

SOIL SURVEY OF MERCER COUNTY, PENNSYLVANIA.

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DESCRIPTION OF THE AREA.

Mercer County, Pa., is situated in the northwestern part of the State, along the Ohio line, almost midway between Pittsburgh and Erie. It is bounded on the north by Crawford County, on the east by Venango County, and on the south by Butler and Lawrence Counties. It contains 700 square miles, or 448,000 acres.

Mercer County presents a wide range in topographic features. The surface ranges from almost level on plateaus and in the valleys, through slightly rolling to strongly rolling or even rough and broken. The southeastern townships of Liberty, Pine, and Wolf Creek are extremely variable in topography. In some places there are strong morainic features while in other places the surface is quite hilly as the result of erosion. On the other hand, there are many large areas which are gently rolling or even level. Some of these areas are low and wet, and not infrequently they constitute mucky swamps. Northwest from these three townships morainic topography becomes more predominant and the surface is mainly gently rolling to hilly, especially in Springfield Township. The more level areas in this section occur along the Mercer and Grove City road. From Mercer west to Sharon, on the Ohio line, the surface is that of a plateau which has been dissected by streams. The slopes to the streams are often long and steep, but on the top of the plateau there are often long stretches of gently rolling to almost level country. In places, however, the level country is broken by knolls and ridges, such as Keel Ridge. Glacial material deposited on the valley slopes often gives them a rather billowy topography. Some of the smaller streams are bordered in places by almost precipitous slopes.

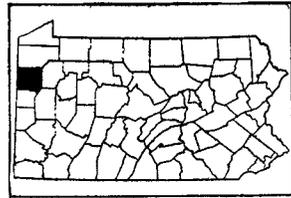


FIG. 6.—Sketch map showing location of the Mercer County area, Pennsylvania.

The northwestern and north-central parts of the county also consist of dissected plateaus, which include comparatively extensive level areas on the plateau tops with few local elevations. Such broad

level areas occur along the Ohio line, in the vicinity of Kremis, and north of Fairview.

The northeastern corner of the county includes level areas as well as hilly and broken country. Along French, North Deer, and Mill Creeks the slopes are often so steep and broken as to be unsuited for cultivation. The difference in elevation between the uplands and valleys is over 320 feet in places. The highest elevations vary from 1,450 to 1,500 feet above sea level.

South of this plateau country, in Sandy Lake Township and in the northern part of Worth Township, is the most strongly developed and most extensive system of moraines in the county. The topography varies from rolling to hilly, but none of the land is too rough for farming. The hill about three-quarters of a mile southeast of the Arab School, 1,620 feet above sea level, is the highest elevation in Mercer County. In marked contrast to this rolling topography, a large area to the west in Jackson Township is level to very gently rolling, and in places poorly drained.

The eastern part of the county ranges in elevation from 1,200 to 1,500 feet above sea level, while elevations in the western part range from slightly over 825 feet in the valleys to 1,200 feet on the plateaus. The lowest elevation in the county, 822 feet, is near the Lawrence County line where the Shenango River leaves Mercer County.

The drainage of the northeastern part of the county finds an outlet into the Allegheny River, in Venango County. The remainder of the county drains into Big Beaver River. The general direction of stream flow is southeast. The Shenango River pursues a rather crooked course throughout the entire length of the western part of the county. These streams and their tributaries reach most parts of the county, but there are level areas, to which the streams have not yet extended, and swampy areas, with only sluggish drainage, which are covered with water during the greater part of the year.

Many of the early settlers in the territory now comprised in Mercer County came from Westmoreland, Washington, Fayette, and Allegheny Counties. The period of settlement began more than a century ago, for by 1800 the population of the county was 3,228, and in 1803 the county was organized. The present rural population is made up largely of persons descended from the early settlers, many of whom were of Irish extraction. In Hickory, Hempfield, and Pine Townships there are some farmers of German descent. The population of some of the towns includes many nationalities.

In the last few decades there has been a marked decrease in the rural population of Mercer County. In 1880 the rural population amounted to 47,470, including the inhabitants of towns having less than 2,500 residents. In 1890 the number had decreased to 44,611, and in 1910 to 39,022. On the other hand, the urban population has

showed a very marked increase, from 8,691 in 1880 to 38,677 in 1910. It has increased even more rapidly in the last few years.

The population of Mercer, the county seat, is nearly 2,000. The chief commercial city is Sharon, in the southwestern part of the county on the Ohio line. Including the suburbs, its population is close to 25,000. Greenville, in the northwestern part of the county, has about 8,000 inhabitants. Thiel College is located here, and there are a number of industries. Grove City, in the southeastern part of the county, has a population of about 4,000. There are located here Grove City College, a government creamery, and various other industries. Sharpsville, an industrial town northeast of Sharon, has about 4,000 inhabitants. Smaller towns are West Middlesex, Jamestown, Stoneboro, Sandy Lake, and Fredonia.

Practically all of Mercer County is fairly accessible by railroads. Lines of several systems traverse the county in all directions, giving ready means of communication with the Pittsburgh coal and iron district, Erie, and other large centers.

The public roads are generally in a good state of repair. A good macadam road extends from Sharon through Mercer to a point within 2 miles of Grove City. Main roads from Pittsburgh to Conneaut Lake and Lake Erie pass through Mercer County.

There are excellent markets for farm produce and dairy products. Grove City, Sharpsville, Greenville, Sharon, and Youngstown, Ohio, together with a number of smaller towns, offer good opportunities for the disposal of farm products. Some of the dairy products are shipped as far as the Pittsburgh district.

CLIMATE.

The climate of Mercer County is temperate and healthful, being characterized by moderately hot summers and moderately severe winters. The extremes of temperature are slightly greater than in some other parts of the State, and more frequent and sudden changes in the weather occur. A temperature above 100° has been recorded on only one occasion, in July, and there is an average of only about 15 days each year with a temperature of 90° or above. There is an annual average of about 100 days with freezing temperatures, while a minimum of 20° or more below zero is reached almost every winter.

The average annual precipitation is nearly as great as that of the Delaware and Susquehanna Basins, but the rainfall occurs in smaller amounts at more frequent intervals, and precipitation in excess of 2½ inches in 24 hours is of rare occurrence. There is an average of about 150 rainy days per annum.

The mean annual temperature is 48.2° F. The winter mean is 27.8° and the summer mean 68.1°. The lowest temperature on record is -27°, reached in January, and the highest 101°, in July.

The mean annual precipitation is 41.72 inches. The precipitation is remarkably evenly distributed throughout the year, but is somewhat heavier during the period from March to July, inclusive. The rainfall has ranged from 29.63 inches in the driest year on record to 50.17 inches in the wettest year. There is a heavy snowfall in this region, the annual fall averaging 52 inches, unmelted.

The average growing season is of sufficient length for the maturing of all the ordinary farm crops. The average date of the last killing frost in the spring is May 27, and that of the first in the fall October 2, the intervening season being 127 days in length. Early maturing varieties of corn are grown, as early fall frosts are not uncommon. The earliest killing frost on record occurred on September 14, and the latest killing frost in the spring June 17. The valleys and places of low elevation are usually more susceptible to frost injury than the adjacent hills and slopes, but at times a fog blanket settling in the lower places acts as a protection against frosts.

In the following table are shown the most important climatic data as compiled from the records of the Weather Bureau station at Greenville, which is in the northwestern part of the county. These data are based on records covering a period of 19 years.

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

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.....	31.0	65	- 8	2.79	2.27	4.49	12.9
January.....	27.0	72	-27	3.57	3.43	3.95	13.4
February.....	25.3	65	-20	2.66	1.62	2.17	12.6
Winter.....	27.8	72	-27	9.02	7.32	10.61	38.9
March.....	36.9	84	- 8	4.07	1.94	2.41	6.7
April.....	45.8	87	11	2.97	2.55	3.49	1.5
May.....	57.7	95	23	3.39	3.03	2.00	.1
Spring.....	46.8	95	- 8	10.43	7.52	7.90	8.3
June.....	66.7	96	29	4.27	1.78	5.98	.0
July.....	70.5	101	36	5.14	3.32	2.25	.0
August.....	67.2	96	35	3.56	.54	8.02	.0
Summer.....	68.1	101	29	12.97	5.64	16.25	.0
September.....	62.0	94	26	3.27	6.03	7.41	.0
October.....	49.6	84	19	3.22	.65	4.89	1.4
November.....	38.4	74	9	2.81	2.47	3.11	3.5
Fall.....	50.0	94	9	9.30	9.15	15.41	4.9
Year.....	48.2	101	-27	41.72	29.63	50.17	52.1

AGRICULTURE.

At one time the raising of sheep and beef cattle was the leading industry in Mercer County, but at present general farming and dairying are the principal agricultural industries and stock raising is of secondary importance. Market gardening, and fruit and berry growing are also engaged in to some extent. The total value of agricultural products in 1909 was about \$5,000,000.

Corn has always been an important crop. In 1909 corn was grown on 23,170 acres as compared with 23,494 acres in 1879. The area in corn in 1917 was 25,932 acres. The average yield of corn in the last four census years is almost 35 bushels per acre, but for 1916 and 1917 the average yields have been 30 and 25 bushels, respectively. The bulk of the corn crop is fed on the farm. In the last few years the area devoted to corn has been greatly increased. White Cap Yellow Dent is the most widely grown variety, because of its early maturity. Other prominent varieties are Clarage, Reids Yellow Dent, and Lancaster County Sure Crop. The principal ensilage varieties are Eureka, Improved Leaming, Cuban Giant, and Keystone Pride.

Oats have generally occupied a greater acreage than any other grain crop, and although the area in oats decreased from 32,834 acres in 1889 to 24,794 acres in 1916, there was an increase in 1917 to 26,530 acres. The average yield in the four census years from 1880 to 1910 has been 33.5 bushels per acre. In 1917 the average yield was 37 bushels. The cool, moist climate of Mercer County is unusually favorable for the growing of oats. Most of the crop is fed to live stock, but a small surplus is occasionally sold. Some of the principal varieties of oats are Siberian, Silver Mine, Swedish Select, Lincoln, and Sixty Day.

The average yield of wheat in Mercer County is from 16 to 18 bushels per acre. This is not a high average yield for the section of the country. Unfavorable conditions of freezing and thawing, causing "heaving," are usually the cause of low yields. The area in wheat in 1917 was 19,463 acres; in 1909 it was 18,007 acres as compared with 23,321 acres in 1879. Wheat is commonly sold to local millers and it is often an important source of farm income. Only a small part of the production is retained for consumption on the farm. Fultz is the most common variety grown.

The growing of rye has been restricted to certain local areas. Some farmers prefer rye to oats for seeding with grass or clover, as they say the dense foliage of oats shades the clover seedlings to such an extent as to weaken them and make them unable to resist drought when the nurse crop is removed.

Buckwheat has always been grown over a moderately large area. Many farmers grow buckwheat in the rotation, either as a source of

income or as a subsistence crop. (See Pl. XVII, fig. 1.) It is grown to advantage following the failure of winter wheat or corn. In 1909 there were 7,073 acres devoted to buckwheat, and the average yield was slightly in excess of 16 bushels per acre. In 1917 buckwheat occupied 7,522 acres, and gave an average yield of 18.8 bushels per acre. The average yield for the State is about 20 bushels per acre. The principal varieties grown in the county are Japanese and Silver Hull.

Potatoes are less sensitive to soil acidity than most other crops, and potato growing has become a fairly well developed industry. From 1879 to 1909 the acreage of potatoes more than doubled. Climatic conditions cause a wide variation in the yield from year to year. In 1889 the average yield per acre was 71.6 bushels, and in 1899, 108.4 bushels. In 1917, 6,458 acres produced 542,472 bushels, or an average of 84 bushels per acre. In some sections of the county potatoes are grown in fields 6 to 8 acres in extent. The surplus crop is either sold on near-by markets or shipped. Among the many varieties of potatoes grown the Carmen, Sir Walter Raleigh, Rural New Yorker, Dibble's Russet, and White Giant are probably the most important.

The climatic conditions in this region are favorable to grass crops. In 1917, 77,289 acres were devoted to hay and forage crops, which area was almost equal to the combined area of all the cereal crops. In 1909, of 71,612 acres occupied by tame or cultivated grasses 39,981 acres were occupied by timothy alone, 29,721 acres by mixed clover and timothy, and only 1,044 acres by clover alone. The average yield of hay varies from slightly over 1 ton to 1 $\frac{3}{4}$ tons per acre. The value of the hay crop in 1916 was \$1,556,408. The hay produced is largely fed to live stock, but some of it is sold in near-by towns and cities.

A majority of the farms have small home orchards, and the aggregate production of fruit is quite large. There are several well-kept commercial orchards, one of 45 acres in extent. Apples and peaches are the most important fruits, but there are a large number of pear, plum, cherry, and apricot trees. Most of the fruit is sold in the near-by towns and cities. A considerable quantity of cider is made in years when yields are sufficiently large. In 1909 there were 194,670 apple trees in the county, 72,251 peach trees, and 9,976 grape vines. Some of the principal varieties of apples grown are the Baldwin, Stayman Winesap, Jonathan, York Imperial, and Stark Delicious. The varieties of peaches include the Elberta, Champion, Solway, and Crosby. White varieties of peaches, it is said, do not winter-kill as easily as yellow varieties, but hardy yellow varieties can be grown successfully. Burbank, Satsuma, and Abundance are varieties of plums that usually succeed. Apricots usually mature in four years out of five. One prominent variety is the Moorpark.



FIG. 1.—FIELD OF BUCKWHEAT ON THE VOLUSIA SILT LOAM.



FIG. 2.—CROSS SECTION OF THE WOOSTER SILT LOAM,
OCCUPYING A SMALL KAME.

Some of the many varieties of grapes grown are the Concord, Niagara, Wyoming, and Pocklington.

Strawberries, raspberries, and blackberries are grown in many parts of the county, particularly in the vicinity of towns and cities, which consume a large part of the crop. Stoneboro is a well-known strawberry center, 20 to 30 carloads of berries being shipped from this point annually. Several local varieties of strawberries have been developed. Some of the leading varieties grown are the William Belt, Glen Mary, Eclipse, and Stoneboro Belle.

Vegetables are grown on almost every farm, and market gardening is steadily becoming more important in the vicinity of Sharon, Greenville, and Grove City. During the present season a large acreage was devoted to cabbage. Some attention is being paid to the growing of special varieties of cantaloupes.

In 1909 the maple groves of the county produced 19,321 gallons of sirup and a small quantity of sugar. This is larger by 3,500 gallons than the production in 1879, but in that year there were 15,824 pounds of sugar produced also.

The revenue from all animal sources in 1909, including animals sold or slaughtered, dairy products, poultry and eggs, and wool, amounted to over \$2,000,000. At one time sheep raising and the production and feeding of beef cattle were of considerable importance, but both the size and the number of flocks of sheep have decreased. Competition with western ranges and the increasing cost of feed have caused an even greater decline in the beef-cattle industry. Among several exceptions is a farm, near Millbrook, having pure-bred Herefords. Buyers still go through the county purchasing veal calves, a few beef cattle, hogs, and sheep. The principal breed of hogs is the Chester White, although there are some Berkshires, Poland-Chinas, and Duroc-Jerseys. Sheep owners find a cross of the Shropshire and the fine wool Delaine Merino desirable.

Dairying and general farming are rapidly becoming the principal lines of agriculture in Mercer County. Milk is produced for local distribution, for sale at near-by creameries or cheese factories for shipment, or for home manufacture into butter. Routes for milk and cream collection reach into many parts of the county, saving time to the farmer in hauling his daily product. Pure-bred herds are being developed, but generally the cattle are grade Holstein, Jersey, or Guernsey. Dairy herds range from 5 or 6 to 30 or 40 head, averaging 8 to 10 head. A large number of farmers do not rely entirely upon the dairy for an income, but grow oats, wheat, buckwheat, potatoes, vegetables, or fruit to sell. The cattle are pastured as much as possible, but the pasturage is supplemented with hay and concentrates. Clover and timothy hay, corn fodder, ensilage, and concentrates constitute the winter feed.

A great stimulus has been given to dairying by the establishment of a Government creamery at Grove City. By thorough utilization of by-products, this creamery is enabled to pay unusually good prices. Aid is also given in obtaining pure-bred cattle for the community. Farmers within a wide radius of surrounding territory send milk and cream to this center. During the month of June, 1917, 57,422 pounds of butter fat were received from 579 patrons, for which they received almost \$32,000.

To a certain extent the topography and the character of the soils have an influence upon their agricultural use. Almost all the poorly drained first-bottom soils along streams, mapped as the Holly silt loam, and also large areas of wet or seepy upland soils, usually of the Trumbull series, are used for pasturing live stock. Many of the steep slopes and stony areas are used as permanent pastures or wood lots, as the growing of cultivated crops would result in serious erosion and would be unprofitable. The better drained soils, such as the Wooster or Canfield types, are considered most desirable for potato growing. Many orchards, particularly the more recent commercial plantings, have been placed on the higher elevations, where there is less liability to frost and where there is good air and water drainage.

There is considerable variation in the character of the buildings, machinery, and work stock on the farms. On some of the more remote farms, and where the land is poorly drained, there is frequently very poor equipment. With the decrease in rural population many dwellings have been abandoned and allowed to fall into a state of decay. On the other hand, there are many houses and barns, built years ago, which have been well maintained. The better farms have comfortable houses, well-constructed dairy barns, and tile, concrete, brick or stave silos. The farm machinery ranges from rather poor equipment to the best modern implements. Some of the work stock used in farming is of poor quality and light in weight, but many farmers have first-class teams of good weight and conformation.

No definite rotation is followed. The common practice is to plow sod land for corn and potatoes, and sometimes even for wheat or buckwheat. The following year oats are generally grown, except after wheat, which is seeded to grass. The oat land is seeded to clover and timothy and allowed to remain in sod as long as it gives even a fair crop of hay. The clover gives its maximum yield the first year, while the timothy attains its best growth during the second year. After 3 to 5 years, when weeds and other native growths have largely displaced the timothy and what little clover remains, the sod is again plowed. Red clover is grown most extensively, although some alsike is sowed. Some of the best farmers keep their fields in clover for only 1 year, or in mixed clover and timothy for 2 years.

In the early agriculture of Mercer County very little lime was used, and the soil's supply of natural bases was gradually exhausted, largely by leaching and cropping. The acid condition of the soils became evident by the widespread growth of sorrel and the inability to secure a good stand of clover. Only within the last few years has the practice of using lime become widespread. In many instances lime is bought in carload lots. It is hauled from the magnesia plant at Stoneboro. Large quantities are also received from New Castle, Pa., and from points in Ohio. Many farmers report that best results are obtained with hydrated lime, but during the present season this form of lime, delivered in paper sacks, sold for over \$7 a ton. The Stoneboro product cost \$4.40 a ton. Good results are obtained in many cases from the use of raw ground limestone. This costs considerably less than the hydrated lime. Where care is taken to obtain very finely ground¹ raw limestone, it is believed that its availability in correcting soil acidity would be reasonably quick enough to warrant its use. The rate of application of the different forms of lime varies from $\frac{1}{2}$ to $2\frac{1}{2}$ tons per acre.² Lime is usually applied to the soil as it is being prepared for seeding to oats, wheat, rye, or grass.

With continuous cropping of the soils and consequent decrease in their productiveness, the use of commercial fertilizers and manure has become increasingly important. In 1879 only \$7,304 was spent for fertilizers; by 1909 the expenditure had increased to \$68,100. Because of the current scarcity of potash its use in any but small percentages has been discontinued and the chief mineral fertilizer is acid phosphate. Some mixed fertilizers, such as 1.65 per cent nitrogen and 12 per cent available phosphoric acid or 0.82 per cent nitrogen and 10 per cent available phosphoric acid, are used. It is a common practice to apply fertilizers for corn, oats, wheat, and buckwheat at the rate of 150 to 350 pounds per acre. Potatoes are given about 500 pounds per acre. Sod land is manured when it is to be planted to corn. It is a common practice to top-dress wheat with manure.

The problem of obtaining farm labor is serious. Farm labor has become scarce because of the opportunities offered by the shops in Grove City, Greenville, and Sharon. Monthly wages for farm hands range from \$30 to \$50 and day wages from \$1.50 to \$2.50. In 1909, \$264,815 was expended for farm labor.

There has been a decrease in the number of farms from 5,021 in 1890 to 4,816 in 1910. The number at present is even slightly less than that in 1880, when there were 4,835 farms. In 1880 the average

¹ About 80 per cent to pass through a 60-mesh screen is a reasonable standard of fineness.

² Where ground limestone is used about $2\frac{1}{2}$ times as much must be applied as where burnt lime is used.

size of each farm was 85 acres, of which 62 acres, or 73 per cent, was improved land. In 1910 the average size of each farm was 80.8 acres, of which 56.5 acres, or 69.9 per cent, was improved land. The percentage of the total area of the county in farms has decreased from 91.7 per cent in 1880 to 86.8 per cent in 1910. This condition is due almost entirely to the fact that industrial centers have taken a large supply of labor from the farms.

For the same reason, the percentage of farms operated by owners decreased from 86 in 1879 to 82 in 1909. During the last few years the rate of decrease has been even more marked. Many farms are rented for a rather low cash rent, the average rental per acre varying from less than \$1 to \$3.

Areas of land near the towns and cities are very high in price because of their desirability for building purposes. Farms close to shipping points or local markets are held for as much as \$75 to \$100 an acre. Usually, however, these farms are in a good state of cultivation and have good buildings. Where farms are several miles from the railroad, but have desirable soil conditions and good buildings, the selling price varies from \$40 to \$60 an acre. The more remote farms, poorly drained lands, and some abandoned farms can be bought for \$20 to \$30 an acre.

SOILS.

The soils of Mercer County have been derived largely from the till of the Late Wisconsin glaciation, which overlies the plateau region of northwestern Pennsylvania, bordering the Appalachian system. This till is very largely of local derivation, and consists mainly of material from sandstone and shale formations, mixed with stony and earthy material brought in from localities farther north. Limestone is of rare occurrence and is found in only a few places. Varying quantities of rounded and angular cobbles and boulders, of foreign and local origin, occur scattered over the surface and through the soil section.

The depth of this mantle of heterogeneous material over the underlying formations is variable. In the northeastern part of the county there is an extensive elevated tract in which the drift averages about 30 feet in thickness. On a knoll of strong morainic expression, at Sandy Lake, bedrock was not encountered in a well drilled 120 feet. Most of the material penetrated was a blue till. Similarly, no rock was found in a 110-foot well drilled at the ice houses at Stoneboro. At Hadley, along the Little Shenango River, a 200-foot well drilled about 100 feet below the stream did not strike rock. In the Neshannock Valley east of Mercer the drift is about 100 feet

deep. On the other hand, many of the higher elevations were left with only a relatively thin covering of glacial till. On Keel Ridge, 4 miles east of Sharon on the State road between Sharon and Mercer, the underlying bedrock is covered by only a few feet of glacial deposits. On some of the higher plateau slopes the underlying sandstone and shales are exposed, and the strata have been broken and weathered to such an extent as to constitute Rough stony land or stony loams. The slopes of the French Creek Valley are examples of this condition.

In general, it may be said that the old preglacial valleys received a deeper deposit of glacial debris than the higher elevations of the dissected plateau. The glacial deposit, however, was not sufficient to conceal the main preglacial ridges and valleys, although the drainage courses in some of these valleys were changed.

At its farthest advance the ice sheet reached only a short distance east of Mercer County, in places approaching within less than a mile of the county line. The general direction of this boundary line is from northeast to southwest, the line leaving Pennsylvania a few miles southwest of New Castle. Along the outer edge of this glacial boundary in southeast Mercer County there is a well-defined morainic belt, which averages about 5 miles in width. These moraines were formed at the terminus of the glacier, and, unlike water-laid material, which is formed in stratified layers, consist of a heterogeneous mixture of boulders, pebbles, sand, silt, and clay, often presenting a knoll and basin topography. The drainage in this morainic belt is usually good, as much of the till is rather loose and contains considerable sand. However, there are some heavier soils, such as silt loams and silty clay loams, in the midst of the moraine, and in these the drainage is less thorough. The sharper, well-defined moraines occur between Henderson and Sandy Lake, in the Little Shenango Valley at Clarks Mills. Here the valley is nearly filled with knolls and ridges for a distance of 3 or 4 miles. Their height ranges from 10 to 40 feet or more, and their slopes are often abrupt. Topography of the character also occurs southeast of Mercer, and formations having strongly morainic features exist in various other parts of the county, representing depositions made during the progress and retreat of the glacier.

In many places the soil owes its accumulation largely to water action. The melting of the ice sent large volumes of water underneath the glacier and from its front, and large quantities of sediment were laid down in the form of kames and eskers. These differ from the moraines in that they consist of stratified material. Kames are hills, knobs, or short ridges of stratified silts, sands, and gravel (see Pl. XVII, fig. 2) with even and rather narrow crests. The trend of kames

is usually contrary to that of the ice flow, while eskers usually have the same general direction as the ice flow.

There are many kamelike accumulations of sandy, stratified gravel in which there are no large boulders, and the pebbles of which are waterworn. This stratification may be seen in the gravel pit just north of Nesbit Corners. The most typical esker occurs about 5 miles southwest of Mercer, along the north side of Indian Run. Another prominent example occurs at Big Bend, where there is a ridge on the east side of Lackawannock Creek, 30 to 40 rods wide and 40 to 75 feet high and over 1 mile long. The knolls and basins along the crest of the ridge give it a somewhat more hummocky surface than eskers commonly have, but the general trend is that of the ice movement, as indicated by near-by striae.

As the ice continued to retreat by melting, the soil material it carried was left as a broad sheet of till or boulder clay covering the country. The drift in the upland generally has a much smoother topography than the morainic areas, and the soils are usually heavier, consisting of silt loams or silty clay loams. Even some of the elevated ridges have soils of this character. The soil structure is not so porous as in the moraines, and drainage is not as thorough. A large part of Mercer County is covered by these smoother areas, the greatest development occurring in the northwestern part of the county.

During the recession of the glacier its melting caused very large volumes of water to rush southward over the country. These swift waters carried clays, silts, sands, and gravel, which were deposited at irregular intervals in stratified layers. As the glacier retreated farther to the north, the volume of waters from its melting ice became smaller, until the size of the present streams was attained. As these waters fell the sediments which had been deposited remained as high second bottoms or terraces.

Modern streams are still at work spreading alluvium over the valley bottoms or flood plains forming the first bottoms.

All of the soils of Mercer County, with the exception of organic soils like Muck and local outcroppings of underlying rocks, are of glacial origin. The manner in which these soils were laid down has been an important factor in determining their texture and agricultural value. Conditions of air drainage, affecting oxidation, and of water drainage have caused important differences in the medium in which plants ordinarily grow. Where the soils have developed under conditions of good drainage they are brown in the surface horizon, while the subsoils are yellowish to brownish yellow. From this condition there are various gradations down to the extremely wet and impervious soils, where the surface soils and subsoil are light gray in color.

The upland soils are divided into five series. The Wooster series is characterized by brown surface soils and yellowish-brown subsoils. The Wooster soils are naturally well drained, and the subsoil is friable and free from mottling. These soils occupy upland areas, usually where glaciation has been heavy and the till is deep, and vary from smoothly rolling to irregularly morainic in topography.

The Lordstown soils are very similar to those of the Wooster series in color, but differ in having bedrock near the surface and in being more nearly true residual soils from the underlying rocks.

The surface soils of the Canfield series are commonly light brown to brown when wet and grayish brown when dry. The subsurface layer is yellow, while the subsoil is commonly mottled gray, yellow, and brown. Drainage is fairly good, but not as thorough as that of the Wooster soils; in fact, the Canfield series is intermediate between the brown, unmottled Wooster soils and the mottled, grayish-brown Volusia soils.

The Volusia series is characterized by generally poor drainage. The surface soils are brownish gray to gray, while the subsurface material is pale yellow or mottled yellow and gray. The lower subsoil is mottled gray, yellow, and brown. Hardpan is not uncommon.

The Trumbull series includes the most poorly drained upland soils in the county. The surface soil is light gray to gray and the subsurface layer is light gray to almost white and streaked with rusty brown. Iron concretions are common. The subsoil varies in color, but usually is mottled bluish gray, yellow, and brown.

The terrace or second-bottom soils are classed in two series. The Chenango soils are brown, with subsoils usually brownish yellow to yellow and with the lower part of the 3-foot section characterized by sand and gravel. The Tyler soils are poorly drained. The surface soils are gray to grayish brown and the subsoils are gray and yellowish brown mottled.

The first-bottom soils are still in the process of formation, receiving additional sediments at each overflow. Three series are mapped. The Huntington soils are well drained, with brown to dark-brown surface soils. The Holly series comprises the most extensive alluvial soils in the county. They are poorly drained, the surface soils generally being gray and rusty brown, while the subsoils are highly mottled with gray, yellow, drab, and rusty brown. Small poorly-drained areas mapped as Papakating silt loam include soils whose surface is in general black and which contain considerable organic matter. The subsoil varies from bluish gray to greenish with minor mottlings of other colors.

In relatively wet, low, flat places where conditions have been favorable for the accumulation of organic matter and its subsequent slow decay the deposits are mapped as Muck and Peat.

Rough stony land is made up largely of massive rock material, formed from the outcropping sandstones and shales. It is too rough and steep for cultivation.

The table below gives the name and the actual and relative extent of the various soil types:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Volusia silt loam.....	175,872	39.3	Chenango loam.....	5,428	1.2
Canfield silt loam.....	121,920	28.7	Trumbull silty clay loam.....	4,992	1.1
Steep phase.....	6,848		Huntington fine sandy loam.....	4,096	.9
Trumbull silt loam.....	40,768	9.1	Muck and Peat.....	3,968	.9
Holly silt loam.....	27,968	6.2	Lordstown stony silt loam.....	3,712	.8
Wooster loam.....	23,104	5.2	Chenango fine sandy loam.....	1,600	.4
Wooster silt loam.....	8,256	1.8	Papakating silt loam.....	896	.2
Chenango silt loam.....	7,488	1.7	Rough stony land.....	512	.1
Huntington silt loam.....	5,440	1.2			
Tyler silt loam.....	5,312	1.2	Total.....	448,000

WOOSTER LOAM.

The surface soil of the Wooster loam consists of a brown, friable, gritty loam, usually 6 to 8 inches deep. The upper subsoil is a yellowish-brown loam changing below to brownish-yellow sandy loam. Varying amounts of rounded gravel and angular shale and sandstone fragments commonly occur on the surface and through the soil section. In some places the gravel is so abundant as to give rise to a gravelly loam; such areas are designated by gravel symbols.

Included with this type are some inextensive areas of Wooster sandy loam. Here the soil to a depth of 8 or 10 inches is a brown to light-brown sandy loam, overlying a brownish-yellow to yellow sandy loam. Both the surface soil and subsoil are very friable and loose in structure, the quantity of sand and other coarse particles being so numerous in places as to make the material rather incoherent. The principal areas of this sandy soil occur just west of the Boston School, near Deer Creek School, in several small areas about $1\frac{1}{2}$ miles east of Sheakleyville and southeast of Kennard.

The Wooster loam has its principal development in the irregular morainic areas. Large areas of morainic debris were deposited by the glacier in the eastern and southeastern parts of the county, and extensive developments also occur in the vicinity of Sandy Lake and northwest and southwest of Henderson. Other extensive occurrences of Wooster loam are northeast of Pardoe and in the vicinity of Schollard and Big Bend. The valley slopes extending from Stoneboro toward Osgood for a distance of about 15 miles consist largely of this type. Scattered throughout the county are numerous other

knolls, ridges, and slopes made up largely of the coarse glacial materials which give rise to this soil.

Characteristic morainic topography as near Sandy Lake varies from rolling to quite hilly. In places the relief is quite bold, made striking by the sharp conical knolls, winding ridges, and isolated hills, often 30 to 50 feet or more in height. Other areas are scarcely more than pronounced swells. The valley slopes typically are gentle and present a rather billowy surface, but they range in places to steep and gullied.

Drainage is usually good, because of the favorable topography and the rather loose surface soil and subsoil, but there are occasional small depressions which have no outlet and are poorly drained, as well as a few slopes where seepage keeps the soil wet. Because of the good natural drainage the soil warms up quickly in the spring, and tillage can be resumed more quickly after rains than on the heavier and more level soils.

At least 95 per cent of the Wooster loam is in cultivation. The remainder largely represents slopes which are too steep or too gullied for profitable cultivation and are covered with timber. Chestnut and oak are the predominating growths. A few areas are so gravelly or hilly that they are allowed to remain in grass. Some areas, like the eskers at Big Bend and northeast of White Chapel, have only a sparse growth of native grasses. The greater portion of the type is used for the ordinary crops of corn, oats, wheat, rye, potatoes, clover, and timothy. Strawberries are grown to some extent, particularly near Stoneboro. Vegetables and fruit are also grown. A good stand of alfalfa has been obtained on some farms and 2 or 3 cuttings are obtained each year.

Yields on this soil probably average higher than those for the county as a whole. Where it is well farmed as much as 2 tons of hay or 20 to 25 bushels of wheat per acre has been produced. The use of manure and commercial fertilizers, chiefly those containing phosphoric acid, is becoming more general.

The average selling price of this land is about \$50 an acre. Areas very gravelly, steep, or somewhat remote in location can be bought for less, while some of the smoother areas, well improved and close to markets, command \$75 or more an acre.

The most urgent needs of this soil are the more extensive use of lime and the incorporation of organic matter. On account of the coarse texture the soil is easily susceptible to leaching, which causes a deficiency in calcium and magnesium bases and also in the elements of plant food. The practice of allowing fields to remain in sod more than two years usually results in a thin stand of grass and in extreme cases is followed by gullyng. On certain large areas of the type it is likely that grass should remain as the only crop, as

cultivation would be followed by serious washing. However, these fields should be top dressed with manure, limed, and reseeded at intervals. On many slopes a system of terraces could be used to advantage. Because of its topography and elevation the Wooster loam would apparently prove an excellent type for growing orchard and bush fruits and vegetables.

WOOSTER SILT LOAM.

The typical Wooster silt loam consists of 8 to 10 inches of brown to yellowish-brown silt loam which passes beneath into yellow or brownish-yellow silt loam or silty loam. There are places, as on the slope west of Crooked Creek, where the subsoil at 18 inches becomes slightly plastic and approximates a silty clay loam. Again there are areas, near Grove City, where the lower 18 inches of the 3-foot section is a yellow friable loam or even sandy loam. North of Kennard the lower subsoil is a yellow, very fine sandy loam. Gravel may be encountered at a depth of 18 inches, and there are small areas where it is abundant enough on the surface to constitute a gravelly silt loam. Plate XVII, figure 2, shows a cross section of the Wooster silt loam where the type is developed on a small kame.

Included with this type are several small areas of Lordstown silt loam, which is similar to the Wooster silt loam except that bedrock is encountered within less than 3 feet of the surface. One of these areas occurs on the high ridge 1 mile east of Centertown; another occurs $1\frac{3}{4}$ miles west of Centertown; Keel Ridge represents another occurrence of this soil. In some places, particularly on slopes, small areas of Wooster silt loam are included with the Canfield silt loam.

Although the Wooster silt loam is not as extensive as the Wooster loam, it is of considerable local importance. Areas are found in many parts of the county, on hills and ridges, on well-drained slopes, and even in gently undulating country. The largest area of the type occurs west and southwest of Grove City. Fairly large areas also exist in the southwest and northeast corners of the county and on the west slope of Crooked Creek Valley. There are a number of smaller, elevated areas, as $2\frac{1}{2}$ miles southeast of Mercer and $1\frac{1}{2}$ miles east of Sandy Lake. In general the run-off and underdrainage are good, but a large percentage of the type, occupying the more level and gently undulating situations, is only fairly well drained.

Practically all of the Wooster silt loam is in cultivation. It is highly esteemed for corn, oats, wheat, buckwheat, rye, grass, and vegetables.

Most of the farms on this type are well improved, and command a selling price of \$60 to \$100 an acre.

The application of lime and the more frequent growing of legumes in the rotation would be beneficial on the Wooster silt loam. Alsike

clover and Canada field peas have been produced successfully. Early maturing varieties of soy beans could be grown.

At Wooster, Ohio, the State Experiment Station has conducted extensive experiments on the acid Wooster soils. In a five-year rotation of corn, oats, wheat, clover, and timothy, the use of 1 ton of burnt lime or 2 tons of ground limestone per acre once in five years has increased the yield of wheat 2.11 bushels per acre, as a 10-year average. The average gain from the use of lime has been over \$16 an acre per rotation. At present market prices acid phosphate and steamed bone meal are about the only commercial fertilizers that can be profitably used. The Wooster experiments show that acid phosphate "produced a somewhat greater immediate effect, while the clover and grass crops which follow wheat in well-balanced rotations show a little larger return for the bone meal, indicating that acid phosphate is more quickly available." For this reason wheat at the experiment station is fertilized with 200 pounds of acid phosphate and 100 pounds of bone meal per acre, nitrogen and potash carriers being used only when they are obtainable at reasonable prices. The 10-year average yield of wheat at the Wooster station was 34 bushels per acre. It has been demonstrated that 8 tons of manure per acre, reinforced with 320 pounds of acid phosphate, has produced results equal to the use of the same amount of acid phosphate with 480 pounds of nitrate of soda and 260 pounds of muriate of potash.

LORDSTOWN STONY SILT LOAM.

The surface 6 or 8 inches of the Lordstown stony silt loam usually is a yellowish-brown silt loam. This overlies a friable yellow silt loam, which extends to a depth of 20 to 36 inches and either rests upon bedrock or passes into a more compact, stony silt loam or loam ranging from brownish yellow to grayish brown in color. As mapped the type necessarily includes small areas of other soils, such as the Wooster silt loam and the Canfield silt loam.

Quantities of angular shale and sandstone fragments, varying in size from small chips to massive bowlders, occur on the surface and through the soil section. The type includes some very small areas of rough stony land which can not readily be separated in mapping.

At least 95 per cent of the Lordstown stony silt loam occurs on steep slopes of hills and valleys. Deep gullies are numerous, and in places they have almost precipitous sides. The largest and most numerous areas of this type occur in French Creek Township, in the northeastern part of the county, on the long, steep slopes of the plateau. Other areas lie along the slopes bordering Sandy Creek, Little Neshannock Creek, Quarry Hill, and Keel Ridge, in the southwest corner of the county, and in a long belt northwest of New Hamburg.

Because of its steep topography and rocky surface the Lordstown stony silt loam has little agricultural value. Most of it is timbered or has been cut over and allowed to grow up in brush. Some of the slopes are in permanent pasture. There are some quarries on this type, the sandstone being crushed and the sand used commercially.

CANFIELD SILT LOAM.

The surface soil of the Canfield silt loam is a light-brown silt loam 8 or 10 inches deep. Upon drying it assumes a somewhat grayish-brown appearance. The percentage of silt is usually high, and imparts a rather smooth and floury feel. There are places, however, where there is a noticeable content of very fine sand and, to a lesser extent, fine sand. The subsurface layer is commonly a yellow silt loam, quite friable in structure. At 18 to 20 inches the subsoil is a mottled gray, yellow, and brown, heavy silty loam to silty clay loam, also friable in structure.

In places the lower subsoil is fairly compact and not infrequently there is an indication of hardpan development. This may occur at any depth between 18 and 36 inches, but is encountered commonly between 24 and 36 inches. It very often consists of a compact but not altogether impervious layer, 6 to 8 inches in thickness, composed of coarse, gritty sand, silt, and clay. The color is dull yellow to rusty brown. In other places the handpan layer is composed of finer material, such as clay and silt, and is mottled gray, yellow, and brown, with some iron stains. In the greater part of the type varying quantities of rounded gravel and angular sandstone and shale fragments are scattered over the surface and through the soil section.

Included in the type are small developments of Volusia silt loam, which occur either in depressions or in seepage areas on slopes. The Canfield silt loam and the Volusia silt loam are closely associated, and in places it is impossible to separate each small area, in which case the area is shown as of that type which predominates.

The Canfield silt loam is the second most extensive soil type in the county. It occurs throughout the county, occupying gentle to moderately steep valley slopes, the slopes and crests of hills, and rolling to nearly level uplands. Where derived from morainic deposits it is characterized by small swells, knolls, and other irregular elevations, giving a pronounced billowy and in places hilly surface. In other localities the surface is nearly level. The largest areas occur within a radius of 6 to 8 miles of Mercer, particularly in Cool Spring, Jefferson, Lackawannock, East Lackawannock, Wilmington, Springfield, and Findley Townships. Another large area lies between Sandy Creek and Mill Creek along the Venango County line.

The valley slopes in the vicinity of Maysville, Greenville, and Sharon, and east of Orangeville include a considerable area of this type.

Although the rolling and sloping areas of this soil have fairly good underdrainage, both these areas and the more nearly level parts are inclined to be too retentive of moisture after rains.

The Canfield silt loam is one of the most valuable soils in the county. The greater part of it is in cultivation, only a very small portion of the type, usually steep slopes, small stony areas, or farm wood lots being timbered. Chestnut is a characteristic growth, together with red oak, white oak, and some hemlock.

Yields on this soil are usually above the average for the county. When the weather is not too unfavorable, as in 1917, corn yields 35 to 50 bushels, shelled, per acre. Ordinary yields per acre for oats are 35 to 45 bushels; for wheat, 20 to 25 bushels; for buckwheat, 20 to 30 bushels; and for hay, 2 tons. Several small areas of this soil are in alfalfa. Although oats are usually sown as a nurse crop for grass, rye is sometimes used for this purpose. Oats make a heavy growth of foliage, and when this is cut the tender clover plants often suffer from the effect of hot sun and drought conditions, resulting in a poor stand of clover. In this respect rye is considered the better crop. Pumpkins and mangel wurzels are often grown in cornfields for stock feed.

Burnt lime is commonly applied at the rate of 1 to 1½ tons per acre, although many fields have never been limed. Some farmers have installed a certain number of tile drains each year until almost the entire farm is thus underdrained. It is a common practice to fertilize the cereal crops with acid phosphate, usually at the rate of about 200 pounds per acre.

There is often a tendency to allow fields to remain in grass for at least three and often five years. At the end of this time there is only a small amount of clover and a sparse stand of timothy, and not only is the quantity of hay greatly reduced but the quality is lowered as well by the coming in of weeds and native grasses. White-top is very troublesome in this respect. Furthermore, the sod which is then plowed for corn contains less fertilizing value, because of the smaller amount of organic matter, stubble, and clover roots having nitrogen-gathering bacteria. On dairy farms, where a large amount of manure is made, it would be as well to top-dress grass fields as to manure sod for corn, which is the common practice. The use of nitrate of soda, so beneficial to grass crops, is now almost impossible. Where lime has been used the resulting stands of clover have been greatly improved and subsequent crops have given increased yields. The use of lime once in the rotation should become more general. Although it involves considerable expense, the installation of tile drains has generally been justified.

Canfield silt loam, steep phase.—The steep phase closely resembles the typical Canfield silt loam in its general texture and structure, and generally has a mottled subsoil at 18 to 24 inches, but it includes narrow strips of Wooster silt loam along the steep and gullied drainage courses, varying from a few feet to several yards in width. On the other hand, it includes small developments of Volusia silt loam, occurring in seepage areas on the steep slopes. A typical example of this occurs on the steep slope near the mill at New Hamburg. There is practically no hardpan in the areas of this phase.

In many sections there are steep-sided to precipitous gullies, which have been cut down to bedrock, which outcrops in places. Here varying quantities of stone, ranging from small shale fragments to large sandstone boulders, occur on the surface, though the quantity is nowhere large enough to interfere materially with cultivation.

The largest occurrence of the steep phase of the Canfield silt loam is in the vicinity of Big Bend, on the slopes of the Shenango Valley and the tributary Lackawannock Valley. A number of the steep slopes in the northeastern part of the county are occupied by this phase, particularly along Sandy Creek. It is also mapped in a similar position along other small streams.

The slopes are so steep as to render the use of farm implements very difficult and in many places impossible. The growing of cultivated crops in most places would result in serious erosion, and the greater part of the phase is timbered. Some of the slopes have been cleared and are now used as permanent pastures. Here and there are some benchlike areas and gentle slopes, a few acres in extent, which are cultivated to general farm crops and vegetables. Some small orchards are found on the type.

The best uses for this land are forestry and pasture. The pastures should be limed, fertilized, and reseeded at intervals in order to maintain a good covering of grass. Where the sod becomes too thin, gullying results. On some of the higher areas orcharding may prove profitable.

The following table gives the results of mechanical analyses of samples of the soil, subsoil, and lower subsoil of the typical Canfield silt loam:

Mechanical analyses of Canfield silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
182525.....	Soil.....	1.7	3.9	2.8	10.9	16.3	51.9	12.5
182526.....	Subsoil.....	2.4	5.0	3.8	14.6	19.3	41.7	13.0
182527.....	Lower subsoil...	2.0	4.6	3.3	13.1	21.0	42.3	13.6

VOLUSIA SILT LOAM.

The surface soil of the Volusia silt loam typically consists of 8 inches of brownish-gray to gray silt loam. When it is dry the grayish color predominates, but after a rain the wet soil assumes more of a brownish-gray to light-brown color, and in places may approach the brown color of the Canfield silt loam. On some nearly level areas its texture is that of a rather heavy silt loam and it is not over 6 inches deep. Where the type occupies gentle slopes or undulating areas the surface soil often contains considerable very fine sand and ranges from 8 to 10 inches in depth.

The subsurface soil varies from pale yellow to mottled gray and yellow in color, and from a heavy silt loam to a light silty clay loam in texture. Where the pale-yellow color is encountered it quickly passes to the mottled condition at 12 to 15 inches. With increase in depth the gray mottling becomes more pronounced and the texture usually heavier. Below 18 or 20 inches the subsoil is mottled with gray, yellow and brown, and drab may occur at 30 to 36 inches, where the texture becomes heavy. The mottled gray and yellow subsoil may continue to a depth of 18 to 28 inches with little change in texture until a layer of hardpan is reached. This hardpan layer underlies the greater part of the type. It is composed of clay, sand, and other gritty material, and has a very compact structure. Iron concretions add a black or rusty-brown color to the highly mottled drab, gray, and yellow layer. Considerable fine sand occurs in places in the upper and lower subsoil, giving it a friable structure. Some gravel may occur on the surface and through the soil section.

Included with the Volusia silt loam are small areas of Mahoning silt loam. The soil here is a brownish-gray to light-brown silt loam, 6 to 8 inches deep, with a subsoil of mottled gray and yellow silty clay loam which passes at about 20 inches into olive-drab or dull-brown dense clay. This lower subsoil contains an unusually high percentage of clay and is calcareous. An area of this type of soil occurs 1 mile east of Hadley, on the slope south of the Little Shenango River along the Pittsburgh, Mercer, and Erie Road; another area lies 2 miles northeast of Transfer.

The Volusia silt loam is the most extensive soil type in the county. Its principal occurrence is in large level areas on the tops of the plateaulike uplands. In a few places it occurs in rather rolling to almost hilly situations. It is also developed on some of the valley slopes and in the lowlands, but the Wooster and Canfield soils usually occupy the slope, while the Volusia silt loam begins where the topography becomes more gently undulating to almost level. This soil usually represents glacial till deposited as a relatively thin mantle,

and the underlying shales and sandstones, weathered and worn by glacial action, have contributed largely to the soil material. Typical developments of the Volusia silt loam are mapped on the level areas along the State road between Mercer and Sharon, and along the Pittsburgh, Mercer, and Erie Road, beginning 1 mile north of Fairview. This soil covers the greater part of Greene, Salem, Sandy Creek, Deer Creek, Otter Creek, and Jackson Townships. There are also large areas in the northern part of Delaware Township, and in Shenango and Hickory Townships.

This soil is inclined to be rather cold and wet. The surface drainage varies from fairly good to inadequate. The slopes, hills, and undulating areas are generally the best drained, though springs on some of the slopes keep the soil poorly drained. Where the surface is nearly level, with only slight swells, it is not uncommon for water to stand in fields a considerable length of time. The rather compact subsoil and impervious hardpan render the conditions of under-drainage even worse than the surface drainage.

This is the most extensive type in the county and an important farming soil. Probably 95 per cent of it is in cultivation or in pasture. The remainder is timbered, beech being a characteristic tree. All the general farm crops are grown, including corn, oats, rye, wheat, buckwheat, clover, timothy, and potatoes. Yields in some cases indicate that the soil needs certain improvements. The yield of shelled corn per acre averages between 20 and 30 bushels. In some seasons a large acreage of corn does not mature and is cut for fodder. Oats do fairly well, yielding 25 to 35 bushels per acre. The yields of wheat are usually low, varying from 12 to 18 bushels. This is largely due to poor drainage conditions and consequent heaving of the plants during the winter. Buckwheat is an important crop on some farms. (See Pl. XVII, fig. 1.) It ordinarily yields from 10 to 15 bushels per acre. Hay does fairly well, yielding 1 ton or more per acre. Where the hardpan layer is absent or is not too close to the surface potatoes give fairly good yields. An abundance of sorrel and a lack of clover indicates that this soil is acid in many places. Where lime has been applied and tile drains installed, the ordinary yields have been greatly exceeded, and no other cultivated soil in the county has been more responsive to such improvements. Where burnt lime is used it should be applied once in the regular rotation of crops at the rate of 1 to 1½ tons per acre. Heavy applications of manure would be beneficial. This could well be reinforced with raw rock phosphate or acid phosphate.

The average selling price of land of the Volusia silt loam ranges from \$25 to \$35 an acre for the less desirable farms, and from \$40 to \$50 an acre for farms that are well located and have good improvements.

TRUMBULL SILT LOAM.

The Trumbull silt loam to a depth of 6 or 8 inches is a light-gray to gray silt loam. Very often it shows slight traces of rusty-brown mottling. In wet, swampy places the surface inch or two is dark brown to almost black, owing to the presence of organic matter. Where the type lies near or is surrounded by higher lying types the surface soil has received an accession of sand and fine sand, due to surface wash, and in small areas the texture is a loam. In some places the type is characterized by numerous small elevations and depressions, the former occupied by Volusia silt loam and the latter by Trumbull silt loam, or even silty clay loam. It is not uncommon to find areas smaller than an acre covered with varying quantities of rock fragments and even boulders.

The upper subsoil is either light gray or almost white, streaked with rusty brown and iron concretions or mottled light gray and pale yellow. Its texture varies from heavy silt loam to fairly heavy silty clay loam. At about 24 inches the subsoil is a silty clay mottled bluish gray and yellow or yellowish brown. Fine sandy loam, fine sandy clay, or other gritty material may be encountered in thin layers between the depths of 15 and 36 inches. A hardpan layer, consisting of clay and concretionary material, may be encountered between 24 and 36 inches.

The Trumbull silt loam is rather closely associated with the Volusia silt loam, but it generally occupies even lower, flatter, and more nearly level areas. Very often the type occurs in large basin-like areas, from whose margins issue small drainage ways. This soil is not so extensive as the Volusia and Canfield silt loams, but it occurs in many parts of the county. Large developments occur northwest of Greenville in Greene Township and in the northern part of West Salem Township. A large number of extensive and irregular areas of this soil begin southeast of Jackson Center and extend north and northwest in a wide belt to the Pittsburgh, Mercer, and Erie Road north of Fairview.

Because of its flat and depressed surface, both the run-off and the internal drainage are poor. After heavy rains the low areas occupied by this soil are covered with water for long periods at a time, the depth ranging from a few inches to a foot or more. A large part of the type is covered with tussocks of grass and mosses and there is some beech and oak. Considerable areas have been cleared. This type is more commonly used for permanent pasture than any other in the county. It is cultivated only in small, low areas in fields composed mainly of the Volusia silt loam or some other soil. In the northwest part of the county, however, some of the Trumbull

silt loam is used in the production of corn, buckwheat, oats, wheat, and grass. The yields are usually low.

Many of the fields have open furrows at frequent intervals to carry away the excess water. If this soil is plowed in a wet condition it turns up in clods, which are broken down with difficulty. On the other hand, when the soil is dry it becomes compact and is difficult to plow.

The selling price of farms on which the Trumbull silt loam is the predominant soil is usually not over \$20 or \$25 an acre, and at times even this figure is reduced.

Before the larger part of this soil can be profitably used for crop production it must be tile drained and limed. In actual elements of fertility the soil is probably not any poorer than surrounding types, but in its natural condition it is cold, wet, and sour. Much of the soil is adapted to the production of hay, particularly timothy and redtop. This, together with pasturage, should be the chief use of the soil where it is unimproved, except on the higher and better-drained situations, where fair yields of the general farm crops can be obtained.

TRUMBULL SILTY CLAY LOAM.

The Trumbull silty clay loam is a gray silty clay loam, mottled with yellow or rusty brown. At 6 or 8 inches the subsoil may become a heavy silty clay loam, but more often it is a silty clay mottled gray and yellow or gray, yellow, and brown. Beginning at about 18 inches, the subsoil is a stiff, dense clay, mottled in varying degrees with drab, yellowish brown, and gray. Often a hardpan layer of gray, yellow, and black concretionary material is encountered at some depth below 24 inches. In a few small depressions the soil is a heavy clay, and locally it is often referred to as "blue clay."

The largest area of the type is about 3 miles northeast of Fredonia, just west of the Pittsburgh, Mercer, and Erie Road. Several developments occur within a few miles of Grove City and west of Jamestown. The Trumbull silty clay loam occupies low, flat situations, whose drainage is in many places so poor as to approximate swamp conditions. Certain areas are covered with standing water during the greater part of the year. The type is mapped in a number of depressions which appear to have been former lakes. In some places parts of the type traversed by small streams are overflowed for short periods during seasons of heavy rainfall.

Very little of this soil is in cultivation, practically all of it being in timber and pasture. Very often there is a good stand of grass, and in its present poorly drained condition grazing is about the only practical use to be made of this land.

CHENANGO FINE SANDY LOAM.

The surface soil of the Chenango fine sandy loam consists of 8 to 10 inches of yellowish-brown to brown fine sandy loam. The content of fine sand may be so high as to give the soil a rather incoherent structure, like a loamy fine sand, or it may be so low as to impart a rather loamy texture. Very often there are quantities of rounded gravel scattered over the surface, occurring in greatest abundance near the edge of the terrace.

To a depth of 20 to 30 inches the subsoil is a yellow to brownish-yellow fine sandy loam, which with increase of depth contains a higher proportion of sand. Below 20 to 30 inches the subsoil consists of gravelly sandy loam occurring in beds of varying thickness. Occasionally the gravelly layer is absent, and the subsoil is then a yellow fine sandy loam to sandy loam. At the west end of the terrace at Big Bend, where there are patches of sandy loam, the type rises in two distinct terraces above the first bottom.

This soil is alluvial in origin, having been deposited by the swiftly flowing waters of the swollen glacial streams. With the retreat of the glacier and subsequent cutting down of the stream channels the deposits were left in the form of a terrace lying above all present-day overflows. The largest areas occur near Kennard and Osgood, and in isolated terraces along the Shenango and Little Shenango Rivers.

The surface is almost level or slightly undulating. The short slopes from the terrace to the first bottom vary from gently sloping to rather steep. Because of the permeable texture and open structure both the surface soil and subsoil have good but not excessive drainage.

The type is not very extensive, but practically all of it is in cultivation to vegetables, potatoes, grass, and the cereal crops. Good yields are obtained. The soil is easily tilled.

The incorporation of organic matter and liming would prove highly beneficial on this soil. Because of its good drainage and "earliness" in the spring, the growing of truck should prove profitable.

CHENANGO LOAM.

The surface soil of the Chenango loam consists of 8 to 10 inches of brown, friable loam, resting on a subsoil of brownish-yellow to yellow loam or light clay loam extending to about 2 feet, where it is underlain by a stratum of gravelly loam of about the same color. Often the soil and subsoil contain enough sand or coarse sand to have a pronounced gritty feel. Quantities of rounded gravel may occur on the surface and through the 3-foot section, being always

most abundant in the lower part of the 3-foot section. In depressions and where the terrace meets the upland slopes the lower subsoil sometimes is mottled gray and yellow.

This is a terrace soil made up of alluvium derived from local sandstones and shales, and other glacial material. Usually it occupies a typical benchlike position, extending out from the foot of upland slopes. In places the type has a level surface, but occasionally the topography tends to be undulating. Drainage in general is good.

The largest development of the Chenango loam occurs along the Shenango River and other large streams. Areas are mapped at Jamestown, Greenville, Big Bend, Sharon, and West Middlesex, and on a number of similar terraces. Typical areas also occur $1\frac{1}{2}$ miles north of Sheakleyville and one-half mile south of Kitches Corners.

The soil is not very extensive, but it is considered a desirable type for all the ordinary hay and cereal crops, of which good yields are obtained. Near the towns truck crops are grown, including cantaloupes, celery, tomatoes, beans, and asparagus.

An average selling price for land of this type is about \$100 an acre. Areas near towns are held at much higher figures.

This soil with its good natural drainage should receive applications of lime at least once in the rotation, and the productiveness should be maintained by the growing of legume crops and the use of barnyard manure. In the few areas of poor drainage tile drains should be laid.

CHENANGO SILT LOAM.

The Chenango silt loam consists of 8 to 12 inches of brown to yellowish-brown silt loam, underlain to a depth of 20 to 30 inches by brownish-yellow to yellow silt loam or silty loam which rests upon a yellow, rather heavy loam, relatively high in fine sand. Rounded gravel may occur on the surface and through the 3-foot section, and below this there are often beds of gravel and sand.

Included with this type, along French Creek and elsewhere, are areas which have some of the characteristics of the Holston silt loam. Here the yellow subsoil becomes somewhat heavier with depth, and approaches a silty clay loam in texture at 20 to 24 inches. In some areas the color characteristics are similar to those of the upland Canfield soils, as 2 miles southwest of Petersburg and in the vicinity of Sharpsville. Here the surface soil consists of about 10 inches of brown silt loam, overlying a yellow to pale yellow silt loam. At about 18 inches the subsoil is a mottled gray and pale yellow silty clay loam or light clay loam.

The Chenango silt loam is a terrace or second-bottom soil made up of the finer old alluvial material. It is more extensive than either the loam or fine sandy loam types. Its principal development is along the Shenango River and French Creek, along the Little Neshannock Creek just north of the southern boundary of the county, in the vicinity of Kennard and Fredonia, and near Orangeville.

The topography varies from almost level to undulating. In places there are small depressions, and a few of these are deep, holding water and organic matter. Drainage is generally good, although only fair where the subsoil shows a mottled and rather compact condition.

This type is not extensive, but it is highly esteemed for farming, and practically all of it is in cultivation. All the general crops are grown, such as corn, oats, rye, wheat, buckwheat, and grass. Good yields are obtained.

The selling price of farms on the Chenango silt loam varies from \$40 to \$75 an acre.

The Chenango silt loam is a good, durable soil, and with proper methods of farming it can be maintained in a state of productivity. Lime should be applied at least once in the rotation.

TYLER SILT LOAM.

The Tyler silt loam to a depth of 8 to 10 inches is a brownish-gray or a mottled gray and brown silt loam. The subsoil is a mottled, light-gray and yellow silt loam which occasionally shows streaks of rusty brown. At about 18 inches the subsoil becomes a rather heavy, gray or drab and yellow silty clay loam, which passes in the lower part of the 3-foot section into plastic, drab or gray clay. In depressions and in places away from the edge of the terrace the type approaches a silty clay loam in texture, while in other areas the soil corresponds closely to the Volusia silt loam. Here the surface 8 inches is a pale-yellow or mottled yellow and gray silt loam. Where the subsoil is pale yellow it quickly becomes mottled at 12 to 14 inches. The lower subsoil is a mottled yellow and gray, light clay loam or silty clay loam.

Some areas mapped as Tyler silt loam represent the Braceville silt loam. The surface soil of this type, to a depth of 8 or 10 inches, varies from grayish-brown to mottled gray and rusty-brown silt loam. This generally overlies a yellow and gray silt loam, which with increase of depth gradually changes to a very fine sandy loam of the same color. However, the surface soil may pass rather abruptly into a light-gray and rusty-brown fine sandy loam containing some iron stains. The largest area of Braceville silt loam occurs one-half mile northeast of Osgood.

The Tyler silt loam is a terrace soil which has as its first-bottom equivalent the Holly silt loam. Most of the type is now above overflow, but in a few places where there is a gradual slope between the terrace and first bottom small areas are occasionally inundated. Usually, however, there is a distinct difference in elevation between the terrace and first bottom. Viewed in a general way, the type has an almost level surface, but in detail it may be varied by local hollows, depressions, and old stream channels. The principal areas of the type are mapped along the Shenango River and its tributaries.

Both the surface drainage and underdrainage of the type are poor, and at least 85 per cent of it is used for pasture. Some of the more desirable and better-drained areas are used for growing corn, oats, buckwheat, and grass. Fair yields are obtained only in seasons of moderate rainfall.

The selling price of this land varies from \$15 to \$35 an acre.

The Tyler silt loam could be made more productive by the installation of tile drains, the use of lime and manure, and the growing of legume crops.

HUNTINGTON FINE SANDY LOAM.

The Huntington fine sandy loam consists of 12 to 15 inches of brown fine sandy loam which overlies somewhat lighter brown and somewhat more compact material of about the same texture. Very often the lower subsoil, at 24 to 36 inches, shows mottlings of gray. In small depressions the soil may be a silty loam or silt loam. Along some of the smaller streams which have narrow bottoms, but which often carry a considerable volume of water, the soil contains some coarse sandy material, and there are varying quantities of rounded gravel and rock fragments.

This soil is made up of sediments which have been deposited in the first bottoms along the streams during overflows. The Chenango soils were deposited when the streams flowed at much higher levels than at present, while the Huntington soils are of more recent origin. During unusually high floods they are overflowed and receive depositions of soil material from the streams. The fine sandy loam consists of the coarser and heavier particles of sediment, carried only by the swiftest currents and deposited along the immediate banks of the larger streams or along the smaller, swift-flowing streams. Along some of the smaller streams the areas are frequently so small that they have been included with other types in mapping. The Huntington fine sandy loam is developed principally along Neshannock Creek and the lower reaches of the Shenango River. It is also mapped in strips along smaller streams such as Booth Run, the West Branch, and North Deer Creek.

The total acreage of the soil is not large, but it constitutes one of the best drained and most easily tilled soils in the county. Only in a few low situations, or near the boundary of the type where it grades toward soils of poor drainage, is there a tendency to retarded under-drainage in the lower part of the 3-foot section. Possibly 40 per cent of the type is cultivated and devoted to corn, small grains, hay, and vegetables. The remainder is used for pasture. Where overflows are not too serious good yields are obtained.

This soil, where subject to overflow only at times of excessive floods, is admirably adapted to the production of early vegetables. It is usually warm and well drained, and responds quickly to the use of manure and commercial fertilizers. Applications of lime have given good results.

HUNTINGTON SILT LOAM.

The surface soil of the Huntington silt loam consists of a brown silt loam with an average depth of 18 inches, though the depth varies from 8 to 20 inches. The subsoil is usually of similar texture to the soil and either lighter brown in color or brownish yellow to yellow, the light-brown color commonly occurring where the surface soil is 15 to 20 inches in depth. In areas whose surface soil is less than 12 inches deep, the subsoil is often mottled with gray and yellow between 18 and 36 inches. The subsoil shows a rather wide variation in texture and structure in places, particularly along the Shenango and Little Shenango Rivers, being a yellow fine sandy loam or very fine sandy loam at some depth between 18 and 36 inches, and this material frequently shows mottling of gray and yellow between 18 and 24 inches. Again, the subsoil to a depth of 18 or 20 inches may be a pale-yellow silt loam passing into a silty clay loam, mottled with gray and yellow at 22 to 24 inches, and somewhat more compact as the depth increases.

The Huntington silt loam represents the finer sediments of the recent alluvium. It is subject to overflow during periods of heavy rainfall, or when the forming of ice gorges causes the streams to rise to unusually high levels. The principal development of this soil is along the Shenango and Little Shenango Rivers and French Creek. Along the larger streams it lies in places at different levels, but all the areas are relatively low and still subject to overflow. The general topography is almost level, although in places the surface is slightly billowy, or cut by sloughs. Drainage is fairly good, being intermediate between that of the Huntington fine sandy loam and the Holly silt loam. In places the soil does not drain quickly and is inclined to remain wet for a considerable length of time.

The timber growth on the Huntington silt loam is largely sycamore, willow, oak, ironwood, elm, maple, and hickory. It is considered

a good farming soil, and probably 80 per cent of its area is used in the production of corn, oats, wheat, clover, timothy, and garden produce, such as onions, radishes, cabbage, and lettuce. The average yield of wheat is about 20 bushels per acre, and of oats about 37 bushels. Where drainage is imperfect wheat does not succeed very well, and oats are inclined to lodge. In seasons when the rainfall is not excessive and when frosts are not injurious yields of 50 bushels of shelled corn per acre are not uncommon. Some excellent stands of red clover are obtained, even where the soil is not limed, but as a rule lime should be applied as on the other soils of the county.

Where land of this type is in a high state of cultivation and near markets it is valued as high as \$75 or more an acre. The average selling price, however, is from \$35 to \$50 an acre.

Although this soil is naturally productive, continuous cropping has caused a decline of yields, and many farmers are now fertilizing corn at the rate of 200 pounds of acid phosphate per acre. Wheat and oats are also fertilized. In at least one instance an application of 1,800 pounds per acre of ground limestone has been made.

The greater part of this type is not overflowed very frequently during the growing season, and it constitutes a good soil for corn and the small grains. Tile drainage would be generally beneficial, although it is often difficult to get sufficient fall for a drainage system. The use of lime and manure has given good results.

HOLLY SILT LOAM.

The surface soil of the Holly silt loam consists of 8 to 12 inches of gray or gray and rusty-brown mottled heavy silt loam. To a depth of 12 to 20 inches the subsoil is a mottled gray and rusty-brown or gray and yellow silty clay loam. The lower subsoil is usually a heavy clay, either mottled gray, drab, yellow, and rusty brown or any two or three of these colors.

The type includes a number of variations in depth, structure, and texture. There are places where it is intermediate between the Huntington and Holly soils. Where the surface few inches is brown or grayish brown and the subsoil is mottled the soil is included with the Holly series. Where the mottling appears at greater depths the soil is included with the Huntington series. Although the characteristic lower subsoil is a heavy clay, there are places where a dark-drab or gray and yellow fine sandy clay or even fine sandy loam is reached at a depth between 20 and 36 inches. Beds of gravel may occur at 24 to 36 inches. The surface soil is often decidedly heavy in texture, including clay loam, silty clay loam, and even silty clay textures, as along Crooked Creek. Here the surface soil consists of 10 to 15 inches of drab and rusty-brown

or yellow silty clay which passes into a very heavy clay of drab to slightly greenish color.

The Holly silt loam occupies first bottoms of streams and is thus of recent alluvial origin. The soil owes its gray and other light colors to inhibited oxidation under poor drainage conditions. The surface is generally level, but is cut by some sloughs and varied by depressions which are filled with water after heavy rains and overflows. Very frequently the type is bounded by narrow strips of well-drained Huntington soils along the immediate banks of the streams and on the outer margin of the bottoms by small areas of Muck and the dark-colored Papakating soils. The Holly silt loam is the most extensive first-bottom soil in the county. It is encountered along the Shenango River and Little Neshannock, Crooked, Otter, Wolf, Sandy, and Cool Spring Creeks.

The greater part of this type is in forest or pasture. The forest includes considerable ash, willow, sycamore, oak, and maple. Most of the areas furnish some grazing. Some of the higher and better drained areas are used for growing corn, oats, wheat, and timothy. A few areas have been reclaimed by open ditches.

The selling price of land of the Holly silt loam varies from \$20 to \$35 an acre.

In its present state the type is best adapted for use as pasture land and for hay production. Alsike clover should do well, as it will grow on moist to wet soils which are slightly acid. Redtop would also succeed. For the production of general farm crops drainage is usually necessary, and open ditches, or, preferably, tile drains, should be employed where there is enough fall. The deepening and straightening of the main stream channels should be the first steps in reclaiming these wet bottom lands on an extensive scale.

PAPAKATING SILT LOAM.

The surface soil of the Papakating silt loam is a black silt loam usually about 6 inches deep. The depth varies from 4 to 8 inches. There is also some variation in texture, as the soil in places is heavy enough for a clay loam or even a silty clay loam. The subsoil is a heavy silty clay loam to silty clay, mottled dark drab and yellowish brown or gray, yellow, and drab, or it may be dark drab, becoming lighter in color with depth. In the lower 6 to 12 inches of the 3-foot section the subsoil often contains very fine sand or fine sand in quantities large enough to impart a decidedly friable structure. The color of this lower layer is mottled bluish gray and yellow, or it may have a decidedly greenish cast.

A number of small areas of Papakating silt loam are included with the Huntington silt loam, both because of their unimportance

and owing to the inaccessibility of parts of the stream bottoms on account of swampy conditions and dense undergrowth.

The black color of the surface soil is largely due to the accumulation of organic matter under rather swampy conditions. The material is almost a shallow Peat or Muck in places, but as a rule the soil contains considerable mineral matter derived from sediments from the near-by uplands. Where the type occurs in stream bottoms it is undoubtedly of alluvial origin, but in many of the depressions there are indications that it represents deposits formed in old lake bottoms.

The Papakating silt loam occurs in stream bottoms and more frequently in low depressions in valleys and uplands. The greater part of the type is mapped near Valcourt and Grove City. There are other scattered areas, as northwest of White School, and 2 miles northeast of New Lebanon.

A large percentage of the type is subject to overflow. Even on the upland it is frequently covered with water accumulating from higher lying land, and run-off and underdrainage are so inadequate over the type in general as to make it one of the most poorly drained soils in the county.

The Papakating silt loam is of small extent. Some of it is in cultivation, and heavy yields of wheat and buckwheat are said to have been obtained, but the fields are too few to form a basis for an accurate estimate of the average yield. In some years overflows ruin all crops. Some ditching has been done to carry away surplus water. The soil is high in organic matter, and oats have a tendency to make too rank growth and to lodge. Corn does well in most places. This is an excellent soil for radishes and onions, of which the Yellow Globe Danvers variety is grown most extensively. Good crops of alsike and timothy have been obtained.

Improved land of this type commands as much as \$100 an acre, but some of the low swampy areas can be bought for as little as \$20 to \$40 an acre.

The greatest problem in the reclamation of this type is drainage. Where the situation is very low it is often impossible to get sufficient fall to carry away the excess waters through tile drains, but most of the type can be tile-drained successfully.

MUCK AND PEAT.

Muck and Peat are organic soils formed by the accumulation and decay of the remains of water-loving plants. The accumulation has been favored by the rank growth of vegetation in wet, swampy places, and by those processes of decay that are evolved under conditions of saturation.

The formation of beds of Muck and Peat has been going on for ages and is still in progress. With the organic matter, which is in varying stages of decomposition, there are admixed small quantities of mineral particles which have been incorporated from time to time, usually in the form of water-deposited sediments.

As a result of these different factors, the organic deposits are not uniform in texture, and Muck and Peat are intermingled. Where the process of decay has not reached an advanced stage and the organic remains retain a rather distinct fibrous or cellular structure the material is true Peat. This is usually brown or dark brown in color, though in some places almost black. In the areas classed as Muck the material has undergone more thorough disintegration, and has attained such an advanced stage of decay as to become a black, spongy mass with little if any trace of the original structure of plant tissues. The depth of the organic deposits also varies greatly. In a few places they are only 8 to 12 inches deep, but ordinarily the depth is at least 2 feet, and in some places 20 feet or more. Where the organic deposit is less than 3 feet deep the underlying soil is a rather light gray, sticky sandy clay or sandy loam, or a bluish-gray to drab, heavy clay.

Muck and Peat areas form the filled-in beds of old lakes and ponds. They also occur in swampy depressions along streams. The largest areas occur in the vicinity of Valcourt and Grove City, 3 miles north of Mercer, 3 miles southeast of Greenfield, southeast of Clarks Mills, northwest of White School, and in the Cranberry Swamp. The areas are low and level and in nature so wet and swampy that they can scarcely be crossed. Water generally covers large areas during most of the year. The characteristic growth consists of cat-tails and water-loving grasses and bushes, but some areas of shallow Muck have a heavy stand of pine and hemlock.

Muck is usually preferred to Peat for agriculture, because it is more compact. Both types can be used to a certain extent for trucking, but Peat, because of its light, spongy structure, affords rather poor support for crops attaining much height.

None of the large tracts of Muck and Peat have been reclaimed. Small areas have been drained and are used for growing truck, as near Grove City. Some alsike and timothy is grown on one area. Many of these swampy areas require rather extensive drainage and clearing operations, but where they lie fairly close to markets the initial cost, though considerable, would be justified by their value for trucking. Celery, onions, cabbage, lettuce, spinach, beets, turnips, and potatoes can be profitably grown. In certain sections of the United States corn, buckwheat, and hay are grown on Muck soils. It is not uncommon to find that after freshly cleared areas of Muck

have been cropped for about three years they begin to show signs of lessening productiveness. In such cases it has been shown the element most needed is usually potash, though phosphoric acid is required to a less extent.

ROUGH STONY LAND.

Areas mapped as Rough stony land are so hilly and rough as to be wholly unfit for agriculture. The slopes are very steep, the difference in elevation in places ranging from 200 to 400 feet within short distances. Great quantities of rock fragments cover the surface and in most places there are numerous large boulders and outcrops of shale and sandstone. In some places the boulders have rolled down the steep slopes and are scattered over adjoining soil types. In most areas springs, fed by seepage waters from the stratified sandstones and shales, are numerous.

Rough stony land is not extensive. Most of it occurs in the vicinity of French Creek. Other areas are found along Sandy Creek, and one area lies 2 miles southeast of Greenfield.

SUMMARY.

Mercer County is situated in the northwestern part of Pennsylvania and comprises an area of 700 square miles, or 448,000 acres.

The surface ranges from level to hilly. The county occupies part of the plateau which extends north and west from the Allegheny Mountains. The elevations range between 822 feet and 1,620 feet above sea level. The Shenango River and French Creek, with their tributaries, receive most of the drainage.

Mercer County was organized in 1803. Many of the early settlers came from counties to the south and east. The towns now have a cosmopolitan population. The rural population has decreased 18 per cent in the last three decades.

With one electric railroad and numerous steam roads, the county has good transportation facilities.

The average length of the growing season is 127 days. The mean annual temperature is 48.2°. The mean annual rainfall is 41.72 inches, and the precipitation is favorably distributed. There is an average annual snowfall of 52.1 inches.

General farming and dairying are the principal agricultural industries. There is some stock raising, market gardening, and orchard fruit and berry growing. Hay and forage crops occupy an area almost equal to that of all cereal crops. A Government creamery at Grove City has stimulated the dairy industry. Corn, oats, wheat, buckwheat, rye, and potatoes are the principal crops.

The soils are generally in need of lime, and liming has become more general in recent years. Manure and acid phosphate are commonly applied to the general farm crops. Truck crops receive heavier applications of complete mixtures when available.

Farm labor is scarce. Monthly wages range from \$30 to \$50. The average size of farms is 80.8 acres, of which 56.5 acres is improved. In 1909 the percentage of farms operated by owners was 82.

Well-improved farms with good location sell for \$75 to \$100 an acre. From this there is a gradation down to \$40 to \$60 an acre. Some poor and abandoned farms can be bought for \$20 to \$30 an acre.

The soils of Mercer County consist principally of glacial till derived through the grinding of local sandstones and shales by the ice sheet. Some of the drift was transported from areas of igneous and metamorphic rocks to the north. The glacial mantle varies from level areas of till to hilly moraine deposits.

The glacial upland soils are represented by the Wooster, Canfield, Lordstown, Volusia, and Trumbull series.

The Wooster loam and silt loam are characterized by brown surface soils over yellowish-brown subsoils. They are well drained. These soils are almost wholly in cultivation, and yields are considerably higher than the average for the county.

The Canfield silt loam has a brown to light-brown surface soil, overlying a yellowish subsurface layer. The subsoil is mottled gray, yellow, and brown. Drainage is intermediate between that of the Wooster and Volusia soils. The Canfield silt loam is a valuable farming soil. It includes a steep phase, the greater part of which is forested.

The Lordstown stony silt loam is confined to stony areas on the steep slope, where bedrock comes near the surface. The best uses for this type are as pasture and forest land.

The Volusia silt loam is the most extensive type in the county. Its surface soil is brownish gray, while the subsoil is commonly mottled yellow, gray, and brown. Hardpan is not uncommon. This soil is mostly under cultivation. It could be considerably improved by drainage and liming.

The Trumbull silt loam and silty clay loam include the most poorly drained upland soils. The surface soils are gray and the subsoils are mottled gray, bluish gray, yellow, and brown. The Trumbull soils are used mainly for pasture, but they are naturally productive, and if properly drained and limed would constitute valuable farming land.

As the glacier retreated, its melting caused the formation of large volumes of water. The sediments deposited by these glacial streams

were left as terraces, now above present overflow. They are classed in the Chenango and Tyler series.

Gravelly or sandy subsoils are the chief characteristics of the Chenango series. It has good drainage. The fine sandy loam, loam, and silt loam of this series are mapped in Mercer County. They are not extensive, but practically all their area is cultivated, all the general farm crops being grown. Good yields are obtained.

The Tyler silt loam has poor surface drainage and underdrainage, and at least 85 per cent of it is used for pasture. Some of the better drained areas are cultivated, and fairly good yields are obtained in seasons of moderate rainfall.

The first-bottom soils are represented by three series. The Huntington soils are usually brown in color and are well drained. The Holly soils have gray as the predominant color, and are poorly drained. The Papakating silt loam is poorly drained, with a dark-brown to black surface soil, high in organic matter. Little of it is under cultivation. The better areas give good yields.

Muck and Peat have been formed by the accumulation and decay of organic matter. They are wet and swampy, but where well drained they are adapted to truck growing.

Rough stony land includes areas too rough and steep for cultivation.

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