SOIL SURVEY OF MAHONING COUNTY, OHIO.

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DESCRIPTION OF THE AREA.

Mahoning County is situated along the Pennsylvania State line in the northeastern part of Ohio, about 60 miles south of Lake Erie. It has an area of 427 square miles, or 273,280 acres.

The county lies wholly within the glaciated region of the United States, and the topography as a whole is gently undulating to rolling. The southern part of the county consists of rather deep narrow valleys, steep slopes, and broad, rolling ridges. The extreme southwestern part is rather level or gently undulating. The northern part is gently rolling. With the exception of the slopes at Lowellville and west of Washingtonville, all of the area can be cultivated. Along the Mahoning River and the various smaller streams there are well-defined first bottoms, and in places the Mahoning River and the larger creeks have well-developed terraces or second bottoms. Throughout the county there are numerous flat areas in the upland, varying from a fraction of an acre to hundreds of acres in extent.

FIG. 27.—Sketch map showing location of the Mahoning County area, Ohio.

The county has an average elevation of about 1,000 feet above sea level. The highest point is the hill in Secs. 27 and 28, Green Township, which rises 1,320 feet above sea level. The lowest point is where the Mahoning River crosses the Pennsylvania State line, 800 feet above sea level. There are no hills rising abruptly above the surrounding country.

Regional drainage is fairly well established, but there are numerous areas where the stream courses are so shallow that drainage is locally inadequate. The southwestern part of the county has the poorest drainage development, while the southern part has a well-developed system.

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All the county except the extreme southern part is drained by the Mahoning River and its tributaries, the largest of which are Meander, Mill, and Yellow Creeks. The streams flow in a northerly direction. The Mahoning River crosses and recrosses the western boundary of the county, flowing in a general northerly direction, and finally reenters the county northwest of Youngstown, whence it flows in a southeasterly direction, leaving the county east of Lowellville. This river has developed a valley over 300 feet deep at Lowellville, but its valley in the southwestern part of the county is rather shallow, probably averaging 100 feet deep. The river channel averages about 100 feet in width, and the valley has an average width of one-half mile. The current in general is moderate.

Meander, Mill, and Yellow Creeks, which drain the greater part of the county, flow in a northerly direction. They have developed valleys ranging up to a mile in width, and of an average depth of 100 feet. The stream channels are shallow and narrow, averaging about 40 feet wide. Little Beaver Creek and Cherry Valley Run, which flow in a southerly direction and drain practically all of Green Township and the southeastern part of Goshen Township, have developed narrow and relatively deep valleys.

Mahoning County was organized in 1846. Originally it was part of Trumbull County, now lying to the north. The county seat was located at Canfield until 1879, when it was moved to Youngstown, its present location. The first permanent resident in this section settled in 1797 on the east bank of the Mahoning River at the present site of Youngstown. After 1797 settlers began coming in rather rapidly from more eastern States, especially Connecticut. Since manufacturing has become important there has been a great influx of Italians, Hungarians, Greeks, Irish, and others in the cities, and a few foreigners have drifted into farming. According to the census, the population of Mahoning County was 42,871 in 1880 and 116,151 in 1910. In 1910, 87,408 were classed as urban and 28,743, or 24.7 per cent, as rural. The density of the rural population is 67.3 persons per square mile. The urban population, which comprises the inhabitants of Youngstown and adjacent suburbs, is increasing rapidly, while the rural population is increasing only very gradually. The farming population is quite evenly distributed throughout the county. A number of small towns are included in the rural population, and it is probable that not over 20 per cent of the population is actually engaged in farming.

Youngstown, the county seat, had a population of 79,066 in 1910, and East Youngstown 4,972. The population of Struthers is 3,370, of Lowellville 1,592, and of Sebring 2,104. Canfield had a population of 685 in 1910. There are small residential villages in each township.

Youngstown is one of the most important steel-manufacturing centers in Ohio. It has numerous other factories and a number of creameries. Sebring is noted for its potteries.

Mahoning County has good shipping facilities. Most parts of the county are reached by railroad. Lines of the Pennsylvania, Baltimore & Ohio, Pittsburgh & Lake Erie, and Lake Shore & Michigan Southern pass through Youngstown, connecting it with other Ohio and Pennsylvania points. The Niles & Lisbon Branch of the Erie traverses the central part of the county, passing through West Austintown, Canfield, Calla, Greenford, and Washingtonville. The Erie & Ashtabula Division of the Pennsylvania crosses the western part of the county, and the New York Central, Alliance Division, the northwestern corner of Smith Township, in the southwestern part of the county. The Pittsburgh, Fort Wayne & Chicago Division of the Pennsylvania connects Garfield, Beloit, and Sebring with points east and west.

There are a number of electric lines radiating from Youngstown. One extends south from Youngstown through North Lima to the junction at Leetonia, Columbiana County. From the latter city lines extend westward through Salem, Columbiana County, Damascus, Garfield, Beloit, Sebring, and Alliance. A line also extends south from Leetonia. There are electric railways connecting Youngstown with Sharon and New Castle, Pa., and with Niles and Warren, Ohio. The southeastern part is the only section of the county inadequately supplied with transportation facilities.

The roads of Mahoning County are good. Most of the earth roads are scraped in the spring and receive several draggings during the summer. Brick and macadamized roads radiate from Youngstown in all directions, good roads connecting almost all the surrounding towns. The improved-road mileage is increasing rapidly.

All sections of the county are reached by rural mail delivery routes and telephone lines. The school system is excellent. Practically every township has one graded and one high school. Children living over a mile from schoolhouses are hauled to and from the school. There are a large number of churches throughout the rural districts.

Youngstown is one of the best markets in the State for farm produce. The local demand for fruit, milk, vegetables, and other farm products is greater than the supply, and many of the necessities have to be imported from surrounding counties. Beef cattle as a rule are sold in Pittsburgh; this is the only farm product that does not reach local markets direct.

CLIMATE.

The accompanying table is compiled from the records of the Weather Bureau Station at Warren, in Trumbull County, at which

place the climatic conditions are practically the same as in Mahoning County:

Normal monthly, seasonal, and annual temperature and precipitation at Warren, Trumbull County.

Month.	Temperature.			Precipitation.			
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year (1889).	Total amount for the wettest year (1890).	Snow, average depth.
	°F.	°F.	°F.	Inches.	Inches.	Inches.	Inches.
December	29.9	72	−10	3.09	2.48	3.19	12.2
January	26.7	74	−25	3.13	3.10	2.60	13.0
February	25.5	72	−20	3.06	1.10	4.15	12.1
Winter	27.4	74	−25	9.28	6.68	9.94	37.3
March	37.5	83	−10	3.52	1.15	3.56	7.5
April	46.9	96	15	3.11	2.27	3.78	5.4
May	58.7	98	24	3.65	2.38	7.24	.....
Spring	47.7	98	−10	10.28	5.80	14.58	12.9
June	67.4	101	32	2.98	2.95	1.75	.....
July	72.4	100	40	4.29	2.34	2.68	.....
August	69.9	99	34	3.44	2.55	3.84	.....
Summer	69.9	101	32	10.71	7.84	8.27	.....
September	64.3	97	26	3.10	3.15	6.46	.....
October	51.6	89	20	2.66	1.54	6.89	.5
November	39.8	75	8	2.52	1.71	2.45	3.6
Fall	51.9	97	8	8.28	6.40	15.80	4.1
Year	49.2	101	−25	38.55	26.27	48.59	54.3

The winters are rather long and moderately severe. January and February have a mean temperature of 26.7° F. and 25.5° F., respectively. The absolute maximum for the winter months ranges from 72° to 74° and the absolute minimum from −10° to −25°. The mean temperature for the winter season is 27.4°. The average snowfall for the year is 54.3 inches. The summers are moderately long and warm. July and August have a mean temperature of 72.4° and 69.9°, respectively, an absolute maximum of 100° and an absolute minimum of 34°. The range between the mean temperatures of the coldest and warmest months is 47°, or from 25.5° in February to 72.4° in July. The spring and fall months have a mean temperature of about 49°.

The average date of the first killing frost in the fall is October 4, and that of the last in the spring May 13. This gives a normal growing season of 144 days, sufficient to mature most crops adaptable to

this section. Frosts have been recorded as early as September 15, and as late as May 29, but this is unusual.

The mean annual precipitation is 38.55 inches. The total rainfall for 1889, the driest year recorded, was 26.27 inches, and that of 1890, the wettest year, 48.59 inches. In normal years the rainfall is fairly well distributed, the spring and summer months having the heaviest precipitation.

The climate is suited to the production of late potatoes, oats, wheat, rye, corn, apples, and truck crops. The southern part of the county is selected principally for fruit, as damaging frosts are here less frequent.

AGRICULTURE.

The well-drained sections of Mahoning County were originally covered with a heavy growth of sugar maple, red oak, white oak, other oaks, elm, and chestnut. The depressions and more level areas supported a growth consisting principally of beech, with some oak and elm. The early settlers had to depend entirely on agriculture and game for a livelihood. Small tracts of land were cleared and seeded to wheat and corn. Each farmer produced only enough grain, vegetables, and pork for home use, as there was no market. The early development of agriculture was consequently very slow. When the settlement of the towns began, in the early part of the nineteenth century, and roads were opened, agriculture began to expand.

A grist and saw mill was erected on Mill Creek in 1798, and the first coal was shipped from the county in 1840. The steel industry, which has been an important factor in the agricultural development of Mahoning County, began with the erection of the first blast furnace in the county at Struthers, in 1806. Saw milling and steel production were the principal occupations, besides agriculture, in the early history of the county. With the establishment of manufacturing industries and the opening up of several railroads between 1853 and 1877, farming has gained rapidly in importance.

There has been comparatively little change in the crops grown, but agriculture has gradually developed into a more intensive system. Hay, corn, oats, and wheat have always been the most important crops. The census of 1880 reports 42,730 acres in hay, 15,415 acres in corn, 14,749 acres in oats, and 12,938 acres in wheat. There were 135,505 bushels of potatoes produced in 1879. Rye was grown on 421 acres and buckwheat on 377 acres. Maple sirup was produced to the extent of 32,304 gallons. The orchard and market-garden products were valued at $85,121.

The 1910 census reports 40,537 acres in hay, with an average yield of 1.3 tons per acre. Corn was grown on 15,155 acres, giving an average yield of 34 bushels. Oats were produced on 16,798 acres,

with an average yield of 35 bushels. The acreage in wheat is given as 14,409 acres, and the average yield 19 bushels. The potato acreage was nearly double that in 1899, 4,202 acres being in potatoes, giving an average yield of 91 bushels per acre. In 1909 there were 117,044 apple trees in the county, and 29,015 peach trees. There were 185 acres in small fruit.

In 1909 there were 15,916 calves and other cattle, 18,151 hogs, and 10,695 sheep sold or slaughtered, with a value of $846,280. The 1910 census reports 13,849 milch cows in the county, and the value of the preceding year's production of dairy products as $694,712. Poultry and eggs were produced in 1909 to the value of $294,945.

The agriculture of Mahoning County consists mainly of the production of oats, wheat, vegetables, and fruits as cash crops. Dairying is the most important direct source of income. Hay and corn are grown almost exclusively to support the dairying, live-stock, and poultry industries. Strawberries, raspberries, and blackberries are grown on a small scale as cash crops. A small percentage of the wheat and oats produced is consumed on the farm. Probably 25 per cent of the corn is grown for silage.

The most generally practiced rotation in Mahoning County consists of corn, oats, and wheat each 1 year, and hay 1 to 3 years. The tendency of farmers at present is to allow the land to stand in grass only 1 year.

The same general methods are employed in the production of corn as in other corn-growing sections. The land is plowed as early in the spring as possible, to a depth of 7 inches, and as a rule is rolled and harrowed several times. The corn is usually planted in check rows, although many farmers still plant 12 inches apart in rows spaced 3½ feet apart. Corn is planted about May 15. A number of farmers harrow corn when the plants are 2 or 3 inches high, and then cultivate every 10 days if possible until it is "laid by." At planting time corn receives an acreage application of 200 to 400 pounds of 16 per cent acid phosphate and 6 to 10 tons of manure when the latter is available. Part of the crop is put up in the silo and the remainder is allowed to ripen and is husked in the field. The fodder is usually hauled to the barn and fed as roughage.

Oats, which follow corn in the rotation, are often put in without plowing, the land being thoroughly disked before the oats are drilled in. Better returns are had when the ground is plowed about 7 inches deep, as early in the spring as possible, and rolled and well harrowed until a fine seed bed is obtained. Oats are drilled at the rate of 2½ to 3 bushels per acre, about May 1. A few farmers make a light application of acid phosphate, with good results. The crop is cut July 15 to August 1, and is thrashed in about 10 days to 2 weeks.

For wheat the oats stubble is preferably plowed as soon as the oats have been removed. Previously to plowing, 10 to 15 tons of stable manure is applied when available, and plowed under. After the land has been plowed the more progressive farmers who grow clover apply one-half to 2 tons of freshly ground limestone per acre. The land is thoroughly rolled, harrowed, and dragged until a seed bed of fine tilth has been obtained. The wheat is then drilled in at the rate of 1½ to 2 bushels per acre in conjunction with 200 to 400 pounds of acid phosphate. Wheat is sowed about September 10 to 25, and is cut about July 10 to 15.

When hay follows wheat the timothy is sowed with the wheat at the rate of about 6 quarts per acre, and clover is sowed broadcast in the spring as soon as hard freezes have passed. Clover is seeded at the rate of about 4 quarts per acre. The hay is cut in the early part of July and stored in the barn or stacked.

Potatoes are not generally grown in the rotation, but they are becoming an important crop. The ground for potatoes is plowed, rolled, and thoroughly harrowed, and the crop is planted about May 20 to June 1. It is cultivated to a shallow depth about every 10 days. The best potato growers treat their seed with formaldehyde for scab and also spray with Bordeaux mixture for blight. The potatoes are harvested from September 15 to the middle of November.

Practically all the farms are supplied with modern implements, such as sulky and walking plows, rollers, spring and spike tooth harrows, manure spreaders, binders, and reapers. As a rule three to four horses of medium to heavy draft types are used. At present there are a number of gasolene tractors in use. According to the 1910 census the equipment of farm machinery is valued at an average of 2.5 per cent of the total value of all farm property.

Dairying is one of the most important industries in the county. Nearly every farmer maintains a herd of high-grade and pure-bred Holsteins or Jerseys, or both. In the majority of cases these are pastured entirely during the summer and fed in the barn during the winter on silage and concentrates.

The feeding of steers is not so important, but there are several herds of Angus, Shorthorn, and Polled Durham in the county. As a rule the beef cattle are bought in September or October and allowed to pasture until the ground freezes, when they are put in the barn and fed on silage and concentrates. In the early spring they are again put on pasture and allowed to graze until July, when they are sold in Pittsburgh or Buffalo. Sheep and hogs are raised on a small scale.

Topography has not influenced the distribution of crops materially, but soil differences have had a marked influence on the agriculture of the county. On the heavy soils of the Mahoning and Ellsworth

series, hay and oats are the most successful of the general crops, and it is recognized that these soils are not especially suited for the production of corn. The Trumbull soils which are naturally poorly drained are used to a very large extent for pasture land, although a considerable acreage is used for growing hay and oats, and a very small area for corn and wheat. Corn usually matures and gives good yields on the Wooster loam and silt loam, the Canfield silt loam, the artificially drained areas of Volusia silt loam, and the Chenango types of the terraces. On these soils corn is a very important crop. In general, it may be said that corn and potatoes are better adapted to the well-drained and lighter textured soils, while oats are grown successfully on nearly all the soils. Grass does best on the cold, damp soils of the Volusia and Mahoning series. Potatoes are grown successfully on the Canfield silt loam and the other well-drained types, but the best soils for this crop are the Wooster silt loam, Wooster loam, and Chenango loam, all of which have good drainage. In trucking the tendency is to use the soils most accessible to the markets, disregarding any special adaptation.

Soil differences do not control the size of farms to any extent, but they do influence the acreage of improved land. Where the heavy and poorly drained types predominate the improved area is considerably smaller than on the lighter and well-drained types. The 1880 census reports 2,842 farms in the county, having an average size of 88.6 acres, of which 66.8 acres was improved. The 1910 census reports 3,024 farms, of an average size of 77.7 acres, with 54.4 acres improved.

The 1880 census reports 83.2 per cent of all farms operated by owners, while the 1910 report shows 78.2 per cent operated by owners 20.1 per cent by tenants, and 1.7 per cent by managers.

Farm leases vary widely in this county. Practically all farms rent on the cash basis, at an average of $3 to $5 an acre. Land close to market brings as high as $10 to $15 an acre. The selling price of land ranges from $10 to $500 an acre, depending on the location as to improved roads and markets. Land within 4 or 5 miles of Youngstown is valued more for its building value than for agricultural purposes. The better grades of agricultural land a short distance from markets can be bought as a rule for $60 to $100 an acre.

The buildings on the average farm consist of a substantial frame house, a large barn and implement shed, and on practically all farms, one or two silos. The barns are sufficiently large to house all the stock in the winter, and to provide sufficient storage room for the various crops, except the silage. In 1910 the buildings represented 24 per cent of the total farm value.

The labor question is the most serious problem confronting the farmer. Owing to the extensive manufacturing industries in the

cities, where relatively large wages are paid, it is very difficult to obtain farm help even in normal times. Harvest hands are paid $1.50 to $3 a day and board. Laborers hired by the year receive from $25 to $50 a month, with board or house furnished. Most of the farmers give each other mutual help when laborers can not be hired.

Commercial fertilizers are used by practically all farmers, in conjunction with barnyard manure and lime. Barnyard manure and compost were the only fertilizing materials until the early seventies, since when the demand for commercial mixtures has increased rapidly. The census of 1880 reports an expenditure of $15,579 for fertilizers, as compared with $87,076 in 1910. In the latter year 73 per cent of all the farmers in the county used fertilizers, at an average expenditure of $39 each. The most common fertilizer used is 16 per cent acid phosphate, applied at the rate of 200 to 400 pounds per acre on wheat and corn. Occasionally oats receive a light application. Lime is applied at the rate of one-half to 3 tons per acre.

SOILS.

The upland soils of Mahoning County are derived for the most part from the glacial till which mantles all the upland and to a more limited extent from old water-laid deposits of reworked glacial material forming terraces or benchlands through the valleys. A very small proportion of the soils consists of recent alluvium occupying the flood plains of the principal streams. In some parts of the upland the soil is derived from organic deposits, which, because natural drainage has not been established, have remained for long periods in a marshy condition.

The glacial till or ice-laid material is almost altogether of sandstone and shale origin, and in most places it bears a very close relation to the underlying formations. As the result of glacial action some mixing of material from different formations necessarily has occurred, and the presence of occasional large bowlders and smaller fragments of crystalline rocks on the surface and imbedded in the till indicates that some of the material must have come from very distant sources, nevertheless a close examination of the material, especially that composing the till plain or the ground moraine, shows it to be derived almost entirely from the local rock formations, and also that much of it has been moved only short distances, for where the underlying rocks consist of sandstones or sandy shales the soil is correspondingly light in texture and usually carries an abundance of stone fragments, and where the finer textured shales, which are easily pulverized, underlie the surface, the soil is quite heavy and virtually stone free. Nearly all of the rock fragments are angular, showing that they have not been far removed from their source.

In the areas of terminal-moraine character the relation of the till to the local rocks is not so striking. A large proportion of the stone content is in the form of waterworn gravel and cobbles showing that it has long been subjected to water and ice action and probably transported from distant points; a larger percentage of the stone content in such deposits is of foreign origin than is the case in the till plains.

The relation of the terraces and the more recent alluvial plains to the uplands is about as close as that of similar formations in a region of residual soils formed in place by the decay and disintegration of the underlying rocks. While the alluvial soils may contain some foreign material they may be considered as composed strictly of the wash from sandstone and shale areas.

Only two geological formations have played an important part in supplying the soil materials of the county—one consisting of grayish, massive and shaly sandstone and sandy shales, and the other of thinly bedded, argillaceous shales and clays, gray to rather dark gray in color and of a more or less calcareous nature. Coal seams occur below the sandstone formation and there are a few local outcrops of limestone, but these have had no important influence on the soils. The sandstone formation may be said to occupy that part of the county east and south of a line beginning about 3 miles northwest of Youngstown and extending in a southwesterly direction to the northwest corner of Green Township, thence northwest to about 2 miles northwest of Ellsworth Station, thence southwest to the county line southwest of Sebring. The shales are to the north and west of this line.

The depth of the till over the solid bedrock varies widely. Where it overlies the sandstone it ranges in depth from a few inches to as much as 50 feet or more; in fact, in some places the bedrock outcrops, as on some prominent knolls or escarpments and on steep slopes where erosion has been active. Scarcely any exposures of the soft shales are to be seen, but in many places the till does not have a depth of more than a few feet over the shale.

The glacial drift at the time of its deposition did not vary widely in its characteristics, but a number of soils have been developed from this material, through different drainage conditions and the varying activity of weathering agencies. The soils now differ widely in characteristics. Where the drainage is best, brown, well-oxidized soils have developed. Where the drainage is not so good but can not be classed as poor the soil is grayish with a yellowish or brownish tinge, the subsurface layer is yellow, and the subsoil is gray and brown mottled, with some tendency to hardpan development. Areas with still poorer drainage are represented by a grayish soil with only a slight brownish cast, a pale-yellow subsurface layer slightly mottled with gray, and a gray and brown mottled subsoil. In the poorly drained flats and de-

pressions the soil is light gray, the subsurface light ashy gray or gray and rusty brown mottled, with numerous small iron concretions present, and the subsoil is gray to bluish gray and yellowish brown mottled; locally the soil may be almost black and the subsoil gray with some yellow and brown mottlings.

Soil development on the terraces has about kept pace with that in the uplands. The alluvial soils, however, have not been deposited long enough to allow the full force of weathering agencies to become operative. Where the drainage is good they have the evenly oxidized, brownish color and loamy structure of the original deposit; while under poorer conditions of drainage a more compact structure and more or less mottling of gray and brown have developed.

Following the differences outlined above, the soils of the upland, terraces, and first bottoms are each separable into subgroups, designated as soil series. A complete series includes all grades of soil from fine gravel through coarse, medium, and fine sand and silt to clays, all having a similarity in mode of formation and in color, structure, and drainage. The different grades of material, textural differences, represented in the series are separated into types, the unit of classification and mapping.

The light-till uplands, confined very largely to the eastern and southern part of the county, give rise to members of five series. The best drained areas where the till is 3 feet or more in depth are mapped as the Wooster series. Where the till overlies bedrock at less than 3 feet and probably is in part residual, the Lordstown series is recognized. The next poorer drainage condition is represented by the Canfield series, and the next below this by the Volusia series. The most poorly drained areas are occupied by the silt loam member of the Trumbull series, except in a few marshy areas where Muck has accumulated.

The heavy till overlying shale in the northern and western sections of the county gives rise to the Ellsworth series under the best conditions of drainage, to the Mahoning soils in areas less well drained, and to the heavy members of the Trumbull series where the drainage is decidedly poor. The terrace soils are classed in the Chenango series where good drainage has been established, and in the Braceville and Tyler series, in areas of poor drainage. The brown and the grayish mottled alluvial soils are classed in the Huntington and Holly series, respectively.

The Wooster series is characterized by yellowish-brown to brown surface soils and yellowish-brown, evenly oxidized subsoils which are not heavier than the soils in texture and not much compacted. More or less stone both angular and rounded occurs on the surface and throughout the 3-foot section, usually being very abundant in the unweathered till substratum. The topography ranges from

nearly level to steeply sloping or very irregular—characteristic of terminal-moraine deposits. The Wooster loam is confined almost entirely to morainal deposits, where the influence from foreign material possibly is greater than in any of the other upland types. The silt loam is in part from morainal deposits, but more largely from till-plain deposits where thorough drainage has been established.

In the Lordstown series the soils are brown and the subsoil yellowish-brown, giving way to sandstone or shale bedrock at a depth of 3 feet or less. These soils occur on tops of ridges or slopes where very little till was left mantling the rock formations. They are naturally well drained and the shallower areas in particular are inclined to be droughty.

The surface soils in the Canfield series are brownish-gray to yellowish-gray. The subsoil to depths of 20 to 24 inches is yellowish-brown in color and friable in structure. It is about the same as the surface soils in texture, but below it is distinctly mottled gray, yellow, and brown with gray as the dominant color. It also becomes more compact with depth, although grading slightly lighter in texture downward. The underlying till is a grayish, loamy mass, usually quite stony and noncalcareous. The topography is gently undulating to strongly rolling, and the run-off is fairly good, but the underdrainage is deficient as is evidenced by the heavy mottling. The Canfield series is intermediate between the Wooster on the one hand and the Volusia on the other.

The soils in the Volusia series are gray with a slight brownish tinge. The upper subsoils range from pale yellow, slightly mottled with gray, to more highly mottled gray and yellow, while the lower subsoils are mottled gray, yellow and brown, usually with gray as the dominant color. There is only a slight change in texture from the surface downward, until a depth of about 2½ feet is reached, below which the material grades slightly lighter or more gritty. The subsoils are more compact and show a greater tendency toward a hardpan development than is the case in the Canfield series. The unweathered till below is noncalcareous. The topography ranges from nearly flat to undulating and gently rolling, and the natural drainage is poor. The Volusia series has an extensive development in the eastern part of the county in association with the Canfield and Trumbull silt loams, being poorer drained than the first and better drained than the latter type.

In the Ellsworth series the surface soils are brownish gray to yellowish gray or light grayish brown, and the subsoils, in the upper part, are yellowish brown, changing at depths of 15 to 24 inches through drabbish brown to olive drab. The subsoils are very heavy, consisting of very smooth, brittle clay which below 30 to 36 inches is in many places moderately calcareous. Owing to their derivation

almost wholly from soft, easily pulverized shales the Ellsworth soils are almost stone free, although an occasional fragment of some foreign rock is to be found.

The Mahoning series includes soils that have reached about the same stage of development as those of the Volusia series, the important difference being that the subsoils are quite heavy and weathering has not extended as deeply. The surface soils are gray with a slight yellowish or brownish tinge. The upper subsoils are gray and yellowish brown mottled and not so much heavier than the surface soils, while the lower subsoils are brownish drab to olive drab in color and very heavy in texture. The heaviness of the subsoils increases with depth until near the lower part of the mottled zone. Here there is encountered a brownish-drab layer which is very heavy in texture and in places moderately to rather highly calcareous.

The Trumbull series is characterized by light-gray surface soils, with a light ashy gray or gray and rusty-brown, mottled subsurface layer, and gray to bluish-gray and yellowish-brown subsoil. The subsoils are as heavy as or heavier than the surface soils in texture, and in the case of the heavier types they are quite tough and plastic. The Trumbull soils are flat to gently undulating or sloping. They occur in level stretches where there is little or no surface drainage, on gentle slopes subject to seepage, and in depressions as about the heads of drainage ways, all the areas are naturally poorly drained.

The Chenango series includes brown soils with yellowish-brown subsoils, resting upon beds of stratified gravel at a shallow depth. The surface is level to gently undulating and sloping and the natural drainage is good. They occupy a terrace position intermediate in elevation between the uplands and stream bottoms. In color characteristics the Chenango soils are similar to the Wooster soils of the uplands.

The Braceville series includes soils that are grayish-brown or gray and rusty-brown streaked in the surface layer and gray and rusty-brown mottled in the subsoil. The subsoils are not heavier than the soils in texture, and gravel forms the substrata at depths of 2 to 3 feet. The Braceville soils are similar in origin to those of the Chenango series, but differ in being poorly drained.

The Tyler series includes terrace soils that are gray at the surface and gray and yellowish brown mottled in the subsoil, which is heavier than the soil in texture. The Tyler soils are similar in color characteristics to the Volusia soils of the uplands, although in places they approach the Trumbull characteristics. They are naturally poorly drained.

The soils of the Huntington series are brown, with light-brown to yellowish-brown subsoils. The soil and subsoil are friable and practi-

cally uniform in texture throughout the entire depth of 3 feet. The Huntington soils occur adjacent to streams and are subject to overflow during high freshets. They represent the well-drained soils of the first bottoms.

The Holly series is characterized by brown and gray mottled surface soils and gray, yellow, and brown, mottled subsoils, of similar or somewhat heavier texture. They occupy first-bottom positions, subject to overflow, and are poorly drained.

Muck consists of well-decomposed vegetable matter, and is black in color. It is found in depressions where conditions have been favorable for the growth and accumulation of plant remains. The areas are covered with water the greater part of the year, owing to poor drainage.

In the following pages of this report the various soils of Mahoning County are described in detail. The following table gives the name and the actual and relative extent of each:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Volusia silt loam	73,088	26.8	Ellsworth silty clay loam	4,288	1.6
Canfield silt loam	54,464	20.0	Holly silt loam	3,904	1.4
Mahoning silt loam	54,208	19.8	Braceville loam	3,648	1.3
Wooster silt loam	14,464	5.3	Huntington silt loam	2,624	0.9
Trumbull silty clay loam	12,288	4.7	Tyler silt loam	2,496	0.9
Dark-colored phase	512		Chenango loam	2,240	0.8
Wooster loam	2,880	4.0	Holly silty clay loam	1,920	0.7
Steep phase	7,936		Lordstown silt loam	1,280	0.5
Mahoning silty clay loam	9,984	3.6	Muck	768	0.3
Trumbull silt loam	9,408	3.4	Tyler clay loam	768	0.3
Trumbull silty clay	5,312	1.9			
Ellsworth silt loam	4,800	1.8	Total	273,280	.....

WOOSTER LOAM.

The Wooster loam is a light-brown to brown silty loam, with a depth of 7 inches, resting on a yellowish-brown light loam or sandy loam extending to a depth of 36 inches or more. This type is uniform in color, but the texture varies from a silt loam to a fine sandy loam. The structure is loose and friable. Rock fragments and small bowlders are scattered over the surface and within the subsoil.

Included with this type are small areas of typical Wooster sandy loam. Their principal occurrence is in the valleys in the southwest part of the county. The soil to a depth of 7 inches is a light-brown sandy loam, underlain by a yellowish-brown sand or loamy sand.

The Wooster loam occurs in rather small, isolated areas throughout the county. Its largest development is in the southern part of

Green Township. It has a typical morainic topography, occurring in ridges and mound-shaped hills. Drainage is good to excessive.

The native forest growth on this type consisted mainly of sugar maple and red and white oak, with some elm and chestnut. Probably 50 per cent of the type has been cleared and is now under cultivation. It is a good agricultural soil. The same general farm crops are grown and the same fertilization and cultural methods employed as on the Wooster silt loam. Hay is the most important, followed by corn, oats and wheat. Yields of the general farm crops are somewhat lower than on the silt loam. Hay yields about 1½ tons per acre, corn 40 to 60 bushels, oats 40 to 65 bushels, wheat 15 to 30 bushels, and potatoes 125 to 200 bushels. Farms sell for an average price of $100 an acre, with a range from $50 to $150.

Farmers recognize that the Wooster loam is better adapted to potatoes and truck crops than any other soil in the county. Owing to the open character of the soil and subsoil it is rather difficult to maintain the productiveness, but with the application of coarse manure or the plowing under of green crops good yields should be obtained indefinitely.

Wooster loam, steep phase.—The steep phase of the Wooster loam is a light-brown to brown silty loam or silt loam with a depth of 4 to 6 inches, underlain by a yellowish-brown loam to clay loam.

This phase is mapped on slopes in the eastern part of the county, most extensively along the Mahoning River southeast of Youngstown and along Honey Creek in Springfield Township. With the exception of a few seepy areas, it is well drained, and in places the run-off is so rapid as to cause gullying in cultivated land.

The greater part of the land is still covered with forest, but some small areas have been cleared and are used principally for hay production or as pasture land. The areas southeast of Youngstown are valued for residence sites. At a distance from the city this land can be bought for $30 to $50 an acre.

Owing to the steepness of the slopes, this phase is probably more valuable as forest and pasture land than for cultivated crops, although very little of it is so steep as to be unarable.

WOOSTER SILT LOAM.

The Wooster silt loam, to a depth of 8 to 10 inches, is a light-brown silt loam. The subsoil is a yellowish-brown, compact silt loam extending to 36 inches or more. The soil is smooth and friable and the subsoil friable but compact, the compactness increasing slightly with depth. There are many rock fragments and small bowlders throughout the soil section. In small areas where drainage is not well established faint gray mottlings occur in the lower part of the 3-foot section. In a few included areas the soil and subsoil contain con-

siderable fine sand, but these areas are not large enough to warrant separation.

The Wooster silt loam is not an extensive soil. Its largest development occurs within the city of Youngstown and there are important areas in the southern part of Green, Beaver, and Springfield Townships.

In some places the type has typical morainic topography, but as a rule it occupies slopes and well-rounded ridges. Owing to its topographic relief and the open character of the soil and subsoil, drainage is excellent, though the soil nevertheless retains a supply of moisture during dry weather.

The Wooster silt loam is an important soil agriculturally, and nearly all under cultivation. All this soil can be cultivated. The areas that have not been brought under cultivation in most cases support a medium to heavy growth of sugar maple, red oak, white oak, and some chestnut.

This soil is highly valued for general farming and for the production of orchard fruits, being one of the most productive soils in the county. Corn, oats, wheat, and hay occupy about equal acreages. Potatoes and apples are produced commercially, but on a small scale. Oats and wheat are the principal cash crops, the hay and corn being fed to the work stock and dairy cattle. A large part of the corn crop is cured in the silo and fed during the winter months. Hay yields 1 to 2 tons per acre, corn 40 to 75 bushels, oats 50 to 75 bushels, wheat 20 to 40 bushels, and potatoes 100 to 200 bushels.

Dairying is the most important agricultural industry on this type. The dairy cattle are mostly pure-bred or high-grade Holsteins. They are generally pastured during the summer on the forested areas and fed on silage and concentrates during the winter. Almost all the milk and cream is shipped to Youngstown.

It is probable that the production of apples and potatoes could be enlarged into profitable industries on this soil. Commercial potato growers by selecting early and late varieties can have potatoes on the market from August 15 until November 15. Where apple orchards have been sprayed and well cared for they have proved profitable.

The Wooster silt loam is easily cultivated and can be kept in good tilth with proper handling. Practically all the farmers use commercial fertilizer, principally acid phosphate, which is applied at the rate of 200 to 400 pounds per acre for corn and wheat, and in about half this quantity for oats. Lime is applied to wheat land at the rate of one-half ton to 2 tons per acre. Hay usually receives a top dressing of stable manure at the rate of 6 to 10 tons per acre.

Farms on the Wooster silt loam, which usually include other soils, sell for $75 to $200 an acre; $125 an acre is probably a fair average.

Experiment has shown that the yields on this soil can be increased by turning under green crops of clover. Land seeded to clover should be given a liberal application of lime.

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

Mechanical analyses of Wooster silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
272008	Soil	1.1	3.2	2.4	7.4	11.2	58.7	15.2
272009	Subsoil	.6	3.0	2.2	6.8	12.4	57.5	17.6

LORDSTOWN SILT LOAM.

The Lordstown silt loam is a brown, friable silt loam, 7 inches deep, underlain by a brownish-yellow silt loam which rests upon sandstone and shale bedrock at a depth of 12 to 36 inches. Some sandstone and shale fragments are scattered over the surface and throughout the soil section, and in a few places ledges of sandstone reach the surface.

As mapped the type is somewhat variable in color, in texture, and in the amount of stone on the surface. In local areas where the bedrock is shale the soil is gray and the subsurface layer is a yellow and gray mottled silt loam. Usually a 2 or 3 inch layer overlying the rock is more or less sandy. The texture of the type as developed at Lowellville varies from silt loam to clay, and the color from gray to brown.

The Lordstown silt loam is not extensively developed. The largest areas occur in the vicinity of Lowellville and in Austintown Township. Small areas are scattered throughout the remainder of the county.

As a rule this type occurs on the west slopes of rather prominent hills or caps the hills. Drainage ranges from good to excessive, the structure of the soil, the topographic relief, and the nearness of bedrock to the surface favoring the removal of excess moisture.

Owing to the small extent of the Lordstown silt loam it is not important agriculturally. Practically all of it is still covered with the natural growth of maple, oak, and chestnut. A few areas have been cleared, and here fair yields of hay, corn, oats, and wheat are obtained. The type seems well adapted to orcharding. Uncultivated areas support a good growth of grass and are used for pasture.

The average selling price of land of this type is about $60 an acre.

CANFIELD SILT LOAM.

The surface soil of the Canfield silt loam is a light brownish gray, gritty, friable silt loam, passing at about 7 inches into a yellow, gritty silt loam which usually extends to 20 inches. The typical subsoil is a yellow, gray, and brown mottled loam. The gray mottlings are characteristic of the type and become more pronounced with increase of depth. The subsurface layer varies from pale yellow to yellowish brown in color. The soil and subsoil both contain relatively large quantities of fine and very fine sand, which gives them a gritty feel. Considerable sandstone and sandy shale fragments occur on the surface and throughout the soil section, the underlying unweathered till being quite stony. The surface soil is friable and the subsoil is crumbly in structure, being readily penetrated by the roots of plants. Included in this type are some small areas of typical Canfield loam, differing only in texture.

The Canfield silt loam is one of the most extensive and important agricultural soils in the county. The largest areas are found in Springfield Township. There are also rather large areas in Poland and Youngstown Townships, with smaller areas scattered throughout the remainder of the eastern and southern parts of the county.

This type occupies slopes and smooth rolling ridges where good surface drainage has been established, and is intermediate between the Wooster and Volusia soils in drainage conditions. Underdrainage is somewhat deficient as the mottled subsoil colors would indicate.

The natural forest growth consists mainly of maple, red and white oak, scattered chestnut, elm, and a few beeches. About 75 per cent of the type has been cleared and the land is now under cultivation. The Canfield silt loam is a productive soil for general and intensive farming. When it is cultivated under proper moisture conditions an excellent seed bed is easily obtainable. It warms up fairly early in the spring. All the type could be cultivated when cleared of its forest growth, if this were advisable.

General farming is the prevailing type of agriculture. Probably twice as large an acreage is devoted to hay as to any other crop. Corn, oats, and wheat are cultivated on about an equal acreage. The hay and corn are fed to the work and dairy animals; the oats and wheat are largely cash crops. Potatoes are grown extensively, but they are not specialized in on any farm; nearly every farmer merely marketing a surplus, after supplying his own needs. There are a few commercial apple and peach orchards, which give profitable returns. About 25 per cent of the corn crop is used for ensilage. The woodlots are all pastured, and some cleared land also is used for permanent pasture. No extensive trucking is done on this soil.

Dairy products are important on every farm, practically every one having a good-sized herd of pure-bred or grade Holstein or Jersey cattle. As a rule the stock is pastured during the summer, and fed on ensilage and concentrates during the winter. The dairy products are sold mostly in Youngstown in the form of milk and cream. The raising and feeding of beef cattle is of minor importance on this type, as on the other soils of the county. Hogs are raised by most farmers to supply pork products for home use, and as a rule there is some surplus for sale. Poultry raising receives considerable attention and is a source of some income.

This is among the best of the extensive soil types for the general farm crops, especially corn. It is recognized by all farmers that for this crop it is superior to all other soils except the Wooster types. Hay yields 1 to 2 tons per acre, corn 40 to 60 bushels, oats 40 to 60 bushels, wheat 15 to 35 bushels, and potatoes 100 to 200 bushels. The pastures on this soil are good.

A 5-year rotation, consisting of corn, oats, and wheat each 1 year, and hay 2 years is usual on this soil. Potatoes do not have any special place in the rotations. The general tendency at present is to make hay a 1-year crop. The farm supply of stable manure is usually applied to the wheat and corn land before plowing. Many farmers give a light top dressing to hay fields in the early spring. In addition to the barnyard manure corn and wheat receive from 200 to 400 pounds of acid phosphate per acre and wheat one-half ton to 2 tons of ground limestone. Timothy is drilled in with the wheat. Clover is broadcasted in the early spring in the wheat and timothy, and a good stand usually results. The cultural methods used in connection with the various crops are the same as on the other soils of the county. Many of the farmers are tile-draining their land, and where this has been done more satisfactory crops have been obtained.

Land of the Canfield silt loam type has a wide variation in value. Prices ranging from $60 to $500 an acre. A fair average price for farms a moderate distance from the city is $85 an acre.

Increasing the organic content of this soil would improve it. Organic matter may be incorporated by feeding the greater part of the crops and returning the manure to the land, or by turning under green crops such as rye and clover. Liming has proved very beneficial, especially in seeding the land to clover. Better drainage by means of tiling should be established in many places.

The results of mechanical analyses of samples of the soil, subsoil, and lower subsoil of the Canfield silt loam are given in the following table:

Mechanical analyses of Canfield silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
272010	Soil	2.4	4.3	3.6	10.9	12.1	52.2	14.2
272011	Subsoil	2.1	4.1	3.2	10.6	10.2	52.4	17.1
272012	Lower subsoil	1.9	6.5	6.0	21.7	15.3	32.9	15.4

VOLUSIA SILT LOAM.

The surface soil of the Volusia silt loam consists of 6 to 8 inches of light brownish gray silt loam, slightly gritty or mealy in texture and quite friable. The subsoil, to a depth of 18 to 24 inches, is a mottled yellow and gray silt loam to light silty clay loam, changing below to a gray, yellow, and brown mottled, compact silty loam to silty clay loam which extends to a depth of 30 to 36 inches. The substratum is brownish to grayish loamy till carrying large quantities of sandstone and sandy shale fragments. Some gravel and angular fragments of sandstone and shale occur on the surface and through the soil section.

In structure and texture the Volusia silt loam is very similar to the Canfield, from which it differs in its gray surface soil and mottled subsurface layer. The Volusia soil also contains numerous stone fragments throughout.

Small areas of Volusia loam and sandy loam in the southwestern part of the county are mapped with the silt loam. The loam areas have a brownish-gray loam soil and a yellow and brown mottled loam subsoil, and the sandy loam areas a brownish-gray sandy loam soil and a gray and yellowish-brown mottled sandy loam subsoil.

The Volusia silt loam is one of the most widely distributed types in the county. Its largest development is in the eastern part of the county, and the largest areas are mapped in Boardman and Coitsville Townships. This soil usually predominates on broad, rolling hills, and its topography is prevailingly flat to gently undulating and gently rolling. Owing to the comparatively level topography drainage is poor. Maximum yields are not obtainable unless artificial drainage is provided.

Probably 40 per cent of this type is under cultivation, the remainder being covered with the natural forest growth consisting principally of beech, oak, hickory, elm, and some sugar maple.

The Volusia silt loam is used for the production of general farm crops and for pasturage. Probably a larger percentage of the cleared land is used for pasture than in the case of any other type. Hay is the most important crop. Corn, oats, and wheat occupy about an equal acreage. Hay yields one-half to 1½ tons per acre, corn 20 to 40

bushels, wheat 10 to 20 bushels, and oats 15 to 40 bushels. Potatoes are grown principally for home use and yield 50 to 100 bushels, per acre.

Where this type is efficiently drained the yields are about the same as on the Canfield silt loam. However, the corn crop on the Volusia soil is used principally for ensilage, as it rarely matures, owing to the unavoidable lateness of planting and to the generally unfavorable drainage conditions. The silage and hay is fed to dairy cows, and other stock. Wheat and oats are sold, and there is usually an excess of potatoes for the market. Dairying and the fattening of steers are the principal farm industries on this type. The dairy cattle are mostly Holstein, but there are a few of Jersey blood. Steers are usually purchased in early fall and allowed to pasture until the early winter, when they are put in the barn and fed on silage and concentrates. In the spring they are turned out to pasture again, and sold some time in July. Hogs are raised mainly for home use, although in most years there is a surplus for sale on many farms.

The usual rotation is practised on this type, corn, oats, and wheat each being grown one year, followed by hay for 1 to 3 years. There is a tendency to keep the land in timothy longer than on the Canfield and Wooster silt loams. The methods of planting, cultivating, and fertilizing are practically the same as on other types.

Land of the Volusia silt loam type sells for $25 to $100 an acre, except where close to the city.

The most important step in the improvement of this type is to provide efficient drainage. After the land has been thoroughly drained lime should be applied and organic matter incorporated in the form of manure or green crops. When managed in this way the Volusia silt loam should produce as good crops as the types naturally better drained.

In the following table are given the results of mechanical analyses of samples of the soil, subsoil, and lower subsoil of the Volusia silt loam:

Mechanical analyses of Volusia silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
272001	Soil	1.9	4.8	3.0	11.2	11.4	51.8	15.6
272002	Subsoil	1.8	4.0	3.4	14.0	17.0	40.4	19.0
272003	Lower subsoil	1.4	4.0	3.5	16.1	16.8	40.0	17.9

ELLSWORTH SILT LOAM.

The Ellsworth silt loam to a depth of 7 inches is a brownish-gray, smooth, floury silt loam, passing into yellowish-brown, light silty

clay loam which extends to a depth of 18 inches. The subsoil proper, from 18 to 36 inches or more, is a brownish-drab, heavy, brittle clay. The lower subsoil is calcareous in some areas and the substratum, consisting of a greenish-drab, heavy clay till, only slightly weathered, is in places moderately calcareous. This type is practically free from stone fragments throughout the 3-foot section, and both the soil and subsoil are very smooth in texture, the latter being quite tough and brittle instead of plastic as is usually the case with heavy clays. The yellowish-brown subsurface layer, free from mottling, is the distinguishing feature between this type and the Mahoning soils.

This type is confined entirely to the western half of the county. The largest area is east of Ellsworth. There are relatively large areas along Meander Creek, and small areas exist throughout the western part of the county. This soil lies slightly higher than the surrounding types, occupying ridges and slopes. It usually occurs where drainageways have been developed, giving good surface drainage, but owing to the heavy subsoil there is little movement of water downward into the subdrainage. Compared to the other heavy types, however, it is on the whole well drained.

About 25 per cent of this type has been cleared of its forest, consisting principally of white oak, sugar maple, and hickory, and is now used as pasture or for cultivated crops. Hay probably occupies three times the acreage of any other crop. Corn, oats, and wheat are grown inextensively. Potatoes are grown principally for home use. Oats, wheat, dairy products, and sheep are the chief sources of income. Corn and hay are consumed on the farm. As a rule corn does not mature on this type, and the greater part of the crop is stored in silos.

Hay yields three-fourths ton to 1½ tons per acre, corn 15 to 35 bushels, oats 25 to 50 bushels, wheat 10 to 20 bushels, and potatoes 50 to 100 bushels. Almost all the farmers use a light application of fertilizer on the various crops except hay. Corn usually receives 100 to 300 pounds of acid phosphate per acre, oats 150 pounds of acid phosphate, and wheat 200 to 300 pounds. In some instances a fertilizer containing 2 per cent nitrogen and 10 per cent phosphoric acid is used instead of straight acid, but farmers report that there is very little if any difference in results. The same rotation of corn, oats, and wheat, each 1 year, with hay 1 to 3 years, is practiced as on other soils. Plowing is invariably done in the spring unless oats are to be planted on sod land, in which case the farmers report it is more advisable to plow in the fall. Dairying is not as important on this soil as on types in the eastern part of the county.

Land of the Ellsworth silt loam has an average selling value of about $50 an acre.

To improve this soil it is necessary to add organic matter by plowing under manure or green crops, as its physical condition is unfavorable. It is probable that liming would be beneficial.

The results of mechanical analyses of samples of the soil, subsoil, and lower subsoil of the Ellsworth silt loam are given in the following table:

Mechanical analyses of Ellsworth silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
272024	Soil	1.4	2.4	1.6	6.8	11.9	56.3	19.2
272025	Subsoil	.6	1.6	1.0	4.5	8.1	56.4	27.2
272026	Lower subsoil	.8	1.4	.9	4.0	8.8	39.6	44.2

ELLSWORTH SILTY CLAY LOAM.

The surface soil of the Ellsworth silty clay loam is a yellowish-gray, light silty clay loam, passing at 5 inches into yellow silty clay which extends to a depth of 15 inches. The subsoil to 36 inches or more is a brownish-drab, heavy brittle clay. The lower subsoil and the substratum are moderately to rather highly calcareous, being unweathered till. The texture varies from typical in places, for on the steeper slopes the surface soil has been washed away, leaving the brownish-drab clay exposed. On the broader ridges the soil is grayish brown rather than yellowish gray. Upon drying this soil cracks rather badly, while when wet it has a smooth, greasy feel. The type is free from stones.

This soil is not extensive. The largest area is mapped along Meander Creek east of Ellsworth. The topography is hilly, as the type occupies rather sharp ridges and slopes where erosion has been excessive. The surface drainage is excellent, but subdrainage is inadequate or in some places almost entirely lacking.

The Ellsworth silty clay loam is an unimportant soil in Mahoning County. The greater part of it is covered principally with white oak and hickory. Small areas are devoted to hay, corn, oats, and wheat, which give fair yields. Crops do not do quite as well as on the Ellsworth silt loam. The heavy texture and steepness of slopes are the cause of the comparative lack of development on this soil.

This type of land sells for $15 to $50 an acre.

The methods suggested for improving the Ellsworth silt loam are applicable also to this type, but as it is heavy in texture and difficult to cultivate satisfactorily it should be generally used as pasture land.

In the table following are given the results of mechanical analyses of samples of the soil, subsoil, and lower subsoil of the Ellsworth silty clay loam.

Mechanical analyses of Ellsworth silty clay loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
272031.....	Soil.....	0.8	3.0	2.0	7.7	8.4	55.9	21.9
272032.....	Subsoil.....	.5	1.6	1.0	3.2	4.6	45.3	43.6
272033.....	Lower subsoil...	.3	1.0	.6	2.4	3.1	44.1	48.3

MAHONING SILT LOAM.

The soil of the Mahoning silt loam is a gray, smooth silt loam with a depth of 6 or 7 inches. Immediately below this is a yellow and gray, mottled, heavy silt loam to silty clay loam extending to a depth of 12 inches, and grading into a gray and yellowish-brown, mottled silty clay which extends to an average depth of 24 inches. The lower subsoil, beginning at a depth of 24 inches, is a brownish-drab, heavy, brittle clay, like the lower subsoil of the Ellsworth silt loam, slightly weathered and in places calcareous. The soil seems rather hard and compact in its natural state, but is friable when cultivated. The subsoil is rather impervious and is commonly called hardpan. The type is practically free from stones.

This type differs from the Volusia silt loam mainly in the structure and texture of the lower subsoil, and the degree of weathering that has taken place here. The subsoil is a heavy, brittle clay instead of a loam to silt loam as in the case of the Volusia, and the soil is slightly heavier and more floury than in the latter type.

The Mahoning silt loam is one of the most extensive types in the county. It is confined, however, to the region of "fire-clay" and bluish-gray shale in the western half of the county. There are large continuous areas in Austintown, Jackson, Milton, Berlin, Smith, Canfield, and Ellsworth Townships.

The topography prevailing is undulating to gently rolling, and in most places gives fair surface drainage, but the imperviousness of the subsoil makes the downward movement of water very slow.

Probably 60 to 75 per cent of this type is under cultivation. The unfarmed land supports forest consisting mostly of white and red oak, hickory, elm, and beech. All the type has a favorable topographic position.

All the common crops are produced on this type under a system of general farming. The acreage devoted to hay is about three times that of any other crop. Corn, oats, and wheat are grown on about an equal acreage. Potatoes are grown principally for home use, as are also a few small patches of buckwheat. Work stock, dairy cattle, and hogs consume practically all the hay and corn produced. Each farmer as a rule has one or two silos to supply winter feed for dairy

cattle. Large areas of this soil are used for pasture. Hay yields 1 to 2 tons per acre, corn 30 to 50 bushels, oats 50 to 75 bushels, wheat 15 to 35 bushels, and potatoes 75 to 150 bushels. This is one of the best soils of the region for oats, but it is less desirable than the Volusia silt loam and the better drained soils of the Canfield and Wooster series for the production of corn.

Dairying is the principal source of income on the Mahoning silt loam, supplemented by wheat and oats as cash crops. Practically all the farms carry herds of Holstein or Jersey cattle, the milk and cream from which are sold in Youngstown. Hogs are raised in small numbers on all the farms, and there is generally a surplus for sale. Poultry is a source of some income.

The same rotation is practiced on this type as on the other soils of the county. The land is plowed to a depth of 7 inches, well rolled and harrowed, and planted to corn about May 15. The crop receives level cultivation about every 10 days if moisture conditions permit. The following spring some farmers merely disk the ground and drill in oats, but generally the land is prepared in the same way as for corn, the oats being drilled about May 1, at the rate of 2½ bushels per acre. As soon as the oats have been harvested the land is plowed again and rolled and harrowed until a fine pulverized seed bed is obtained, and wheat sown about September 10, at the rate of 2 bushels per acre. About 6 quarts of timothy per acre is usually sown with the wheat, and in the early spring before the frost leaves the ground about 4 quarts of clover are broadcasted per acre. The grass remains as a rule from 1 to 3 years, but the tendency at present is to make only one year's cutting of hay.

All the available manure is applied to the wheat and corn ground, being either plowed under or spread on the surface after plowing. When lime is applied to wheat the manure is plowed under and the lime is applied after plowing and harrowed in. Some farmers report markedly increased yields of hay when the fields receive a top dressing of manure. In conjunction with the manure from 200 to 400 pounds of acid phosphate is usually applied to corn and wheat. The latter crop also receives as a rule from one-half ton to 2 tons of freshly ground limestone per acre.

Land of the Mahoning silt loam is held at $40 to $100 an acre. The average selling price is about $60.

According to a number of farmers tile drainage is the best means of increasing yields on this type. There is, however, need for more organic matter in the soil.

The table following gives the results of mechanical analyses of samples of the soil, subsurface soil, subsoil, and lower subsoil of the Mahoning silt loam.

Mechanical analyses of Mahoning silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
272027	Soil	0.9	3.2	2.4	9.6	9.2	51.0	22.8
272028	Subsurface	.4	2.2	1.6	6.4	9.2	49.1	30.5
272029	Subsoil	.5	1.7	1.0	5.0	7.4	39.7	44.4
272030	Lower subsoil	.6	2.8	1.8	7.2	10.8	39.8	37.0

MAHONING SILTY CLAY LOAM.

The surface soil of the Mahoning silty clay loam is typically a gray, light silty clay loam to a depth of 6 inches, passing into a gray and brownish-yellow, mottled silty clay loam which extends to a depth of 15 inches. The subsoil is a brownish-drab, heavy, brittle clay extending to a depth of 36 inches or more. The last 6 inches of the 3-foot section is not infrequently, and the heavy clay substratum always calcareous. When wet the soil and often the subsoil are sticky and somewhat plastic, but upon drying they become hard and the surface cracks considerably. The lower subsoil has a characteristic soapy feel. The brownish-drab lower subsoil is the characteristic in this soil distinguishing it from the Volusia soils. Very few rock fragments are to be found on the surface or within the 3-foot section.

This soil is confined principally to the western half of Smith Township. Rather large areas lie north and west of Berlin Center. A few smaller areas are mapped in the northwestern part of the county. The surface typically is practically level to gently undulating. Drainage is poor, owing to the lack of topographic relief and to the heavy, brittle clay subsoil, which does not allow water to pass downward rapidly.

Owing to its small extent and comparatively low productiveness this type is not very important agriculturally. About 30 to 40 per cent of it has been cleared of the natural forest, mainly beech, white oak, red oak, and hickory, and is now under cultivation. Grass occupies probably 50 per cent of the cultivated area. Wheat and oats are grown on about equal acreages. Corn is of minor importance, only sufficient being produced for home use. As a rule corn does not mature on this type and is grown principally for silage, to be fed to stock during the winter. Hay yields one-half ton to 1½ tons per acre, corn 20 to 35 bushels, oats 40 to 60 bushels, and wheat 12 to 30 bushels. The same rotation and cultural methods are followed as on the Mahoning silt loam. Owing, however, to the heavy texture of this type, it can not be handled under as wide a range of moisture conditions as the silt loam. If plowed when too wet the soil tends to bake upon drying.

The Mahoning silty clay loam supports a good growth of pasture grasses, and dairying is the most important source of income. The dairy herds are principally Holstein. Milk and cream are sold in Youngstown and other near-by markets. Hogs and poultry do not receive special attention. Sufficient pork and poultry products are produced for home use, and the surplus is sold on the local markets. Vegetables are grown for home use, and give good results.

This type of land is held at $30 to $75 an acre.

Artificial drainage seems to be the foremost need of this soil. The liberal incorporation of organic matter should also greatly increase the yields.

The results of mechanical analyses of samples of the soil, subsoil, and lower subsoil of the Mahoning silty clay loam are given in the following table:

Mechanical analyses of Manoning silty clay loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
272021	Soil	0.9	2.7	2.0	12.4	8.4	50.7	22.6
272022	Subsoil	.8	2.2	1.8	10.8	7.4	41.1	35.6
272023	Lower subsoil	.2	.6	.5	2.9	2.9	36.5	56.1

TRUMBULL SILT LOAM.

The Trumbull silt loam to about 6 inches is a gray silt loam, underlain to a depth of 12 inches by a streaked light-gray and rusty-brown silt loam containing many iron concretions. The typical subsoil is a light-gray and yellow silt loam having a peculiar greasy feel. The characteristic feature of this type is the light-gray subsurface layer containing rusty-brown streaks. The texture of the soil is fairly uniform, but the subsoil varies from a gritty silt loam or loam to a light silty clay loam. Where it is lighter textured it is rather compact and in places acts as a hardpan. The heavier subsoil is plastic and sticky. Stone fragments are frequently encountered on the surface and in the subsoil.

This type occurs throughout the county in rather numerous small areas, though it is confined principally to the eastern half and the southern part of the county where it is associated with the Volusia and Canfield silt loams. The largest areas are mapped southwest of Boardman.

The type as a rule occupies depressions in the Volusia and Canfield soils. Many small streams head in the areas of Trumbull soil. The topography is typically level and drainage is poor. Occasionally, however, the type extends up slopes where it is subject to seepage

from the higher lying soils. During the rainy season an excess of water accumulates on the surface of this type, and unless artificially drained or there is little rainfall the land remains wet the entire season.

The Trumbull silt loam is not cultivated except in small fields within areas of better drained types. Where it has been properly drained good yields of hay are obtained; in fact, farmers report larger yields than on any other upland type. Corn, oats, and wheat are grown. On undrained land the crops are unprofitable. The greater part of this type supports a forest growth consisting mainly of beech, oak, hickory, and elm. The land is used largely for pastures.

The Trumbull silt loam can be bought for $10 to $40 an acre. It is sold only in conjunction with better drained soils.

To insure profitable returns from this type it must be drained, limed, and handled to increase the supply of organic matter. From 1 to 3 tons of lime per acre should be applied and stable manure and green vegetation should be plowed under. In its existing wet condition the soil is better adapted for pasturage than for any other use.

TRUMBULL SILTY CLAY LOAM.

The Trumbull silty clay loam to a depth of about 6 inches is a gray, light, rather friable silty clay loam underlain by a light-gray and rusty-brown mottled, sticky silty clay loam which extends to a depth of 12 inches. The typical subsoil, from 12 to 36 inches or more, is a light-gray and yellow mottled silty clay loam. In some places the subsoil is mottled light gray and reddish yellow. The light-gray subsurface layer, containing iron concretions, is the characteristic feature of this type. The soil and subsoil are sticky and plastic when wet, and the soil cracks upon drying.

The Trumbull silty clay loam is confined principally to the western half of the county. The largest areas occur southeast of Austintown and south and west of Jackson Center. There are a few small areas in the eastern part of the county.

The prevailing topography is nearly level. In most cases the type occurs as a slight depression within areas of the Mahoning soils, and small streams invariably head in such areas. The soil is wet the greater part of the year except during very dry spells. The level topography prevents run-off and the denseness of the subsoil greatly retards the movement of water downward.

Practically all of the type is forested with beech, oak, and elm. Small areas adjoining the better drained types are farmed to hay, corn, oats, and wheat. The greater part of the type supports a good

growth of grass, and it is used largely as pasture land. Hay yields one-half to 1 ton per acre, corn 20 to 30 bushels, oats 20 to 30 bushels, and wheat 8 to 15 bushels.

This type is valued at about the same price as the silt loam. The methods suggested for improving the silt loam are also applicable to this type.

Trumbull silty clay loam, dark-colored phase.—Included with the Trumbull silty clay loam are some scattering small areas, usually in a semimarshy condition and supporting a growth of cat-tails and coarse water grasses, where the soil is a dark-gray to black, waxy silty clay loam to a depth of 6 or 8 inches, resting upon a dark-gray, plastic silty clay subsoil. The subsoil gradually becomes heavier in texture and lighter in color with increase in depth, the lower part being streaked with yellow. The surface soil is plastic and sticky, and contains a high percentage of finely divided organic matter. These areas are separated as a dark-colored phase of the Trumbull silty clay loam. If they were more extensive they would be mapped as a separate soil. It is of scarcely any value in its present condition.

In the following table are given the results of mechanical analyses of samples of the soil, subsoil, and lower subsoil of the typical Trumbull silty clay loam:

Mechanical analyses of Trumbull silty clay loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
272051	Soil	0.5	2.9	2.0	8.8	11.4	48.9	25.2
272052	Subsoil	.5	3.6	2.9	8.4	10.5	51.8	22.2
272053	Lower subsoil	.4	2.6	2.2	6.3	10.2	47.0	31.2

TRUMBULL SILTY CLAY.

The Trumbull silty clay to a depth of 6 inches is a streaked gray and rusty-brown, heavy silty clay loam to silty clay, passing into a mottled light-gray and rusty-brown heavy silty clay, extending to a depth of 12 inches. The subsoil, from 12 to 36 inches, is in most places a mottled gray and yellow, heavy silty clay. Here and there a brownish-drab clay is encountered in the lower part of the 3-foot section. This soil is more sticky and plastic than the Trumbull silty clay loam, and it cracks badly on drying.

The Trumbull silty clay is confined entirely to Smith Township. It occurs, as a rule, within areas of Mahoning silty clay loam. The topography is level, and in some places the type occupies depressions where natural drainage is almost lacking. It remains wet the greater part of the year.

Practically all of this type supports a stand of beech, oak, and hickory, and a luxuriant growth of bunch grass. It is used principally for pasture and woodlots. Small areas are farmed to hay, corn, oats, and wheat in conjunction with the better drained soils. Fair yields of oats and hay are obtained, but corn and wheat as a rule are unprofitable.

This land is valued at $10 to $30 an acre. It is usually sold in connection with other soils.

The character of the soil and subsoil of this type seems to indicate that it would be more profitable to use it for pasture than to drain it for the production of cultivated crops. Even where it is to be used for pasture the excess water should be kept off the surface by means of open ditches, as otherwise coarse water-loving grasses will become too abundant.

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

Mechanical analyses of Trumbull silty clay.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
272018	Soil	0.5	3.4	2.5	9.6	4.2	38.6	41.0
272019	Subsoil	1.4	4.6	2.8	10.0	3.8	37.8	39.6
272020	Lower subsoil	.4	1.9	2.0	8.8	4.1	32.0	50.8

CHENANGO LOAM.

The Chenango loam is a brown silty loam, 8 inches deep, underlain by a yellowish-brown silty loam extending to a depth of 24 inches. The lower subsoil, the section below 24 inches, is a brown gravelly sandy loam showing stratification. As is characteristic of the Chenango series, the texture becomes lighter with increase in depth, and the type is invariably underlain with gravelly sand or sandy loam. As mapped it includes areas in which the soil and subsurface layer are practically free from grit and the soil is a typical silt loam. There is, however, very little textural difference in the lower subsoil.

The Chenango loam is not an extensive type in Mahoning County. The largest areas occur in Boardman Township along Mill and Yellow Creeks. There are a few small areas along the Mahoning River and the larger creeks. The type occupies a flat terrace position, but owing to the gravelly and friable nature of the subsoil the drainage is thorough or even excessive.

Practically all of the type is under cultivation. A few small areas are forested with sugar maple and red and white oak. The type is

not important in the agriculture of the county, owing to its small extent, but all the common crops are produced on it and yields compare favorably with those obtained on the upland types. Agriculturally this type is closely related to the Wooster loam. Hay yields one-half ton to 1½ tons per acre, corn 25 to 50 bushels, oats 25 to 50 bushels, and wheat 15 to 30 bushels. As a rule corn and wheat are fertilized with 100 to 300 pounds of acid phosphate per acre, as well as 8 to 10 tons of stable manure. Potatoes yield 75 to 200 bushels per acre, but are not grown extensively. Where this type occurs near good markets, truck farming is carried on extensively with good returns.

This land ranges in selling value from $50 to $150 an acre.

Probably the best method for improving this type is to keep the land well supplied with manure, and to plow under green crops. This soil is especially adapted to potatoes and other truck crops.

The results of mechanical analyses of samples of the soil, subsoil, and lower subsoil of the Chenango loam are given in the following table:

Mechanical analyses of Chenango loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
272036	Soil	2.1	6.9	5.5	16.2	12.0	43.2	13.8
272037	Subsoil	.9	4.4	3.8	14.8	11.4	49.1	15.2
272038	Lower subsoil	4.0	10.9	9.2	26.1	13.8	25.0	10.8

BRACEVILLE LOAM.

The Braceville loam consists of 6 inches of streaked gray and brown loam, underlain by a light-gray and rusty-brown mottled loam or light clay loam, which extends to a depth of 24 inches. Below 24 inches the material is a rusty-brown gravelly sandy loam, showing a slight development of gray mottles. There are some small areas, not large enough to justify separation, where the soil and subsurface layer are a smooth, friable silt loam, underlain by the typical subsoil. In some local areas the surface soil has a well-developed brown color.

This type of soil is inextensive. The largest area occurs in the Mahoning River valley in the southwestern part of the county. The type is also quite extensively developed southeast of Youngstown, and in small areas in the larger creek valleys. It occupies a flat terrace position, usually adjacent to the upland and separated from the stream by the Chenango loam, from which it is distinguished by its color. In many places it receives seepage from the upland, and the

subsoil in many cases is cemented, forming a slight hardpan which restricts the drainage.

Probably 40 per cent of this type is under cultivation, principally to hay, corn, oats, and wheat. A small acreage is devoted to rye and potatoes. The remainder of the type supports a growth of beech and oak and is used as pasture, as are also some portions of the cleared land. This soil yields surprisingly well. The yield of hay ranges from one-half ton to 1½ tons per acre, corn 30 to 40 bushels, oats 30 to 50 bushels, and wheat 12 to 25 bushels. These results are obtained with the application of about 200 pounds of acid phosphate per acre on corn and wheat. Lime at the rate of one-half ton to 2 tons per acre is applied to wheat. The same crop rotation and cultural methods as used on other types are followed on this type.

Land of the Braceville loam sells for prices ranging from $40 to $125 an acre.

This soil produces fairly well in its present wet condition, but by efficiently draining it with tile or ditches the yields should be increased. The soil is rather low in organic matter, which can be supplied by plowing under green crops or liberal quantities of stable manure.

The results of mechanical analyses of samples of the soil, subsoil, and lower subsoil of the Braceville loam are given in the following table:

Mechanical analyses of Braceville loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
272015	Soil	2.0	4.5	4.1	27.1	13.0	35.8	13.6
272016	Subsoil	3.6	7.2	5.6	25.4	12.4	33.8	11.8
272017	Lower subsoil	3.3	7.3	6.0	34.5	15.2	21.7	12.2

TYLER SILT LOAM.

The Tyler silt loam consists of a gray silt loam, 7 inches deep, underlain, to a depth of 36 inches or more, by a light-gray, brown and yellow mottled, rather plastic silty clay loam. This type differs from the Braceville loam in having a subsoil heavier than the surface soil, whereas the Braceville subsoil is decidedly lighter in texture. In some included areas, as mapped, a rusty-brown sandy loam is encountered in the lower 6 inches of the 3-foot section. The surface soil of this type is smooth and friable, but the subsoil shows a slight grittiness, though it is plastic and sticky.

This is the least extensive of the terrace soils. It occupies flat, poorly drained areas. Typical areas lie east and southeast of Cornersburg and east of New Buffalo. There are a few small areas

along Meander Creek in the northeastern part of Ellsworth Township.

Probably 25 per cent of the type is covered with beech, hickory, oak, and elm. The remainder is used principally as hay land; a small acreage is devoted to corn, oats, and wheat. Hay probably occupies 75 per cent of the cleared area. It yields one-half to 1 ton per acre. Corn yields 20 to 30 bushels per acre, oats 25 to 40 bushels, and wheat 10 to 20 bushels. No crop rotation is practiced on this soil. The type is unimportant agriculturally, owing to its small development and low yields.

This land is held at prices ranging from $25 to $100 an acre.

Owing to the level topography of this type, draining is more or less difficult. It is probable that the land could be used more profitably for pastures and woodlots than for cultivated crops.

TYLER CLAY LOAM.

The Tyler clay loam is a gray clay loam, 7 inches deep, passing into a gray, yellow, and brown mottled clay loam containing a rather high percentage of sand. As mapped small areas of typical Braceville clay loam and Tyler silty clay loam are included, and there is consequently a textural variation in the surface soil from a clay loam to a silty clay loam and in the subsoil from a silty clay loam to a gravelly sandy loam. The typical clay loam, however, is the predominating soil.

The Tyler clay loam is developed only along Mill Creek west and southwest of Boardman and west of Sebring in the Mahoning River valley. It occupies a flat terrace position, and is poorly drained, remaining wet the greater part of the year.

The entire type supports a growth of bunch grass and other coarse grasses, with an abundance of good pasture grasses. Probably half of it has been cleared of the natural timber growth, consisting of beech, oak, and hickory, and is used for pasture. The forested areas are also used as pasture lots, as well as to supply wood for fuel and other purposes.

None of this type is cultivated and the land can be bought for probably $20 to $75 an acre.

Drainage is essential in reclaiming this type for cultivated crops. After draining, adding 1 to 3 tons of lime per acre, and supplying organic matter, fair yields of the common crops should be obtained. It is, however, probable that this soil is better adapted for pasture than for any other use.

HUNTINGTON SILT LOAM.

The Huntington silt loam is a smooth, friable, brown silt loam with a depth of 7 inches, underlain by a light-brown to yellowish-

brown, smooth, friable silt loam to a depth of 36 inches or more. As mapped in this county it varies from a fine sand to a silt loam, the former texture occurring as a rule in a narrow strip bordering the streams, which here extends to a depth of 3 feet or more. In some other small areas the soil and subsoil are typical fine sandy loam.

The Huntington silt loam is developed along the Mahoning River in the southwestern part of the county, and along Little Beaver Creek and the northern part of Meander Creek. It occupies flat areas adjacent to the streams and is subject to overflow, but the drainage between inundations is good.

Probably not more than 5 per cent of this type is under cultivation. The remainder is still covered with maple, sycamore, oak, and elm, and is used for pasturing dairy cattle.

The area farmed is devoted principally to hay and corn, with a small acreage in wheat and oats. Corn, the most important crop, yields 50 to 100 bushels per acre. It produces a very large stalk. Hay yields 1 to 2 tons per acre, oats 30 to 60 bushels, and wheat 15 to 35 bushels. This is a productive soil and is maintained in this condition by fresh deposits of sediments at each overflow.

This land is sold at prices ranging from $50 to $150 an acre.

HOLLY SILT LOAM.

The surface soil of the Holly silt loam is a brown and gray mottled, smooth, friable silt loam 6 inches deep. The subsoil, which extends to 36 inches or more, is a gray, yellow, and brown, mottled, heavy silt loam. In places gray predominates in the surface soil, with brown streaks. There are included in this type small areas of clay loam. In some places the subsoil is plastic and sticky. The type, however, is fairly uniform in texture throughout the county.

The Holly silt loam is the principal first-bottom soil in the county, and areas of it lie along practically all the streams. It is flat and poorly drained, and subject to overflow during high floods. These inundations deposit additional sediments which enrich the soil.

This type is used almost entirely for pasture. A large proportion of it is covered with beech, oak, hickory, elm, and sycamore. Only very small areas are cultivated. These are used for the production of hay, corn, oats, and wheat, which give fairly good yields.

Land of the Holly silt loam type sells at prices ranging from $25 to $100 an acre.

Artificially drained this type should produce excellent yields of corn and hay. The organic content is fairly high, owing to the fresh deposits of sediment, which contain considerable vegetable matter.

HOLLY SILTY CLAY LOAM.

The Holly silty clay loam, to a depth of 6 inches, is a gray to dark-gray silty clay loam, streaked slightly with rusty brown. The subsoil is a mottled gray, brown, and rusty-brown silty clay loam. Both soil and subsoil are sticky and plastic when wet, and crack badly upon drying. This type is rather uniform in texture and structure. The surface soil is predominantly dark gray and in places black. The subsoil occasionally contains some yellow mottlings.

This is a first-bottom soil subject to overflow. It is confined to Beaver Township, in the first bottoms of Mill Creek, and to one small area along Little Beaver Creek in Green Township. The topography is flat, and the drainage poor.

This entire type is used for pasturage. Small areas have been cleared, but even these are pastured. The native timber consists mainly of elm, cottonwood, sycamore, and a few maple. Bunch grass is the predominating vegetation, and this soil does not furnish as good pasturage as the Holly silt loam.

Land of the Holly silty clay loam can be bought for $20 to $50 an acre.

It is probable that the Holly silty clay loam is more valuable as pasture land than for cultivated crops, for owing to the plasticity of the soil it would be expensive to drain it thoroughly enough to make the production of cultivated crops profitable. In its present condition one acre will support one cow or steer.

MUCK.

Muck consists mainly of dark-brown to black, smooth, finely divided and well-decomposed organic matter, with which is mixed a small proportion of silt, clay, and fine sand. The depth of this organic deposit varies from 12 inches to 36 inches or more. Where it does not extend throughout the entire 3-foot section, a fine sandy loam of a whitish color underlies it. As mapped, however, the mucky deposit is 3 feet or more deep except in a few local areas. Muck is the result of the decay of water-loving vegetation in poorly drained situations.

This type of soil occurs in rather small areas throughout the southern and eastern parts of the county. The largest area lies northwest of Greenford. It occurs as flat and depressed areas with practically no natural drainage.

Only an acre or two of this soil is cultivated to truck crops. The remainder is covered with cat-tails, brush, and other water-loving vegetation. None of this land is sold separately, but it can probably be bought for $5 to $10 an acre.

In sections of Ohio where Muck has been drained and reclaimed, excellent yields of celery, lettuce, onions, and other truck crops are obtained.

SUMMARY.

Mahoning County lies in northeastern Ohio, along the Pennsylvania line. It has an area of 427 square miles, or 273,280 acres.

The topography is gently undulating to rolling. The elevation averages about 1,000 feet above sea level. There is a general slope to the northward. Regional drainage is moderately well established, but much of the county needs artificial drainage for best results in farming. All the county except the south-central portion is drained by the Mahoning River and tributaries.

The urban population of Mahoning County numbered 87,408 in 1910 and the rural population 28,743. The rural population averages 67.3 persons per square mile. Youngstown and suburbs constitute the urban population. At present (1917) Youngstown has an estimated population of about 125,000. A large number of Italians, Hungarians, Austrians, Germans, and foreign-born persons of other nationalities are found in the cities and towns, and there are a few foreigners on farms, but the rural population is made up mostly of native-born persons.

Youngstown, the county seat, is one of the best markets in Ohio, and the demand for agricultural products is greater than the supply.

The county is well supplied with transportation facilities. There are a large number of brick or macadam roads, and the dirt roads receive considerable attention. There are a number of churches throughout the rural section, and practically all townships have consolidated schools. The entire county is supplied with telephone and rural mail delivery service.

The winters are rather long but only moderately severe. January and February, the coldest months, have a mean temperature of 26.7° F. and 25.5°, respectively. The average depth of snowfall is about 54 inches. The summers are moderately long, but not very hot. July and August, the hottest months, have an average temperature of 72.4° and 69.9°, respectively. The rainfall is sufficient for the production of crops, averaging 38.55 inches and being fairly evenly distributed.

The greater part of the area of the county is suited to agriculture. General farming, dairying, trucking, and orcharding are the principal industries. Hay is produced on about 50 per cent of the farmed area, and corn, oats, and wheat each occupy about 15 per cent of the cultivated area. They are commonly grown one year each in rotation, followed by hay for 1 to 3 years. Oats, wheat, truck crops, and dairy products are important sources of farm income. A small number of cattle, hogs, and sheep are raised. Commercial fertilizer, gen-

erally in the form of acid phosphate, is being used in increasing quantities. Lime also is used extensively on wheat. Farm labor is generally scarce.

According to the 1910 census, 78.2 per cent of the farms in Mahoning County are operated by the owner. The average size of farms is 77.7 acres, of which 54.4 acres are improved. The farm buildings as a rule are commodious and kept in good repair. The barns are large enough to house all the stock and to store the crops.

The range in the selling value of good agricultural land is from $60 to $200 an acre. Ordinarily farms sell for $60 to $100 an acre.

Mahoning County includes three distinct groups of soils: upland soils, consisting of reworked glacial material; terrace or old-alluvial soils deposited as glacial outwash plains or on old stream flood plains; and first-bottom soils, consisting of recent alluvium. The soils range in texture from silt loam to silty clay loam, silt loams predominating. The Mahoning, Volusia, and Canfield are the three most extensively developed series.

The upland soils are classed in seven series. The soils in the areas of light glacial till are classed in the Wooster series where the till is at least 3 feet in depth. Where bedrock is encountered at less than 3 feet and the material is probably in part, at least, residual the Lordstown series is recognized. With progressively poorer drainage the soils are classed in the Canfield, Volusia, and Trumbull series, respectively. In the areas of heavy till overlying shale in the northern and western part of the county the Ellsworth series is recognized in the best drained areas, and the Mahoning series in areas of poorer drainage.

The terrace soils are classed in the Chenango, Braceville, and Tyler series, which differ from each other in drainage development.

The brown soils of the first bottoms are classed in the Huntington series and the grayish mottled soils in the Holly series.

Muck consists of organic matter in varying stages of decomposition, mixed with some mineral matter. The areas of Muck can be reclaimed and made highly desirable for certain types of agriculture.

In general, the soils of Mahoning County are productive. They are mainly in need of liming and organic matter. Tile drainage is essential in many cases.

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