.	° F.	° F.	Inches.	Inches.	Inches.	Inches.
December.....	28.0	66	-17	2.67	1.36	1.65	11.2
January.....	23.4	64	-24	2.61	2.66	2.30	12.8
February.....	24.4	63	-18	2.47	0.80	2.00	13.4
Winter.....	25.3	66	-24	7.75	4.82	5.95	37.4
March.....	33.3	79	- 8	2.75	2.43	7.29	11.1
April.....	46.7	88	13	2.67	2.12	3.79	1.2
May.....	59.2	93	29	3.50	0.96	4.97	T.
Spring.....	46.4	93	- 8	8.92	5.51	16.05	12.3
June.....	68.4	99	40	4.03	3.58	7.25	0
July.....	72.3	100	48	4.12	2.00	9.37	0
August.....	70.5	98	42	3.82	3.83	10.59	0
Summer.....	70.4	100	40	11.97	9.41	27.21	0
September.....	62.5	96	32	3.37	3.37	0.85	0
October.....	50.2	90	23	3.41	2.38	3.34	T.
November.....	39.1	71	-10	2.97	1.49	3.38	4.7
Fall.....	50.6	96	-10	9.75	7.24	7.57	4.7
Year.....	48.2	100	-24	38.39	26.98	56.78	54.4

Normal monthly, seasonal, and annual temperature and precipitation at Cooperstown, N. Y.

Month.	Temperature.			Precipitation.			
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year.	Total amount for the wettest year.	Snow, average depth.
	° F.	° F.	° F.	Inches.	Inches.	Inches.	Inches.
December.....	24.6	62	-30	2.85	3.27	4.33	13.1
January.....	20.2	62	-33	2.60	1.68	4.39	14.1
February.....	20.6	57	-28	2.48	0.85	2.91	18.7
Winter.....	21.8	62	-33	7.93	5.80	11.63	45.8
March.....	28.0	76	-16	2.82	2.29	4.17	12.8
April.....	41.2	82	14	2.72	2.19	2.86	2.4
May.....	54.6	87	23	3.65	3.40	8.84	0.1
Spring.....	41.3	87	-16	9.19	7.88	15.87	15.3
June.....	64.0	90	30	4.20	1.00	4.89	0
July.....	68.1	94	39	4.55	1.79	3.39	0
August.....	65.4	90	35	3.15	5.81	6.01	0
Summer.....	65.8	94	30	12.90	8.60	14.29	0
September.....	58.3	87	27	3.40	2.88	7.24	0
October.....	46.7	80	17	3.35	2.39	5.91	0.7
November.....	35.0	70	0	3.05	2.37	3.17	5.2
Fall.....	46.7	87	0	9.80	7.64	16.32	5.9
Year.....	43.9	94	-33	39.82	29.92	58.11	67.0

AGRICULTURE.

The early settlers of Schoharie County cleared small patches of land in the valleys. Wheat and corn, the first crops grown, did so well that larger areas were cleared, the timber being thrown into piles and burned. The production of grain continued until the competition of the larger grain-producing sections of the West made it unprofitable.

In the early part of the nineteenth century the growing of hops on a commercial scale was entered into, and hop growing became the leading industry, but during the last 25 years the low prices, combined with the keen competition of the far West and the loss from plant diseases, have forced the growers of hops to reduce their acreage and turn to diversified farming. At the present time dairying is the most important industry, the chief products being raw milk and butter.

The following table gives the acreage and production of the principal crops of the county for the census years 1879 and 1909:

Acreage and production of principal crops of Schoharie County, 1879 and 1909.

Crop.	1879		1909		Crop.	1879		1909	
	Acres.	Tons.	Acres.	Tons.		Acres.	Bushels.	Acres.	Bushels.
Hay and forage..	90,446	92,463	95,527	114,376	Wheat.....	5,789	80,467	399	9,334
		Bushels.		Bushels.	Barley.....	1,559	30,157	638	13,582
Oats.....	32,804	727,690	25,190	573,010	Potatoes.....	3,575	261,720	3,273	307,746
Buckwheat.....	18,583	293,443	12,312	240,770	Hops.....	5,871	2,982,873	3,419	2,156,883
Corn.....	7,602	217,506	5,492	197,520			Pounds.		Pounds.
Rye.....	5,941	76,628	2,218	34,207					

Hay and forage are by far the most important crops in the county, being valued in 1909 at \$1,321,364. Approximately 60 per cent of the hay produced in 1909 consisted of timothy and clover mixed and nearly 27 per cent of timothy alone. Most of the mixed timothy and clover is fed on the farm, while the greater part of the timothy is sold.

The acreage devoted to oats in 1909 exceeded that of all the other cereals combined. This crop is grown throughout the county, a part of it being used on the farms and a part being sold. Buckwheat is grown upon nearly every farm, and most of the crop is sold. Corn is grown mainly in small patches in connection with the dairy farms. The production of corn for ensilage is becoming more general.

Between 1880 and 1900 the hop industry was of considerable importance, an average of 5,798 acres being devoted to it annually, with an average annual production of 3,298,186 pounds. Nearly every farmer had a hop "yard." Owing to low prices and increased cost of production, however, there was a considerable decrease in acreage and production during the decade from 1900 to 1910. At the present time this industry is confined to the best soils along the Schoharie and Cobleskill Valleys.

In 1909 the combined acreage in rye, barley, and wheat, amounted to only 3,255 acres, showing a decrease of more than 10,000 acres in the last 30 years.

Alfalfa was grown in 1909 on 267 acres, with a yield of about two tons per acre. In that year there were also produced 219,343 bushels of apples, 58,282 pounds of grapes, and 112,491 pounds of nuts.

The 1910 census reported 40,743 head of cattle in the county, including 26,138 dairy cows. There were also 11,422 sheep and 9,645 hogs in the county in that year. The Holstein is the predominating breed of dairy cattle. The value of dairy products, excluding the milk and cream used at home, was \$1,443,765, and the receipts from the sale of dairy products amounted to \$1,418,629. The number of poultry raised was 176,000 and the number sold was 73,047. Poultry and eggs produced were valued at \$428,454, and the receipts from the sale of poultry and eggs amounted to \$329,388.

On the better valley soils the farms are supplied with modern implements and machinery, but this is not generally the case on the hill farms. The buildings on the valley farms also are larger and more commodious than those on the hill farms. Improved cow barns and silos are common. Most of the farm machinery is housed when not in use.

The farming methods in Schoharie County do not differ materially from those of the hill regions throughout southern New York. Plowing is done both in the fall and spring, the depth of plowing varying from 3 inches on the poorer soils to 6 or 8 inches on the better land. Most of the seeding is done in the spring.

The importance of crop rotation is not yet generally recognized. On the valley farms the usual practice is to grow corn one year, oats the following year, and then allow the land to remain in grass for several years, or until it runs out. On the hill farms the usual procedure is to grow buckwheat or oats for one year and then leave the fields in grass until it runs out. Pastures receive little or no attention. Hops are usually grown on the same fields for long periods.

In 1909, according to the census, the total expenditure for commercial fertilizer was \$32,225, or \$24.19 per farm reporting. The crops for which commercial fertilizers are most regularly used are hops, oats, and corn. Ground limestone is used to some extent.

In 1910, 72.7 per cent of the farms reported the use of hired labor, the total amount spent for this purpose being \$552,050, or \$230.89 per farm reporting. Permanent laborers are hired for a period of seven or twelve months, the wages varying from \$25 to \$40 per month, with board. Wages paid day labor during the harvest season are at a higher rate.

In 1910 there were 268,179 acres reported in farms, of which 185,293 acres consisted of improved land. The number of farms in the county was 2,495, and their average size was 112.9 acres. Nearly 76 per cent of the farms are operated by owners, and nearly 23 per cent by tenants. Farms are usually rented on a share basis, the owner furnishing the land, one-half the seed and commercial fertilizer, and part or all of the dairy stock, and receiving one-half the gross returns.

Farm lands vary in value according to location and improvements. The highest priced land in the county is probably in the Schoharie Valley, between Middleburg and Central Bridge, where it is valued at \$150 to \$225 an acre. Farm lands in the Cobleskill Valley, especially near the towns, sell for \$75 to \$150, and those in the vicinity of Seward and Sharon Springs for \$35 to \$60 an acre. In the southern part of the county farm land can be bought for \$8 to \$20 an acre. Very few farms are changing hands at the present time. The 1910 census reports the average value of farm property in Schoharie

County as \$4,396, of which 36.9 per cent represents land, 37.9 per cent buildings, 7.6 per cent implements, and 17.6 per cent domestic animals. The average value of farm land is given as \$14.36 an acre.

SOILS.

Schoharie County extends from the comparatively smooth, rolling Mohawk lowland belt across the high, hilly Allegheny Plateau region into the rough foothills of the Catskill Mountains. The entire region was glaciated during the late Wisconsin stage, resulting not only in a greatly modified general topography, but in the displacement of all preexisting soils by a mantle of glacial débris. The present soils, with the exception of small areas of cumulose material, are derived from this glacial material, either weathered in place or reworked and redeposited by water. The soils derived from glacial till occupy the uplands, while those derived from water-deposited material occur as smooth terraces at low elevations in plainlike to badly dissected areas in the Schoharie Valley, which seem to be remnants of an old glacial-lake plain, and as narrow overflow plains along all the streams in the county.

The substructure of the county consists of a large number of sedimentary formations, ranging in geologic age from early Silurian to late Devonian. Most of the lowland belt in the northern part of the county is occupied by gray shales and shaly sandstones of the Hudson River Group and by the black Utica shales, which are highly carbonaceous and moderately calcareous. Immediately south of this belt is a strip 2 to 6 miles wide extending across the county by Sharon Springs, Sharon, Cobleskill, Schoharie, and Gallupville, in which the Helderberg and Onondaga limestones are the dominant rocks, although the Clinton, Niagara, Salina, and Oriskany formations are represented in narrow bands.¹

Throughout the central part of the county, or the high, hilly section, as far south as the Catskill foothills, the surface rocks are gray sandy shales and flaggy sandstones, classed geologically as the Hamilton formation, and the Catskill region is made up of the Chemung sandstone, Oneonta sandstone, and the Catskill formation consisting of red and gray sandstones and shales.

The glacial till represented in the ground moraine mantling nearly all the upland areas, bears a close relation to the rocks over which it lies, except along the lines of contact between the important formations, where material from one is intermingled with that of the other. As in a residual region where each kind of rock gives a characteristic soil-forming material, the till shows marked differ-

¹The names of the geological formations and information about their occurrence in the county were obtained from the Preliminary Geologic Map of New York, issued in 1894, and from other works published by the Geological Survey of New York.

ences over the different formations, ranging from gray and non-calcareous over the gray shales and sandstones to bluish gray and highly calcareous where the material is almost entirely derived from limestone and to pinkish or Indian-red where it is largely derived from red sandstones and shales. Also the black carbonaceous shales give a characteristic dark-gray, slightly calcareous till carrying black shale chips in large quantities.

The material forming the stream terraces, the old glacial-lake deposits, and the recent alluvium varies in different sections of the county. Where the drainage is almost entirely from gray sandstone and shale uplands the soil material is brown to yellow in color and rests upon beds of sandstone and shale gravel, and the recent alluvium is brown to dark brownish gray in color, while along the streams rising in the Catskill region the terraces and first bottoms are pinkish to decidedly reddish in color. The lake-deposited material in the Schoharie Valley shows in its reddish cast strong influence from the red sandstones and shales of the Catskill region.

Based on the broader differences in origin and mode of accumulation and important differences as exhibited by color, structure, drainage, and topographic position, the soils of Schoharie County are grouped into several series. The noncalcareous till from the gray sandstones and shales gives rise to two well-drained series, the Wooster, where the till is deep, and the Lordstown, where the depth to bedrock rarely exceeds 3 feet; and to two poorly drained series, the Volusia in the deeper till areas and the Allis in areas underlain by rock at less than 3 feet. In the red sandstone and shale areas the lighter colored soils with a pinkish to brownish cast are classed as the Culvers, and those with a pronounced Indian-red color as the Lackawanna series, the latter usually being confined to areas of very shallow till over red sandstone and shales. The black shale till gives rise to the Mohawk series and the highly calcareous till to the Honeoye series, while the soils of mixed sandstone, shale, and limestone origin, with the noncalcareous material predominant, are classed as Ontario. The terraces and best developed flood-plain areas, where the material is almost entirely derived from the gray, noncalcareous rocks, are classed in the Chenango and Genesee series, respectively, while the corresponding soils with a high content of red sandstone and shale material are grouped in the Tunkhannock and Barbour series. The old lake deposits in the Schoharie Valley are not classifiable with the Dunkirk series on account of the peculiar reddish tinge of the soil material. The Schoharie series is made to include soils of this character.

In all, 14 series of soils, embracing 18 distinct types, in addition to areas of Muck, Meadow, Rough stony land, and Rock outcrop, are mapped in Schoharie County.

The Ontario series is characterized by brown surface soils and light-brown to yellow subsoils, resting at a depth of 2 to 3 feet upon gray to bluish-gray, moderately calcareous till. Throughout the soil section there are scattered fragments of sandstone and shale, and in a few places fragments of limestone. The topography is rolling, or that of drumloidal hills, and the natural drainage is good (see Pl. I, fig. 1). In this series only one type, the silt loam, is mapped in Schoharie County.

The Honeoye series differs from the Ontario in having darker colored surface soils and subsoils and in being derived almost entirely from limestone. Two types, the stony loam and loam, are mapped in this county.

The Mohawk series includes types having brown to dark-brown surface soils and grayish-brown to dark brownish gray subsoils. The lower part of the subsoil contains varying quantities of black shale fragments, and may also be slightly calcareous. The topography is rolling and natural drainage is good (see Pl. I, fig. 2). One type, the silt loam, is mapped.

The surface soils of the Volusia series are brownish gray to gray, and the subsoils, which usually are somewhat more compact than the surface soils, are yellow and brown mottled or pale yellow in the upper part of the 3-foot section and gray mottled in the lower part. The surface soil and upper subsoil are generally deficient in lime, but in the heavier types the lower subsoil and substratum may be slightly calcareous. Small angular fragments of sandstone occur throughout the soil section. The soils of this series are poorly drained. This series is represented in Schoharie County by three types, the stony silt loam, silt loam, and silty clay loam.

The surface soils of the Allis series are brownish gray to gray or pale yellowish and the subsoils are gray, yellow, and brown mottled, resting upon sandstone and shale bedrock at a depth of 3 feet or less. These soils are the shallow equivalents of the Volusia soils. The Allis silt loam is the only type mapped in this series.

The Lordstown series includes types having light-brown to yellowish-brown surface soils and yellow to grayish-yellow subsoils. Both surface soil and subsoil have a loose, friable structure, and the shaly sandstone forms bedrock at a shallow depth. The topography is rolling to hilly. (See Pl. II, figs. 1 and 2.) Two types are mapped in this series, the Lordstown stony silt loam and silt loam, each with a steep phase.

Morainic deposits with yellow to brown surface soils and yellow subsoils are classified as the Wooster series. These soils are loose, friable, and relatively deep. The topography is rolling. In Schoharie County only one type, the gravelly silt loam, is mapped.

The surface soils of the Culvers series are brown to light reddish brown and the subsoils, which are similar to the surface soils in texture and structure, are pinkish to yellowish brown. Red and gray sandstone and shale fragments occur in varying quantities on the surface and throughout the soil section. The topography is rolling to slightly hilly and the drainage is good. One type, the stony silt loam, is mapped in this county.

The surface soils of the Lackawanna series are brownish red to dark Indian-red, with somewhat lighter colored subsoils. The topography is rolling to hilly and mountainous and drainage is good. (See Pl. II, fig. 1.) The series is represented in Schoharie County by one type, the stony silt loam.

The Schoharie series includes types having brown to reddish-brown surface soils and mottled subsoils in which pink, red, gray, and brown are the dominant colors. There is little or no difference in the texture of the material from the surface downward, although the subsoil is rather compact and shows the lack of drainage. Little or no stone is present in the soil section. The topography is nearly level to quite rolling and choppy and the drainage is good. These soils are derived from sedimentary material laid down in glacial lakes or in the valleys of ancient streams, the material being largely of red sandstone origin. The series is represented in Schoharie County by one type, the silty clay.

The Chenango series includes types with brown, mellow surface soils and yellowish-brown, friable subsoils, resting at a depth of 2 to 4 feet upon beds of sand or gravel, mostly of sandstone and shale origin. The soils of this series occupy a terrace position above overflow and have good natural drainage. The gravelly loam is the only type mapped in this county.

The Tunkhannock series includes terrace types with reddish-brown surface soils and reddish-brown to Indian-red subsoils. These soils have a level topography and are well drained. One type, the very fine sandy loam, represents the series.

The surface soils of the Genesee series are brown to dark brownish gray, and the subsoils are light brown to brown and gray mottled, the heavier members usually being the darker. These soils occupy first bottoms subject to overflow, and are alluvial in origin, being derived from mixed sandstone, shale, and limestone material. The silt loam is the only type mapped in this county.

The Barbour soils differ from the Genesee soils mainly in their peculiar reddish color. They occupy alluvial plains, principally along the creeks and rivers issuing from the Catskill region. One type, the very fine sandy loam, is mapped.

Rock outcrop is a term applied to exposures of the bare rock.

Rough stony land comprises areas that are too rough and stony for cultivation.

Muck comprises decomposed vegetable matter mixed with some mineral matter, accumulated under conditions of poor drainage.

Meadow is a term applied to poorly drained undifferentiated material along stream courses and throughout the uplands.

The following table gives the name and the actual and relative extent of each soil type mapped in Schoharie County:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Lordstown stony silt loam	97,728	46.4	Meadow	5,504	1.4
Steep phase	86,592		Honeoye stony loam	5,120	1.3
Volusia silt loam	39,744	10.0	Chenango gravelly loam	3,776	1.0
Culvers stony silt loam	27,520	6.9	Rock outcrop	3,456	.9
Lordstown silt loam	14,144	6.5	Volusia stony silt loam	3,072	.8
Steep phase	11,840		Allis silt loam	2,496	.6
Ontario silt loam	21,824	5.5	Rough stony land	2,304	.6
Honeoye loam	19,904	5.0	Barbour very fine sandy loam ..	2,304	.6
Mohawk silt loam	15,680	4.0	Wooster gravelly silt loam	2,240	.6
Lackawanna stony silt loam	11,584	2.9	Genesee silt loam	2,112	.5
Schoharie silty clay	9,856	2.5	Volusia silty clay loam	1,088	.3
Tunkhannock very fine sandy loam	6,336	1.6	Muck	576	.1
			Total	396,800

ONTARIO SILT LOAM.

The Ontario silt loam consists of a brown, heavy silty loam to silt loam, 8 to 10 inches deep, underlain by a light-brown to yellow silt loam which grades into a gray or brownish-gray loam to silt loam at a depth of $2\frac{1}{2}$ to 3 feet. This type as mapped in Schoharie County lacks the slight reddish cast that is characteristic of the Ontario soils in Oneida and some other counties of New York. Scattered fragments of sandstone, shale, limestone, and crystalline rocks occur on the surface and through the upper part of the soil section, while in the deep subsoil and substratum limestone fragments are rather abundant, and the finer material is slightly calcareous.

The Ontario silt loam occurs as a narrow belt and in detached areas in the northern part of the county. It is found principally in the towns of Sharon, Seward, Carlisle, Cobleskill, and Schoharie. It occupies rolling hills, with only a few slopes that are too steep to cultivate with machinery, and drainage is adequate.

Practically all this type is cleared and under cultivation, but in only a few places is it developed to its full capacity. Hops are the

principal crop, being most extensively grown in the towns of Seward, Cobleskill, and Sharon. Buckwheat is an important crop in the town of Sharon. Other crops are oats, corn, alfalfa, clover, and timothy. Dairying is gradually becoming an important industry on this type. Hops yield 700 pounds, buckwheat 25 to 35 bushels, and oats 35 to 40 bushels per acre. Alfalfa does well, yielding ordinarily 3 tons of hay from two or three cuttings. Ensilage corn yields 10 to 12 tons per acre. Clover yields about $2\frac{1}{2}$ tons and timothy 1 to $1\frac{1}{2}$ tons per acre. Some fertilizer is used for hops and oats.

Good land of this type can be bought for \$30 to \$50 an acre, while well-improved farms bring \$75 to \$100 an acre. Probably the best use of this type is for dairying.

HONEOYE STONY LOAM.

The Honeoye stony loam consists of a brown stony loam varying in depth from 10 to 24 inches. Where the till is of shallow depth there is very little difference between the soil and subsoil, but where the underlying rock is from 20 to 24 inches below the surface the lower subsoil is usually lighter brown in color. Limestone outcrops are of frequent occurrence, and fragments of limestone, sandstone, and shale are scattered over the surface and through the soil material.

This type occurs in the northern part of the county in association with the other limestone soils. The largest area is located in the vicinity of Sharon Center. The topography is generally flat, conforming to the surface of the underlying formation, but in many places there is a sharp escarpment of limestone separating the two levels. Owing to the shallowness of the soil and the proximity of the underlying rocks to the surface, it is a droughty type and crops usually suffer from lack of moisture. It is partially residual, particularly in the shallower areas, but whether residual or entirely glacial the material is very largely of glacial origin and is quite calcareous.

Most of this type is cleared and utilized for pasture. Some of the areas in which the soil is deepest are cultivated, fair yields of oats, corn, and hay being obtained. No definite prices can be quoted for land of this type.

HONEOYE LOAM.

The Honeoye loam consists of a brown to dark-brown loam to silty loam, 8 to 12 inches deep, underlain by a light-brown to yellowish-brown loam to silty loam of a slightly more compact structure. The deep subsoil and substratum consist of a brownish-gray to bluish-gray, calcareous till in which limestone fragments are abundant. A large percentage of the stone on the surface and through the soil section is limestone. The stones are not sufficiently large or numerous to



FIG. 1.—TOPOGRAPHY AND BUILDINGS ON FARMS IN THE REGION OF ONTARIO AND HONEOYE SOILS.

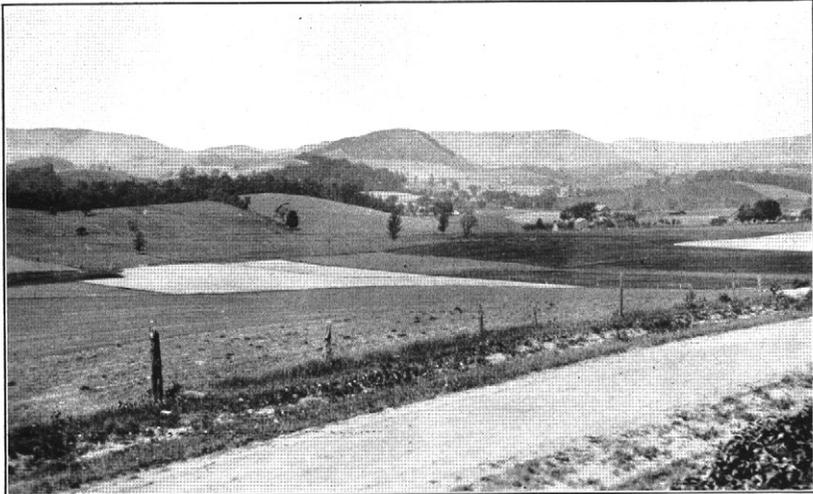


FIG. 2.—MOHAWK SOILS IN THE FOREGROUND; VOLUSIA ON THE HIGHER HILLS.



FIG. 1.—LORDSTOWN SOILS IN THE FOREGROUND; LACKAWANNA SOILS ON THE HILLTOPS.

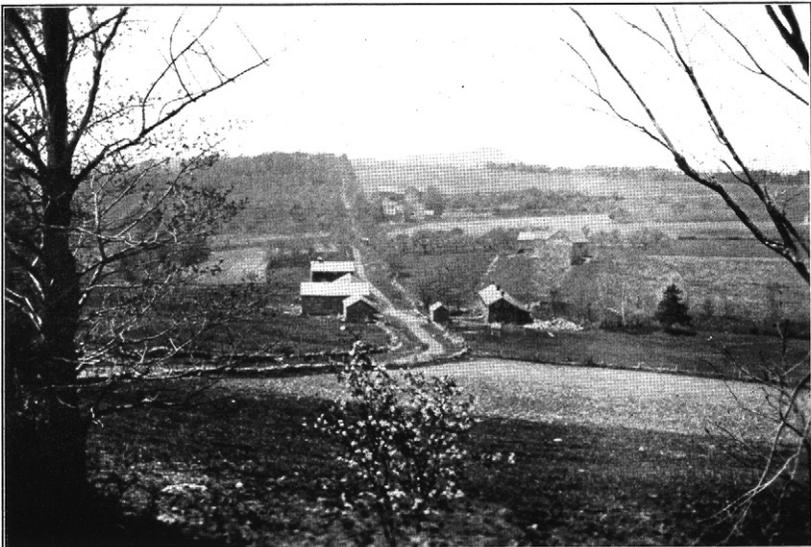


FIG. 2.—FARMS ON SOILS OF THE LORDSTOWN SERIES.

interfere with cultivation. There are included with this type, on account of their small size, a number of areas of silt loam and silty clay loam, the former occurring along the Cobleskill Valley and the latter immediately west of Cobleskill. This heavier soil requires more care in handling than the loam, as it will clod if plowed too wet.

The Honeoye loam is not of large extent, occurring mainly in the limestone belt through the northern part of the county. It is most typically developed in the towns of Sharon, Cobleskill, Schoharie, and Wright. For the most part the type occupies rounded hills with gentle slopes, though in a few places the topography is steep. Drainage is excellent and in some places excessive.

This is one of the best developed soils in the county. Clover, timothy, alfalfa, oats, corn, and hops are the principal crops. A considerable acreage is devoted to buckwheat in the town of Sharon. There are some excellent dairies on this type. In the northern part of the limestone belt, however, especially in the town of Sharon, the scarcity of water is a hindrance to dairying, and conditions are not so prosperous as in the Cobleskill Valley.

Clover yields from 2 to 2½ tons of hay per acre and timothy following clover from 1 to 2 tons. Alfalfa, which is a comparatively new crop in this region, does well. Oats yield 35 to 45 bushels, buckwheat 25 to 35 bushels, and corn for ensilage about 10 tons per acre. Hops yield ordinarily about 725 pounds per acre.

Crop rotations are usually practiced on this type. Modern machinery is used and tillage is thorough. Commercial fertilizers are used for hops and oats, and many farmers top-dress their mowing land. Although this soil is naturally calcareous, the use of ground limestone has proved beneficial on many farms.

Improvements on this type are modern, and the buildings and fences are in good repair. Land values vary according to location, farms in the town of Sharon bringing \$35 to \$50 an acre, while those along the Cobleskill Valley bring from \$50 to \$100 an acre.

The extension of dairying and the production of alfalfa, as well as a more general use of some form of lime, are recommended for this soil.

In the following table the results of mechanical analyses of samples of the soil and subsoil of the Honeoye loam are given:

Mechanical analyses of Honeoye loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
162207.....	Soil.....	2.0	3.0	2.2	14.0	17.7	44.5	16.5
162208.....	Subsoil.....	1.4	2.8	2.2	14.8	21.1	38.7	18.8

MOHAWK SILT LOAM.

The surface soil of the Mohawk silt loam is a brown to dark grayish brown, mellow silt loam, from 8 to 12 inches deep, with an average depth of 9 inches. The subsoil is a grayish-brown, compact silt loam, changing at a depth of 15 to 18 inches to a darker gray silt loam carrying a large percentage of black shale chips. The lower subsoil and substratum are moderately calcareous. In places a small quantity of black shale chips is scattered over the surface and through the upper part of the soil section, but the predominant rock fragments are light-colored sandstone, except in areas bordering the Honeoye types, where there may also be some limestone.

There are included with this type a few areas of clay loam too small to show on a map of the scale used. About $2\frac{1}{2}$ miles north of Lawyersville an area occurs in which the surface soil is lighter than that of the typical Mohawk silt loam, and the subsoil is mottled and contains only a few fragments of black shale. In the northern part of the town of Sharon a variation occurs in which the surface soil is a light-brown to yellowish-brown silt loam about 6 inches deep, underlain by a mottled gray and yellow silt loam, becoming dark gray or grayish yellow at a depth of about 18 inches. The lower subsoil contains scattered fragments of the black Utica shale and in places grades into a silty clay. This variation owes its formation to the action of glacial ice, which spread a mantle of the lighter colored shales and sandstone material over the dark-colored till.

The Mohawk silt loam has its typical development in the north-western part of the county, mainly in the towns of Seward and Sharon. The topography is rolling, and drainage is generally adequate. The surface permits the use of all kinds of farm machinery.

This type is especially well adapted to dairying, which is fast becoming the chief industry. Hops, which were formerly an important crop are now grown to only a small extent. Oats, buckwheat, clover, and timothy are also grown, timothy to a very small extent. The lighter colored areas are used principally for the production of oats, buckwheat, and hops, the yields and general agricultural conditions being better than on the Volusia silt loam. At the present time hops and milk are the only farm products sold.

Oats yield 30 to 45 bushels and buckwheat 25 to 30 bushels per acre. Clover does exceptionally well, yielding 2 to 3 tons per acre. Hops yield from 650 to 725 pounds per acre.

Deep plowing, careful cultivation, and crop rotation are usually practiced. Mowing land is usually left in grass three or four years then plowed for corn, which is followed by oats, after which the land is reseeded to grass.

This type embraces some of the best farming land in the county. Good farms can be bought for \$35 an acre, although the average price of land is nearer \$45.

An extension of dairying, the growing of alfalfa, and the use of lime are recommended for this soil.

VOLUSIA STONY SILT LOAM.

The surface soil of the Volusia stony silt loam is a pale-yellow to grayish-brown silt loam, with an average depth of 8 inches. The subsoil, which extends to a depth of about 36 inches, is a yellowish-gray, compact silt loam, with gray, brown, and yellow mottlings. Both the surface soil and subsoil contain an abundance of angular sandstone fragments ranging in size from small cobbles to blocks 3 feet square.

The Volusia stony silt loam occurs throughout the county in small, widely scattered areas. The largest areas occur near Boucks Falls and northwest of Sloansville. The type occupies depressed areas or slopes where the underlying rock formations are not at great depth. Drainage is poor.

This type formerly was heavily forested with white pine, maple, hemlock, and beech, but most of the timber has been removed. The land is farmed only in a desultory manner, supporting a few dairy cows and sheep and producing a little hay of inferior quality. It can best be utilized for pasturage or forestry.

VOLUSIA SILT LOAM.

The Volusia silt loam consists of a brownish-gray silt loam, 6 to 8 inches deep, underlain by a pale-yellowish to gray silt loam, which changes within a few inches to a gray, yellow, and brown mottled, compact silt loam to heavy silt loam. Usually bedrock is not encountered within 3 feet of the surface, and in places the till has considerable depth. Small, angular fragments of sandstone are scattered throughout the entire soil section, but usually not in sufficient quantity to interfere with cultivation. Near the towns of Howes Cave, Grovenor Corners, Carlisle, and Barton Hill there are several small areas in which the limestone formation is encountered at depths ranging from 3 to 10 feet. As in the typical development, however, the soil-forming material is almost entirely derived from shales and sandstones and is not at all calcareous. Small depressions, seldom more than 10 by 20 feet in size, are characteristic of this variation.

Areas of the Volusia silt loam occur in every town in the county, with the exception of Broome and Conesville in the southeastern part. Probably its most typical development is in the towns of Carlisle, Esperance, Schoharie, and Wright. Throughout the southern

part of the county this type occurs around the heads of streams or in partially depressed areas. The topography is undulating to gently rolling (see Pl. III, figs. 1 and 2). The heavy, compact structure of the subsoil, together with the lack of natural drainage, renders this a cold soil and interferes with crop growth.

This type is not important agriculturally. Many of the farms are held in tracts of 600 to 700 acres. On most of the farms only a small area is under cultivation, while in many cases the fields are not even mowed for hay or used for pasturage. Some farms are deserted. The fences and buildings are generally in poor condition, and in many places the former have been entirely removed. Most of the original forest growth, which consisted of sugar maple, white pine, beech, and hemlock, has been removed, and at present golden rod, daisies, sorrel, and devils paintbrush abound in the pastures, old fields, and fence corners of cultivated fields.

The principal crops are timothy hay, oats, buckwheat, corn, and potatoes. At present timothy hay is the most important crop. It is usually baled and hauled to the nearest railroad station for shipment. Very little clover is grown, although excellent stands of red clover have been obtained with the use of lime. Nearly every farmer produces some oats for feeding stock. Potatoes are not extensively grown, as the product is of poor quality. Dairying is carried on in a desultory manner. As a rule a few cows of mixed breeds are kept, and the returns are correspondingly low. Some of the more progressive farmers, however, have good cows, usually Holstein. Where the farms are close enough to a railroad the raw milk is shipped, otherwise it is sent to the creamery or made into butter on the farm.

On some of the better farms yields of 1 to $1\frac{1}{2}$ tons of timothy hay to the acre are obtained, but on most farms only about one-half to three-fourths of a ton per acre is obtained. Oats yield 20 to 30 and buckwheat 25 to 35 bushels per acre. Owing to the short growing season and the poor drainage, very little corn is matured. It is grown mostly for fodder.

The agricultural methods followed by most of the farmers on this type are among the poorest in the county. There are but few silos, and crop rotations are seldom practiced. Fields are allowed to stand until the grass is too light to cut, when buckwheat or corn is grown one year, followed by oats, and then by grass. The soil is plowed only about 3 to 5 inches deep, and no manure is used. Tenants usually sell off practically all the hay and straw instead of keeping stock and feeding the roughage. A small quantity of commercial fertilizer is sometimes used with oats.

Land values vary with location and improvements. Thousands of acres in a more or less run down condition can be purchased at \$6 to

\$15 an acre. Farms with fair buildings are held at \$10 to \$18 an acre. The average price of land is less than \$15 an acre.

This type is best suited to dairying and the raising of live stock, especially sheep and poultry. All the manure should be returned to the soil, and some form of lime should be used. Most of the type requires artificial drainage for profitable production of crops.

VOLUSIA SILTY CLAY LOAM.

The surface soil of the Volusia silty clay loam is a light grayish brown loam to silty clay loam, about 8 inches deep, sometimes containing gray and brown mottlings in the lower part. The subsoil to a depth of about 36 inches is a light-yellow to gray silty clay loam, heavily mottled with yellow, orange, and brown. In many places the subsoil below 24 inches consists of a clay or silty clay and may carry a few dark-colored shale fragments, in this respect resembling the lower subsoils of the Mohawk series. There is usually a small quantity of light-colored, angular fragments of shale and sandstone strewn over the surface.

This type is of small extent, occurring mainly in the town of Seward. The topography is gently rolling to nearly level, and the natural drainage is poor.

General farm crops as well as some hops are grown. The yields are about the same as on the Volusia silt loam. Grass does well where properly drained. Land values vary according to the improvements, usually ranging from \$15 to \$30 an acre.

In the following table the results of mechanical analyses of samples of the soil and subsoil of this type are given:

Mechanical analyses of Volusia silty clay loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
162231.....	Soil.....	0.4	1.5	1.1	5.2	4.1	52.4	35.1
162232.....	Subsoil.....	1.0	1.3	.8	4.0	4.2	46.0	42.4

ALLIS SILT LOAM.

The Allis silt loam to an average depth of 8 inches is a light-gray to grayish-yellow, friable silt loam, underlain by a gray to brownish-gray silt loam, mottled with brown, yellow, and orange. The entire soil section contains a large percentage of small, shaly sandstone fragments. The type is shallow, ranging in depth from a few inches to about 20 inches, and narrow ledges and ridges of the underlying sandstone formation outcrop in many places, interfering with cultivation.

Near Howes Cave, Carlisle, Carlisle Center, Grovenor Corners, and Sloansville there is a variation of this type in which the sandstone and shale material overlies limestone, which is encountered at a depth of 8 to 20 inches.

The soil material in these areas was undoubtedly transported by the glacier in one of its east to west movements.

Where typically developed, the Allis silt loam occupies the tops of the higher elevations and the slopes of ridges. The largest area is encountered north of Esperance. Other bodies occur near Central Bridge, and 3 miles north of Gallupville. Drainage is unsatisfactory, seepage from the joint planes and crevices of the underlying ledges making the soil too wet during the spring season, while the shallowness of the soil causes it to be droughty in the summer.

Only a small proportion of this type is under cultivation. Buckwheat, oats, and hay are the principal crops. Only fair yields are obtained. A large proportion of the type is used for pasturing cattle and sheep. A forest growth of beech, maple, and hemlock usually covers the steepest slopes.

Very little of this type is changing hands at present. Land values are low, and the type can best be utilized for forestry.

Mechanical analyses of samples of the soil and subsoil of the Allis silt loam are given in the following table:

Mechanical analyses of Allis silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
162213.....	Soil.....	1.7	3.0	1.4	8.5	16.2	49.7	19.5
162214.....	Subsoil.....	2.7	3.4	1.7	11.7	19.3	43.4	17.5

LORDSTOWN STONY SILT LOAM.

The Lordstown stony silt loam consists of a light-brown to yellow, mellow silt loam, 5 to 8 inches deep, underlain by a yellow to light-yellow, friable silt loam, which rests upon bedrock at a depth of 12 to 36 inches. The surface is thickly strewn with shaly sandstone fragments ranging in size from small cobbles to boulders 3 feet or more in diameter. While the rock fragments are for the most part of local derivation, foreign rocks, such as gneiss, schist, granite, and quartzite, are often encountered. In many places the underlying shaly sandstone formation outcrops in the form of narrow ridges or ledges or lies just below the surface. Scattered throughout this type are a number of low-lying, poorly drained areas that would have been mapped in the Volusia series had they been of sufficient size.

The Lordstown stony silt loam is the most extensive soil type in the county. It occurs on the uplands in the towns of Seward, Cobleskill, Esperance, Schoharie, Wright, Middleburg, Fulton, Richmondville, Summit, Jefferson, Blenheim, Gilboa, and Broome. The topography is rolling to hilly and drainage is good.

Owing mainly to the distance from railroads, the elevation, and the high stone content, this type is not valued highly for agriculture. The early settlers established many farms upon it, but a large number of these have been abandoned and allowed to deteriorate.

Dairying is the principal industry on this type (see Pl. IV, figs. 1 and 2). Some farmers raise poultry on a commercial scale. A few sheep are kept. Enough hay is produced to feed the stock and any surplus is sold. Only a small acreage is devoted to the production of corn. Oats, buckwheat, and potatoes are grown mainly for home consumption.

Hay crops yield one-half to one and one-half tons, oats 25 to 35 bushels, buckwheat 15 to 20 bushels, and potatoes 75 bushels per acre. Very little commercial fertilizer is applied to any of these crops, and in many cases the barnyard manure is not utilized.

The price of land of this type ranges from \$6 to \$25 an acre, depending upon the condition of the soil and the character of the improvements. It seldom changes hands.

The Lordstown stony silt loam is best suited to dairying or stock raising. The raising of sheep for wool and mutton should be extended. The rougher and stonier areas should be reforested.

Lordstown stony silt loam, steep phase.—The Lordstown stony silt loam, steep phase, does not differ materially from the main type. It usually consists of 4 to 6 inches of a yellow to dark-yellow silt loam, underlain by a somewhat lighter colored, friable silt loam. A large number of angular fragments of shaly sandstone are scattered over the surface and throughout the soil section. These are numerous enough to interfere with cultivation. The underlying rock formations are close to the surface and often protrude.

This phase is mapped along the valleys throughout the southern part of the county, occupying steep hillsides which in places attain an elevation of 700 feet in half a mile. It is separated on the basis of topography, and the boundaries are therefore more or less arbitrary.

Most of this steep phase is utilized for pasturage or forestry. A part of it supports a second growth of hemlock, beech, and maple. Some small patches are used for the production of the general farm crops of the region, and fairly good yields are obtained. Land values are low.

This phase, because of its stony character and steep topography, should never have been cleared. Cultivated fields should be reforested or seeded to grass and used for permanent pasture, and forested areas should receive careful attention.

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

Mechanical analyses of Lordstown stony silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
162241.....	Soil.....	1.6	2.6	1.1	5.9	15.1	52.5	21.0
162243.....	Subsoil.....	4.1	4.7	1.7	7.9	19.0	46.0	16.3

LORDSTOWN SILT LOAM.

The surface soil of the Lordstown silt loam is a light-brown to yellow, friable silt loam from 6 to 8 inches deep. The subsoil consists of a light-yellow to slightly grayish yellow, friable silt loam. Both the soil and subsoil contain small, angular fragments of shaly sandstone. Bedrock, consisting of gray sandstones and sandy shales, is encountered at a depth of 2½ to 6 feet.

This type is most extensively developed in the western part of the county, with smaller areas scattered throughout the uplands in the southern part. It is typically developed in the towns of Summit, Richmondville, Seward, and Cobleskill. The topography is gently sloping to rolling, and both surface drainage and underdrainage are well established. Some of the more shallow areas suffer from drought during the summer months.

Most of this type has been cleared and is under cultivation. A small percentage of it has been allowed to deteriorate and is not of much value for agriculture. The soil is well adapted to the general farm crops of the region. Buckwheat, oats, and hay are the principal crops. Yields are fair. Very little commercial fertilizer is used. Land values range from \$8 to \$45 an acre, depending mainly upon location.

This type of soil is well adapted to potato growing and is utilized for that purpose throughout the potato region of southern New York. At present the meadows are left down too long. Rotation should be more generally practiced. The utilization of all stable manure, together with applications of limestone, can not be too strongly urged.

Lordstown silt loam, steep phase.—The Lordstown silt loam, steep phase, consists of a light-brown to yellowish-brown silt loam, 4 to 6



FIG. 1.—SCENE ON THE VOLUSIA SILT LOAM.



FIG. 2.—TOPOGRAPHY AND BUILDINGS ON VOLUSIA SILT LOAM.



FIG. 1.—PASTURE ON THE LORDSTOWN STONY SILT LOAM. DAIRYING IS THE PRINCIPAL INDUSTRY ON THIS TYPE.



FIG. 2.—BUILDINGS ON A DAIRY FARM IN THE REGION OF LORDSTOWN SOILS.

inches deep, underlain by a yellow to pale-yellow, friable silt loam. Both soil and subsoil carry a few small, angular sandstone fragments, and bedrock usually is encountered within 2 or 3 feet of the surface.

This phase is developed principally in the towns of Seward, Cobleskill, Middleburg, and Richmondville. It occupies hillsides that are too steep for profitable cultivation and is well drained.

A part of this phase is under cultivation, but most of it is utilized for pasturage or woodland. It should never have been entirely cleared. Land values are low.

WOOSTER GRAVELLY SILT LOAM.

The Wooster gravelly silt loam consists of a light-brown to yellow, mellow silt loam, 6 to 10 inches deep, underlain by a yellow to light-yellow, friable silt loam, which extends to a depth of 3 feet or more or gives way at about 2 to 3 feet to a loam or gravelly layer. The soil and subsoil contain varying quantities of waterworn gravel and angular fragments of sandstone, and the substratum is very gravelly or stony. The stone and gravel are usually of small size and do not interfere seriously with cultivation. A few small bodies of stratified kame and esker formation and others, consisting of reddish morainic material similar to that of the Lackawanna soils in the southern part of the county, are included with this type.

The Wooster gravelly silt loam occurs principally in the towns of Richmondville and Summit, with smaller areas through the southern part of the county. The material consists of morainic deposits along the heads of the larger valleys or streams. The natural drainage is adequate.

This soil is farmed in connection with the adjacent types, and similar yields are obtained. Potatoes, corn, and oats do especially well. Commercial fertilizer is used on corn and oats.

CULVERS STONY SILT LOAM.

The surface soil of the Culvers stony silt loam is a brown to pinkish-brown stony silt loam, 7 to 10 inches deep. The subsoil to a depth of 3 feet or more is a brown to yellowish-brown, heavy loam or silt loam, which also has a decidedly pinkish cast. The type carries enough angular fragments of gray and red sandstone to interfere somewhat with cultivation. This type is intermediate between the light-brown soils of the Lordstown series, derived largely from gray shales and sandstones, and the Lackawanna soils, which are derived almost entirely from the red Oneonta sandstone.

This type has its principal development in the southeastern part of the county, in the towns of Broome, Conesville, and Gilboa. The topography is rolling to hilly, and drainage is well established.

Agriculture is not well developed on this soil type. Dairying is probably the main industry. Most of the milk is made into butter at home. Some hay is produced for market. Much of the type is in forest or pasture. Farm buildings are in a fair condition of repair. Only a few farms have silos.

Hay crops yield 1 to 1½ tons per acre. Corn yields 8 to 10 tons of silage per acre. Oats yield 25 to 35 bushels, buckwheat 18 to 25 bushels, and potatoes 75 to 100 bushels per acre. Only a small quantity of commercial fertilizer is used. Crop rotations are practiced only in a general way.

Better methods of cultivation, crop rotation, either the raising of sheep or dairying, and the introduction of silos are recommended. Much of the land should be reforested.

Farms range in value from \$8 to \$30 an acre, depending upon improvements and the proportion of the land under cultivation.

LACKAWANNA STONY SILT LOAM.

The Lackawanna stony silt loam consists of a brownish-red to bright-red, mellow silt loam, 8 to 12 inches deep, underlain by a reddish-brown silt loam. Red sandstone fragments are numerous on the surface and through the soil section, seriously interfering with cultivation.

This type is confined to the southern part of the county, the largest areas occurring in the towns of Jefferson and Conesville. The topography varies from rolling to mountainous, and drainage is good.

Owing to the unfavorable topography, only a relatively small proportion of this type is under cultivation, most of it being used for pasturage and forestry. It produces good yields of hay, corn, oats, and buckwheat. Dairying is the most important industry, the milk going to local creameries for shipment to New York City.

Land values vary greatly within short distances and depend upon the agricultural possibilities and condition of the farm improvements.

Probably the best uses of this type are for dairying, sheep raising, and forestry.

SCHOHARIE SILTY CLAY.

The Schoharie silty clay consists of a brown to reddish-brown silty clay, with an average depth of 9 inches, underlain to a depth of 36 inches or more by a grayish-brown to reddish-brown, heavy silty clay loam or silty clay, usually thickly mottled with gray and brown. The type as a whole is quite free from rock fragments. In places there are a few inches of till, containing limestone and sandstone fragments overlying the lake-deposited material of which this type

consists, but as the total area of such material is less than 200 acres, it is not shown on the map.

This type occurs along the Schoharie Creek Valley in the towns of Gilboa, Blenheim, Fulton, Middleburg, Schoharie, and Esperance. The topography is nearly level to rolling and broken.

The rolling and broken areas of this type are not well developed agriculturally. Some hay, oats, and buckwheat are grown and a few cows are kept. Only small yields are obtained. On the level areas in the towns of Middleburg and Schoharie, however, agricultural conditions are excellent. Here dairying is the main industry, and hay, oats, and wheat are the principal crops. A little corn is grown for ensilage and hops are grown to a small extent. Hay crops yield $1\frac{1}{2}$ to 2 tons, oats 35 to 45 bushels, and wheat 20 to 40 bushels per acre. Commercial fertilizers are used and crop rotations are generally practiced. Modern machinery is used on nearly every farm. The buildings are in good repair, and the farms show evidences of thrift.

The price of land of this type ranges from \$50 to \$150 an acre. The land seldom changes hands.

Results of mechanical analyses of samples of the soil and subsoil of the Schoharie silty clay are given in the following table:

Mechanical analyses of Schoharie silty clay.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
162201.....	Soil.....	0.1	0.9	0.7	3.7	3.4	51.0	40.0
162202.....	Subsoil.....	.0	.3	.3	1.0	0.7	47.6	50.0

CHENANGO GRAVELLY LOAM.

The Chenango gravelly loam consists of a brown gravelly loam, 8 to 12 inches deep, underlain by a yellowish-brown to yellow gravelly loam, which extends to a depth of 3 feet or more. The lower part of the subsoil is usually coarser in texture than the upper part, and in many places it consists of stratified gravel or coarse sand. The gravel includes both waterworn and subangular fragments of light-colored sandstone and shale. It seldom occurs in quantities sufficient to interfere with cultivation. There are included with this type a few areas having a darker color and in which the predominating gravel consists of limestone. Such areas would have been mapped as the Fox gravelly loam had they been of sufficient size. Near the village of Dorloo there is an included area of silt loam about 200 acres in extent. Here the surface soil consists of a brown to grayish-brown silt loam, about 9 inches deep, underlain

by a yellow silt loam containing gray and brown mottlings, and extending to a depth of about 22 inches, where a stratum of fine to medium sand is encountered.

The Chenango gravelly loam is most extensively developed along Cobleskill and Schoharie Creeks. The largest areas are found near Middleburg and northeast of Richmondville. Smaller areas occur throughout the larger valleys in the uplands. The type occupies level to undulating terrace areas and is well drained.

Nearly all the Chenango gravelly loam is under cultivation, as it is recognized as one of the best soils in the county. Corn is grown both for silage and for grain and yields an average of 12 tons of the former and 35 to 70 bushels of the latter per acre. Oats yield from 35 to 65 bushels and hops 600 to 700 pounds per acre. Mixed hay crops yield $1\frac{1}{2}$ to 2 tons per acre. A few good stands of alfalfa have been obtained on this soil type.

Good cultural methods are employed, and both stable manure and commercial fertilizer are used. Farm buildings are above the average. Land values range from \$75 to \$150 an acre.

TUNKHANNOCK VERY FINE SANDY LOAM.

The Tunkhannock very fine sandy loam consists of a brown to reddish-brown very fine sandy loam, 8 to 12 inches deep, underlain by a brown to reddish-brown fine sandy loam to very fine sandy loam, which extends to a depth of 3 feet or more. On the larger flats near Schoharie the soil approaches a silty fine sandy loam and even a silt loam in texture.

The Tunkhannock very fine sandy loam occurs along Schoharie Creek in the towns of Gilboa, Blenheim, Fulton, Middleburg, Schoharie, and Esperance. In the last-named town the material lacks the pronounced reddish color that is exhibited to the southward. The type occupies low-lying, level terraces along Schoharie Creek, where the material is largely from the red shales and sandstones of the Catskill Mountains. It lies above normal overflow and is well drained, except in unusually wet seasons.

The Tunkhannock very fine sandy loam is well developed agriculturally. Wheat, oats, hay, and hops are the principal crops. In the vicinity of Schoharie there are several large fruit nurseries. Wheat yields 20 to 35 bushels and oats 45 to 60 bushels per acre. Hay crops do well, considering the texture of the soil, mixed clover and timothy yielding $1\frac{1}{2}$ to 2 tons per acre. Some exceptionally fine hop yards are located on this type and yields of 650 to 750 pounds per acre are obtained. The farmers have modern implements and practice good cultural methods. The farm buildings are in excellent condition.

Land values are high, especially for this section of the State, farms being held at \$125 to \$200 an acre.

A number of areas of Tunkhannock gravelly loam occurring in association with the Tunkhannock very fine sandy loam, mainly in the towns of Gilboa and Conesville, are included with the latter type and are indicated by gravel symbols on account of their small extent. The surface soil of the Tunkhannock gravelly loam consists of a dark-brown to dark reddish brown gravelly very fine sandy loam to silty loam, and the subsoil of a red to reddish-brown gravelly very fine sandy loam to loam. Stratified gravel usually occurs at a depth of 24 to 30 inches, but the particles are generally of small size and do not interfere with cultivation. These included areas are utilized for general farm crops. Corn does well and is grown both for grain and ensilage. Some oats and hay are also grown and fair yields are obtained.

In the following table the results of mechanical analyses of samples of the soil and subsoil of the Tunkhannock very fine sandy loam are given:

Mechanical analyses of Tunkhannock very fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
162205.....	Soil.....	0.0	0.2	0.3	14.3	25.6	47.0	12.5
162206.....	Subsoil.....	.0	.0	.3	22.1	29.2	37.8	10.6

GENESEE SILT LOAM.

The surface soil of the Genesee silt loam to an average depth of 10 inches is a brown to dark-brown silt loam. This is underlain by a dark-brown silt loam, which extends to a depth of 36 inches or more, and is deeply mottled in many places with gray and yellow. The entire soil section is practically free from rock fragments.

Included with this type are a number of small areas of Genesee gravelly loam, having a brown to dark-brown, gravelly loam surface soil, about 10 inches deep, and a somewhat lighter colored subsoil of similar texture. The gravels consist of light-colored shales and sandstones, with occasionally some limestone. They are not plentiful enough to interfere with cultivation.

The largest area of the Genesee silt loam occurs along Cobleskill Creek near the village of Cobleskill. Smaller areas are encountered in first-bottom positions throughout the county. Usually the natural drainage is deficient.

Where well drained this soil is suited to the production of general farm crops and to pasturage. Its agricultural value depends pri-

marily upon drainage conditions. It is utilized mainly as mowing and pasture lands.

BARBOUR VERY FINE SANDY LOAM.

The surface soil of the Barbour very fine sandy loam is a dark-brown to reddish-brown, mellow very fine sandy loam, 8 to 12 inches deep. The subsoil is slightly lighter in color and of similar texture. In places the type contains a small quantity of waterworn fragments of sandstone and shale.

The Barbour very fine sandy loam occurs only in the eastern and southeastern parts of the county along the Schoharie Creek and its tributaries, and is subject to overflows. The topography is level to nearly level and the drainage is usually deficient.

Only a few of the larger and better drained areas are under cultivation, and these are devoted to general farm crops. Where sufficiently well drained this soil produces good yields of corn, oats, and hay.

In the following table the results of mechanical analyses of samples of the soil and subsoil of the Barbour very fine sandy loam are given:

Mechanical analyses of Barbour very fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
162203.....	Soil.....	0.0	0.1	0.1	12.8	39.1	40.5	7.2
162204.....	Subsoil.....	.0	.0	.3	16.6	39.1	36.4	7.6

ROCK OUTCROP.

Rock outcrop comprises areas in which the bedrock is either completely exposed or has such a thin covering of soil as to be incapable of supporting anything but a scant growth of scrub timber and briars. Such areas usually occur as steep slopes and ledges, the rocks on the slopes consisting of shale and sandstone, while the ledges are of limestone.

ROUGH STONY LAND.

Rough stony land includes areas that are too rough and stony for cultivation. There are a few patches of arable land occurring within the areas of Rough stony land, but these are too small to indicate on the map. This type is encountered mainly within the region occupied by the Culvers and Lackawanna soils in the towns of Conesville, Gilboa, and Jefferson. In places it affords a little pasturage, but the greater part of it is forested with a scattered growth of hemlock, maple, beech, and pine. The value of Rough

stony land depends upon the quality and quantity of the forest growth. Its best use is for forestry.

MUCK.

The surface soil of Muck consists of an accumulation of dark-brown to black decomposed vegetable matter mixed with fine particles of soil washed from higher lying areas. It varies in depth from 12 inches to several feet. The subsoil is usually a blue or mottled gray and drab plastic sandy clay.

The largest areas of Muck are encountered in the towns of Sharon and Carlisle, while smaller areas are widely scattered throughout the uplands. All the areas occupy low-lying positions and are naturally poorly drained. Most of this type supports a growth of cedar, hemlock, and elm, as well as water-loving plants and bushes. None of it is under cultivation. A few of the larger areas might be reclaimed by drainage. Values are based on the quantity and quality of the standing timber, the larger tracts usually bringing about \$10 an acre.

MEADOW.

The term Meadow is applied to poorly drained areas not suitable for cultivation or for any use other than pasturage. The surface soil is usually dark colored, while the subsoil is mottled gray, brown, and yellow. The texture of the soil varies widely even within a few feet.

Meadow occurs in small, scattered areas throughout the county. It is usually encountered along streams, and is low, wet, and swampy. A few areas are too small to show on a map of the scale used.

SUMMARY.

Schoharie County is situated in the eastern part of New York. It has an area of 620 square miles, or 396,800 acres.

The topographic features are the rolling uplands in the northern part of the county and the rugged mountainous section in the southern part. Elevations range from 600 to 3,200 feet above sea level.

The summers are mild and pleasant, while the winters are long and cold. The growing season is long enough to mature most of the crops grown in this region and the rainfall is abundant and evenly distributed.

Schoharie County was settled early in the eighteenth century. The population of the county decreased from 32,910 in 1880 to 23,855 in 1910. About 75 per cent of the population is rural and the density of the rural population is 37.2 persons per square mile.

At present dairying is the most important industry, the chief products being raw milk and butter. The principal farm crops are hay and forage, oats, and buckwheat. Other important crops are corn, rye, wheat, barley, potatoes, and hops.

Approximately 90 per cent of the total area of the county is in farms, and of this 69 per cent is improved. There are 2,495 farms, of an average size of 112.9 acres. Nearly 76 per cent of the farms are operated by owners and nearly 23 per cent by tenants. The adaptation of soils to crops is recognized only in a general way. Commercial fertilizers are used to some extent. Much of the land under cultivation is too rough for the use of machinery.

The soils of the county are divided into three groups, based on origin, character of material, and method of formation. These are ice-laid soils, stream terrace and lake-laid soils, and alluvial soils. In all, 14 series of soils, embracing 18 distinct types, in addition to areas of Muck, Meadow, Rough stony land, and Rock outcrop, are mapped. The glacial-till soils occupy the uplands and are the most extensive and important soils in the county. The topography of these soils ranges from hilly to mountainous, and drainage is good.

The Ontario series is represented by one type, the silt loam. This soil is composed of calcareous till from light-colored shales and sandstones, with a small proportion of limestone. It is a productive soil. Hops, oats, and buckwheat are the principal crops, and dairying is an important industry. Good farms on this type sell for \$50 an acre.

The Honeoye series comprises the highly calcareous soils of the limestone belt in the northern part of the county. This series is represented by two types, the stony loam and loam. Agricultural conditions on these types are among the best in the county. Good yields of clover and timothy hay and alfalfa are obtained. Hops, oats, and corn also do well. Dairying is an important industry. Land values range from \$35 to \$100 an acre.

The Mohawk series is represented by one type, the silt loam, having a brown to dark-brown surface soil and a grayish-brown to dark brownish gray, slightly calcareous subsoil. The principal crops are hops, clover, oats, and buckwheat. Dairying is carried on and is increasing in importance. Land values are relatively low, considering the productiveness of the soil.

The Volusia series is represented in Schoharie County by three types, the stony silt loam, silt loam, and silty clay loam. The material forming these soils is derived from light-colored shales and sandstones. The soils are poorly drained and mottled and have a low value.

The surface soils of the Allis silt loam is light gray to grayish and yellow, and the subsoil is gray to brownish gray, mottled with brown,

yellow, and orange. This is a poorly drained soil and only a small proportion if it is under cultivation. Buckwheat, oats, and hay are the principal crops. Only fair yields are obtained.

The Lordstown is the most extensively developed series in the county. The surface soils are light brown to yellowish brown and the subsoils are yellow to grayish yellow. The abandoned and run-down farms of southern New York are located on these soils. This series is represented by two types, the silt loam and stony silt loam, each with a steep phase. These types are best suited to dairying or sheep raising.

The Wooster gravelly silt loam is a light-colored, well-drained soil. It is inextensive and is farmed in connection with other types. Potatoes, corn, and oats do well.

The Culvers stony silt loam has a brown to pinkish-brown surface soil and a brown to yellowish-brown, heavy loam or silt loam subsoil with a decidedly pinkish cast. Agricultural conditions are poor on this type. Dairying is the principal industry. Some hay is produced for market. Much of the type is in forest or pasture.

The surface soil of the Lackawanna stony silt loam is brownish red and the subsoil is somewhat lighter in color. The topography is rolling to hilly and mountainous. Only a small proportion of the type is under cultivation. It is devoted mainly to pasturage and forestry.

The surface soil of the Schoharie silty clay is brown to reddish brown and the subsoil is grayish brown to reddish brown, with gray and brown mottlings. The topography ranges from nearly level to rolling and broken. On the more level areas agricultural conditions are excellent. Dairying is the main industry, and hay, oats, and wheat are the principal crops.

The Chenango gravelly loam has a brown surface soil and a yellowish-brown to yellow subsoil. This type, though inextensive, is one of the best soils in the county and is fairly well developed. Corn, oats, and hay are the principal crops.

The Tunkhannock series is represented by one type, the very fine sandy loam. This is a brown to reddish-brown, low-lying, level terrace soil occurring along Schoharie Creek. It lies above normal overflow and is usually well drained. Good yields of wheat, oats, hay, and hops are obtained. Land values are relatively high.

The first-bottom soils subject to overflow are represented by the Barbour very fine sandy loam and the Genesee silt loam, which are of small extent and relatively unimportant.

Muck consists of an accumulation of dark-brown to black decomposed vegetable matter mixed with fine particles of soil washed from higher lying areas. None of it is under cultivation, owing to its undrained condition.

The term Meadow is applied to poorly drained areas not suitable for any agricultural use other than pasturage. Small scattered areas of Meadow occur throughout the county.

Rock outcrop represents rock exposures which in places have a sufficient covering of soil to support a scant growth of scrub trees and briers.

Rough stony land includes areas that are too rough and stony for cultivation but afford a little pasturage.



[PUBLIC RESOLUTION No. 9.]

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

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

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

Approved March 14, 1904.

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

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