U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF SOILS—MILTON WHITNEY, Chief.

IN COOPERATION WITH THE OHIO AGRICULTURAL EXPERIMENT STATION,
CHARLES E. THORNE, DIRECTOR; E. R. ALLEN,
IN CHARGE SOIL SURVEY.

SOIL SURVEY OF HAMILTON COUNTY, OHIO.

BY

A. L. GOODMAN, OF THE U. S. DEPARTMENT OF AGRICULTURE,
IN CHARGE, AND E. R. ALLEN AND S. W. PHILLIPS, OF
THE OHIO AGRICULTURAL EXPERIMENT STATION.

W. E. McLENDON, INSPECTOR, NORTHERN DIVISION.

[Advance Sheets—Field Operations of the Bureau of Soils, 1915.]

WASHINGTON:
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1917.

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS,
Washington, D. C., May 29, 1916.

SIR: In the extension of the soil survey in the State of Ohio a survey was made of Hamilton County during the field season of 1915. This work was done in cooperation with the State of Ohio, and the selection of the area was made after conference with State officials.

I recommend that the report and map covering this survey be published as advance sheets of Field Operations of the Bureau of Soils for 1915, as provided by law.

Respectfully,

MILTON WHITNEY,
Chief of Bureau.

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

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SOIL SURVEY OF HAMILTON COUNTY, OHIO.

By A. L. GOODMAN, of the U. S. Department of Agriculture, In Charge, and E. R. ALLEN and S. W. PHILLIPS, of the Ohio Agricultural Experiment Station.—Area Inspected by W. E. McLENDON.

DESCRIPTION OF THE AREA.

Hamilton County is situated in the extreme southwestern corner of Ohio. It is bounded on the north by Butler and Warren Counties, on the east by Warren and Clermont Counties, on the south by the Ohio River, which forms the dividing line between Ohio and Kentucky, and on the west by the State of Indiana. The county approaches a rectangle in form, and has a length of approximately 28½ miles east and west and a width of 14½ miles north and south. It contains 407 square miles, or 260,480 acres.

Hamilton County lies in a high plateau region that has been deeply dissected by stream action. The topography is quite varied, ranging from level to gently rolling, ridgy, and rough. Over most of the county stream dissection is complete and, on account of the youth of the dissection, the hill slopes are steep. On the basis of physiography and relief the county may be described under five distinct divisions, as follows: (1) Level to undulating upland; (2) rolling, hilly, ridgy, and rough and stony lands; (3) swampy and poorly drained upland depressions; (4) level, high-lying second bottoms or terraces not subject to overflows or only occasionally overflowed during excessive floods; and (5) level alluvial bottoms subject to overflows.

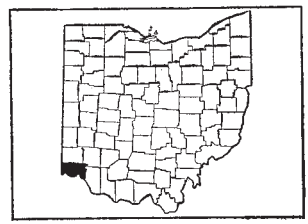

FIG. 1.—Sketch map showing location of the Hamilton County area, Ohio.

The upland country of level to undulating topography lies between the main drainage ways of the county, and for the most part is undulating and well drained.

The sections comprising the hilly division of the county lie along the Indiana State line, the Ohio River, both sides of the Miami and Little Miami Rivers, and north and northwest of Cincinnati, along Mill Creek. The land here has been so deeply eroded and dissected that all remnants of the plateau surface have been removed. Erosion has been most severe along the Miami and Ohio Rivers, where

the hills rise abruptly to an altitude of 250 to 400 feet above the stream. As a rule, the slopes are steep and more or less benchy, while the crests of the ridges are narrow, sharp, and irregular. The smaller streams have not cut so deeply and their hill slopes as a whole are less steep, the crests of the ridges more rounded, and the altitude above the valleys is not so great. Throughout practically all the hill section the surface is so uneven that the ridge-crest roads are not free from heavy grades. On the surface of much of the land there are large quantities of flat, platelike limestone rocks, and these, together with the steep grade, interfere with cultural operations.

The upland depressions with poor drainage lie in the flat part of the uplands, mainly in the vicinity of Mount Healthy, Rossmoyne, Norwood, and Blueash, and north of Loveland.

Along all the streams of the county there are well-defined terraces lying between the overflowed bottoms and the adjacent uplands. They are remnants of old alluvial plains. One of the striking natural features of the county is the occurrence of wide terraces in valleys occupied now by very small streams. Several terraces are mapped in valleys occupied by streams that seem to be entirely too small to have developed such prominent terraces, and the simplest explanation of their existence is that they were formed at a time when the valleys were occupied by larger streams which later were blocked by the glacier and forced to abandon them. One of these old valleys runs across the northeastern part of Crosby Township, extending due westward from the present course of the Miami River in a belt about 2 miles wide. Near the west line of the township it is deflected to the south, and from that point to where it enters the existing valley of Whitewater River it is occupied by the Dry Fork of Whitewater. That the streams which now hide themselves in this great valley have really had almost nothing to do with its excavation is evident from the fact that there is not one of them whose course agrees with that of the valley, but all cut it transversely. More than half of the townships of Crosby, Harrison, and Whitewater are thus made up of ancient river valleys. Some other terraces of importance in the county are along the Little Miami River near Camp Dennison, Terrace Park, and Newtown; along Mill Creek at Carthage, Elmwood, and Cumminsville; and along the Ohio River at Cincinnati and Sayler Park. Two miles southeast of Harrison, between the Harrison Pike and the first bottom of the Whitewater River, six different terraces are developed, showing that the valley of the Whitewater has been made in at least six different stages.

The recently formed flood plains along the streams range in width from a few feet to about 1½ miles. The broadest belts lie along the

Little Miami River, Mill Creek, and the Miami, Whitewater, and Ohio Rivers. These areas are all practically flat and lie a few feet above the mean water level of the rivers.

The elevation of the county ranges from 445 feet above sea level in the extreme southwestern part to 939 feet in the north-central part, just north of Bevis.

The drainage system of Hamilton County is so well developed that only a very small part of the county can be termed poorly drained. There are five main drainage ways—the Ohio, Miami, Little Miami, and Whitewater Rivers, and Mill Creek. The upland slopes slightly toward the southwest, and all the main interior streams enter the county from the north and flow in a southwesterly direction. Owing to the fact that the Ohio River has an exceptionally deep and gorge-like valley, all its tributaries have sufficient fall to carry off the surplus water and insure good drainage. Many of the small streams throughout the county have carved their channels into solid limestone rock.

A large percentage of the inhabitants of Hamilton County are of German or Irish descent. According to the 1910 census, the population of the county is 460,732. Of this number 53,473 persons, or 11.6 per cent of the total population, are classed as rural, this number including residents in towns of less than 2,500 population. However, all sections of the county are well settled and there is a fairly uniform distribution of the rural population. Its density is given as 131.4 persons per square mile.

According to the census of 1910, Cincinnati, the county seat, had a population of 363,591. Norwood, the second largest city in the county, had a population of 16,185. Some of the important villages are Reading, Lockland, College Hill, Wyoming, Glendale, Rossmoyne, Camp Dennison, Mount Washington, Cleves, Loveland, North Bend, Elizabethtown, and Harrison.

The transportation facilities in Hamilton County are excellent, Cincinnati being one of the large railroad centers of the country. No point in the county lies at a greater distance than 5 miles from a steam railroad or interurban electric line. In addition, the Ohio River affords cheap transportation for coal and iron from Pittsburgh south. These numerous lines of transportation place the farmer and manufacturer of Hamilton County in direct communication with the leading markets of the country, including Cincinnati, Louisville, Columbus, Toledo, Dayton, Indianapolis, Cleveland, Pittsburgh, Chicago, and New York.

The public roads of Hamilton County rank among the best in the State for excellence of construction and durability. There are hundreds of miles of oiled, rock-ballasted pikes. Owing to the large quantities of crystalline limestone and gravel found throughout the

county, road-building material is easily accessible and roads can be constructed at a minimum cost. All the rivers and smaller streams are crossed by substantial steel bridges or concrete culverts.

The public-school system of the county ranks among the best in the country. There are good rural schools within easy reach of all sections and all the small villages have modern, well-equipped high schools, while several colleges of law, medicine, engineering, and music are located at Cincinnati. The high-school system of Cincinnati is considered the best in the State. The county demonstration farm is located 3½ miles north of Mount Healthy.

Hamilton County is among the leading manufacturing counties of the State, Cincinnati being one of the most important soap and tool manufacturing centers of the United States.

CLIMATE.

In general, the climate of Hamilton County is typical of that of the east-central part of the United States, and is well suited to the production of a wide variety of crops.

Records of the Weather Bureau station at Cincinnati show that the mean annual temperature is 55.2° F. The mean temperature for the winter is 34.4°; for the spring, 53.8°; for the summer, 75.6°, and for the fall, 56.8°. The lowest temperature recorded, −17°, occurred in February, and the highest, 105°, in July. There are no large bodies of water near enough to the county materially to affect the climate, Lake Erie being about 200 miles and the Atlantic Ocean 500 miles distant.

The winters are milder than in other counties of Ohio which lie farther north. The growth of corn, potatoes, and early truck is sometimes retarded by late spring frosts, and full development of the crops, especially corn, may sometimes be prevented by early fall frosts. Winter wheat is seldom injured by severe winter weather.

Hamilton County lies in the path of a large number of the general low-pressure or storm areas which move across the United States from west to east, accompanied usually by cloudy weather and precipitation. The mean annual precipitation as recorded at Cincinnati is 40.91 inches, while the means for the winter, spring, summer, and fall seasons are 9.83, 10.93, 11.58, and 8.57 inches, respectively. The total amount of rainfall reported for the driest year of which there is any record (1901) is 17.99 inches, and that for the wettest year (1847) is 65.18 inches. June is usually the wettest month in the year. The average annual depth of snowfall is 17.4 inches.

The average date of the last killing frost in the spring is April 14, and that of the first in the fall, October 25, giving a normal growing season of 194 days. The date of the latest recorded killing frost in the spring is April 24 and that of the earliest in fall September 30.

The following table gives the normal monthly, seasonal, and annual temperature and precipitation as recorded by the Weather Bureau station at Cincinnati:

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

Month.	Temperature.			Precipitation.			
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year (1901).	Total amount for the wettest year (1847).	Snow, average depth.
	° *F.*	° *F.*	° *F.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
December	35.9	72	− 8	3.38	3.37	8.15	3.5
January	32.9	75	−12	3.27	0.87	4.71	5.2
February	34.4	73	−17	3.18	1.35	4.06	4.7
Winter	34.4	75	−17	9.83	5.59	16.92	13.4
March	43.1	85	1	3.77	2.01	5.37	2.8
April	53.8	87	18	3.20	1.93	2.12	0.5
May	64.6	94	33	3.96	1.62	4.30	T.
Spring	53.8	94	1	10.93	5.56	11.79	3.3
June	73.6	98	39	4.20	2.27	7.63	0
July	77.6	105	53	3.77	1.44	8.25	0
August	75.5	101	51	3.61	0.88	3.20	0
Summer	75.6	105	39	11.58	4.59	19.08	0
September	69.2	99	35	2.79	0.92	3.87	0
October	56.9	88	26	2.59	0.59	9.57	T.
November	44.4	78	5	3.19	9.74	3.95	0.7
Fall	56.8	99	5	8.57	2.25	17.39	0.7
Year	55.2	105	−17	40.91	17.99	65.18	17.4

AGRICULTURE.

The agricultural development of Hamilton County began in the early part of the nineteenth century and progressed very rapidly. Corn was the most important crop grown by the early settlers, followed, in the order named, by wheat, hay, oats, barley, and potatoes. Some cattle and hogs were kept on nearly every farm and a large proportion of the corn crop was consumed in fattening this stock. Sheep raising never became an important industry, although flocks were to be found on many of the farms. The sale of wheat and of live stock afforded the chief source of income, these going mainly to distant markets. Later, with the growth of Cincinnati and other near-by cities as important commercial centers and with improvement in transportation facilities, a demand for a wide variety of farm products was created, as a result of which the agriculture of Hamilton

County has undergone many important changes. The relative importance of the staple crops has changed somewhat; many new crops, particularly market-garden vegetables, have been introduced, and dairying has grown into a very important industry. In 1909 dairy products sold had a value of $1,306,565; vegetables, $1,028,876; and animals sold or slaughtered, $857,865. Cereals produced were valued at $974,197, hay and forage at $521,019, and poultry and eggs at $377,303.

A larger acreage is devoted to corn than to any other crop and it is grown by all the farmers, except a few of the market gardeners operating on a small scale. The census reports 30,827 acres planted to this crop in 1909, producing 1,261,232 bushels, or an average of 40.9 bushels per acre. Approximately one-fifth of the corn produced is pulled while green and marketed in Cincinnati as sweet corn or sold to canning factories. A considerable quantity also is cut while green and used for ensilage. Most of the corn that is allowed to mature is fed on the farms to hogs, beef cattle, and work stock, a small proportion being marketed. Some of the principal varieties of corn grown in this section are Reids Yellow Dent, Boone County White, Leaming, and Mammoth Yellow Dent.

Hay ranks second to corn in acreage. The census of 1910 shows 29,824 acres devoted to tame and cultivated grasses, with a production of 40,716 tons. Of all the hay crops, timothy ranks first, with an area of 19,764 acres and a production of 24,976 tons; alfalfa second, with 4,021 acres, producing 8,456 tons; timothy and clover mixed, third, with 3,236 acres, producing 3,814 tons; and clover alone, fourth, with 1,148 acres and a production of 1,324 tons. The acreage of alfalfa and clover is yearly increasing and in the present year (1915) a considerably greater area was devoted to these crops than is reported for 1909 by the census. Timothy and alfalfa hay is more extensively marketed than clover hay. Approximately two-thirds of the timothy and alfalfa hay harvested is sold, while the clover is more generally fed to stock on the farms. The acreage devoted to hay has changed very little in the last 30 years, the 1880 census reporting 27,081 acres in hay crops, which is almost as large as the acreage given by the 1910 census.

Wheat, which is strictly a money crop, is not so extensively grown as corn. The census shows a total of 12,971 acres sowed in 1909, with a production of 178,863 bushels, or an average yield of 13.8 bushels per acre. This yield is somewhat lower than that given for 1879, when 15,595 acres were sowed, producing 259,891 bushels, or 16.6 bushels per acre, and is also below that of 1899, when the area sowed was 28,071 acres and the production reached 482,000 bushels, averaging 17.2 bushels per acre. In 1914 about 14,000 acres were sowed to wheat, producing about 250,000 bushels.

The acreage of oats has also been slightly reduced during the last 30 years. The census reports show that in 1879, 8,609 acres were sowed, producing 203,055 bushels, or 24.7 bushels per acre, while in 1909, 7,268 acres were sowed, producing 216,275 bushels, or 29.7 bushels per acre. Only a very small quantity of oats is marketed, most of the crop being fed on the farms.

The decrease in the acreage of rye and barley has been much greater proportionally than that of oats. In 1879 there were 1,474 acres in rye and 5,379 acres in barley, while in 1909 only 647 acres were devoted to rye and 162 acres to barley. The yield per acre also has slightly decreased.

Irish potatoes are an important income crop in Hamilton County, and are grown almost exclusively for the Cincinnati market. The potatoes are dug in the late summer or early fall and marketed immediately, a very small proportion being kept for the winter market. The census for 1909 shows 7,502 acres planted, with a production of 780,538 bushels. The average yield was 104 bushels per acre. Fields that are heavily fertilized and carefully cultivated, however, often produce 150 to 200 bushels to the acre. The number of acres planted to potatoes has been steadily increasing for the last 30 years. Some of the most popular varieties grown are the Early Ohio, Irish Cobbler, and White Mountain.

Many market-garden crops are grown and disposed of in Cincinnati and its suburbs. In 1909 there were 7,438 acres in vegetables other than potatoes.

Tobacco, though still grown only to a small extent, is becoming an important crop. The census of 1910 shows 638 acres in tobacco, with a production of 689,807 pounds, or 1,081 pounds per acre, but since 1910 the acreage throughout the county has greatly increased. Several tobacco barns were under construction at the time of the soil survey. Some of the varieties of tobacco recommended by the Ohio Agricultural Experiment Station which do well in this county are the Ohio Wrapper, Ohio Binder, Tall Spanish, Montgomery Seed-leaf, and Tall Zimmer. The Ohio Wrapper is a drought-resistant variety, semierect, very dark green in color, requiring 92 days to mature and giving an average yield of 1,500 pounds to the acre.

Considerable fruit, including apples, peaches, cherries, pears, grapes, strawberries, blackberries, dewberries, raspberries, and loganberries, is grown throughout the county. The census of 1910 reports 70,933 apple trees in the county, producing 26,173 bushels; 52,088 peach and nectarine trees, producing 23,376 bushels; 134,058 grape vines, producing 424,220 pounds; 170 acres of strawberries, producing 187,241 quarts; 187 acres of blackberries and dewberries, producing 206,140 quarts; and 352 acres of raspberries and loganberries, producing 324,793 quarts. About one-half the fruit pro-

duced is sold in the Cincinnati markets, the remainder being consumed on the farms. Some of the most popular varieties of apples grown in the county are Yellow Bellflower, Mann, Maiden Blush, Rome Beauty, Northern Spy, Winesap, Smith Cider, Baldwin, White Pippin, and Rhode Island Greening.

Dairying is an important industry and the chief source of income of a large proportion of the farmers of the county. There are some large dairy farms, and a few dairy cows are kept on a large number of farms. Practically all the milk and cream is disposed of in the Cincinnati market. In 1909 there were 15,374 dairy cows in the county.

The total number of animals sold or slaughtered in the county in 1909 was 38,241. Of this number, 7,626 were calves, 11,951 other cattle, 17,283 hogs, and 1,381 sheep and goats.

The distribution and character of the various soil types, variations in topography, and distance from market all have had an influence on the distribution of crops and the development of special farming industries. The sandy terrace soils are considered the best for early truck, and the largest number of truck farms are located on these soils along Mill Creek, Little Miami River, and Whitewater River. Here beans, cabbage, tomatoes, cucumbers, sweet potatoes, horseradish, cantaloupes, peppers, and rhubarb are grown. Owing to the extensive growth of Cincinnati and the building up of the Mill Creek Valley, many truck farms have been displaced by the encroachment of suburban villages, and the trucking industry is gradually moving to the sandy soils in the western part of the county. The glacial soils in the north-central part of the county and the residual limestone soils developed on nearly all the slopes are well suited to alfalfa, and nearly all this crop is grown on these soils. Tobacco growing is being developed on the rough, steep clay slopes where there is an abundance of lime in the soil and is confined mainly to the western half of the county along the uplands bordering the Miami and Whitewater rivers. The bottom-land soils, which are subject to overflow, are used very largely in the production of corn, although some areas are used for oats and hay.

Cincinnati is an excellent market for farm produce of all sorts and the farmers have very little trouble in disposing of any crop they may grow. For this reason nearly every crop suited to this section of the country may be found in Hamilton County.

Cultural methods vary considerably throughout the county. Many farmers cling to the methods that were in use years ago, but some of the more progressive ones employ modern labor-saving machinery and practice intensive cultivation. As a general rule, lighter farm machinery and implements are used in cultivating the steep slopes than on the level land. Hillside plowing is done by

means of single walking plows, while on the more level areas heavy, double riding plows and cultivators are used. The topography prevents the general use of steam and gasoline tractors, and only a few are seen. The horses for the most part are of the heavy draft type. Many of the truck farmers have their own auto trucks for hauling their produce to Cincinnati.

The farm buildings are generally well built and maintained in good repair, and afford ample protection for animals, feed, and machinery during the winter months. Nearly all the farm dwellings are well painted and many farmers have private waterworks and electric or gas lighting plants.

Many of the dairy farmers pasture their cows on the steep hillside slopes during the spring and summer and feed them during the winter. A large number have silos, silage constituting a very important winter feed for dairy cows. Most of the dairies are well equipped with modern appliances, such as cream separators and sterilizers. Cattle, hogs, and sheep are pastured during the summer months and fed in barns during the winter. Beef cattle and hogs are sold and slaughtered at Cincinnati as soon as they reach maturity.

The preparation of the land for winter wheat is begun in the late summer or early fall. Fields that are to be planted to corn or truck crops are worked immediately after the winter freezes and rains have ceased and the soil begins to warm up. Corn generally is planted from the 20th of April to the 30th of May. On some of the well-drained sandy lands it may be planted a little earlier than on the heavier soils, as the latter take longer to warm up in the spring. A considerable acreage of corn is planted as late as May 30, but this is intended either to be sold as sweet corn or to be cut for ensilage. In planting corn the check-row, flat-cultivating system and the "bedding-up," row system, are used to an equal extent. Where wheat is to follow corn it is often customary to drill it in between the shock rows. This allows more time for the corn to cure thoroughly and the yields of wheat are nearly as satisfactory as where the whole field is thoroughly broken.

The harvesting of wheat begins about the latter part of July or the 1st of August. The wheat is cut with a binder and shocked in the field until a thrashing machine is available. Corn is cut before thoroughly dry and shocked in the fields. Later in the fall it is husked and stored in cribs covered with a roof but having well-ventilated sides. The stalks are used for feed.

The tobacco crop is harvested between the 25th of August and the 15th of September. Tobacco is cut by hand and strung on sticks holding 4 or 5 plants each. It is left in the field for three or four days, when the leaves wilt and begin to turn yellow, after which it is placed on racks in a tobacco barn and allowed to cure thoroughly.

Some system of rotation is followed on practically all the lands of the county under cultivation, except some of the river bottoms subject to overflow. The general practice is to plant corn, followed by wheat, then clover, returning to corn after the clover. In some sections of the county truck crops are grown in the rotation. On some of the soils suited to alfalfa a rotation including alfalfa for 3 years, followed by corn and wheat, is quite common. Many of the overflowed bottom soils along the various rivers throughout the county have been planted to corn for 20, 30, and even 50 years in succession without noticeable diminution of yields.

Commercial fertilizers are used to a considerable extent in Hamilton County, particularly with potatoes and other market-garden crops. Generally the market gardeners find it profitable to make heavy applications of fertilizer with a high content of phosphorus and nitrogen. Some of the farmers use small quantities of commercial fertilizer with wheat and corn, and the tobacco lands are generally heavily fertilized. Liming is rapidly coming into favor. The 1910 census reports the use of fertilizer on 25.6 per cent of the farms of the county in 1909, with an expenditure of $46,421, or an average of $43.96 per farm reporting.

As early as 1880 there were 4,064 farms reported in the county, of an average size of 53 acres, and 84 per cent of the farm land was improved. In 1910 the number of farms was 4,129 and the average size 47.9 acres, 77.2 per cent of the farm land being classed as improved. The small average size of the farms is due chiefly to the great number of small truck farms consisting of 10 to 20 acres. The farms in the neighborhood of Harrison, Glendale, and Loveland average considerably more than 48 acres.

According to the census of 1910, 67.5 per cent of the farms are operated by owners, 31 per cent by tenants, and 1.5 per cent by managers.

Labor is rather scarce, as well as expensive. This is probably due to the close proximity of large cities, such as Cincinnati, Covington, Hamilton, and Dayton, where better inducements are offered than on the farms. The average wage of farm hands in Hamilton County is between $25 and $35 a month, with board and washing.

The price of farm land ranges from $50 to $150 an acre, depending upon topography, improvements, and distance from Cincinnati and other towns.

SOILS.

The soil-forming material in Hamilton County is complex in origin as well as in mode of accumulation. It is partly glacial drift or till, partly residual material left in the decay of limestone and calcareous shales, partly a smooth, silty material whose origin is not thoroughly understood, and partly alluvium.

There is unmistakable evidence that areas along the northern border of the county were overrun by ice during glacial times, presumably during the Early Wisconsin stage of glaciation,[1] and it is considered by some authorities that the Illinoian Glacier at a much earlier period covered the entire county and extended a short distance into what is now Kentucky. The more recently glaciated areas are distinctly glacial in topography and the material giving rise to the soils is for the most part an unassorted mass of rock débris, consisting of rock fragments, sand, silt, and clay. Over the remainder of the county, on the other hand, where only the Illinoian ice sheet reached, there is not much evidence of glacial action. The topography appears purely erosional and there is very little material that can be definitely identified as glacial till. Important areas of stratified material occupying terrace positions along the present streamways are no doubt mainly of glacial age, although some may be the remnants of more recent alluvial plains left by the streams in carving their way to lower levels.

The substructure of Hamilton County is made up of bluish, highly fossiliferous limestone, calcareous shale, and soft, shaly limestone interbedded. The soil material throughout the rougher upland areas of the county is undoubtedly residual from such limestones and shales. Erosion is so active that only a thin mantle of soil material has accumulated over the rock, and this is not thoroughly weathered, as evidenced by its high lime content. Varying quantities of rock fragments are scattered over the surface, outcrops of the more resistant layers being of frequent occurrence, and the depth to bedrock rarely exceeds 3 feet.

Along the ridge crests in the more broken sections of the county and over a large part of the smoother uplands, the soil mantle to a depth of 4 to 6 feet is a very smooth, silty material, practically free from rock fragments, except that here and there a fragment of limestone or of chert or crystalline rock may be found. Usually the more friable silty mantle gives way at a depth of about 3 feet to a more plastic silty clay loam, and this at depths of 4 to 6 feet to limestone bedrock. It is considered by some authorities that this silty mantle bears no direct relation to the underlying rocks, being true loess brought in from foreign sources; but more probably it is the residue left in the weathering of a comparatively thin mantle of very old till, largely of limestone material, or is residual directly from the underlying rocks. The content of lime is very low, in striking contrast to conditions on the clay lands of the steep slopes; this difference may be accounted for by the fact that weathering and leaching are more complete than on the slopes, where, as the result of erosion,

[1] See Leverett's Glacial Map of Ohio.

the unweathered rock is kept within a foot or so of the surface, and there has not been time for complete weathering.

In the glaciated areas along the northern border of the county the till is largely of limestone origin. A large proportion of the stone present, especially below the zone where much weathering has taken place, is limestone, and the finer material is highly calcareous. Occasional granitic bowlders occur on the surface and similar fragments of crystalline rocks, sandstone, and shales occur through the till, but it is doubtful whether much of the soil-forming material is from rocks of this character.

The terrace or bench lands through the valleys consist of stratified deposits. The surface material, to a depth of 18 to 36 inches, consists of sand, silt, and clay, with or without an admixture of gravel. Below this there is little else than beds of gravel and sand, usually extending to a depth of several feet. A large proportion of the gravel is limestone, although, as in the till of the uplands, other rocks are represented.

Alluvial plains subject to overflow occur along practically all the streams in the county. Along the smaller streams the material is largely local in origin from such material as gives rise to the upland glacial and residual soils, while there is little doubt that along the larger streams a part of the material has been transported for some distance and probably was several times reworked on its way to its present position.

In the process of formation of the soils, differences in texture and topography have influenced drainage, aeration, oxidation, and the power to assimilate organic matter to such an extent that a considerable variety of soils has been produced.

The smooth, silty material of the uplands which is of doubtful origin occurs in large bodies through the eastern and central sections of the county and caps all the higher ridges through the western part where the topography is hilly or quite rough. It gives rise to the soils of the Cincinnati series in the best drained areas, or where the surface is distinctly rolling; to the Rossmoyne series where there is fair to good surface drainage but deficient underdrainage; and to the Clermont series in the flattest, poorly drained areas. The glacial-till uplands, which are confined to the extreme northern part of the county, also comprise three series, differing in topographic expression, in thoroughness of drainage, and in the color and structure of the surface soils and subsoils. The Miami series is developed in the rolling areas where good drainage has been established. Other areas with less thorough drainage where the surface soil is light colored and a subsurface gray layer has developed are included in the Crosby series, while the poorly drained areas with a dark-gray to black soil are classed in the Clyde series. The steeper slope soils that are undoubt-

edly residual from the underlying limestones and calcareous shales are grouped in the Fairmount series. The stratified deposits now in the form of second bottoms and higher terraces are all classed in the Fox series, while the Genesee series is made to include all the first bottoms or overflow plains. Through the valleys are a few areas of sandy material whose occurrence and surface relief indicate that they owe their formation to wind action. These are included in the Knox series.

The surface soils in the Cincinnati series are brown to light brown, with a grayish or yellowish tinge, and are smooth textured and friable. The subsoils are brownish yellow to light yellowish brown in color, compact in structure, though with only a slight degree of plasticity, and somewhat heavier than the surface soils in texture. A slight mottling with gray may occur in the lower part of the 3-foot section, usually below a depth of 24 inches. This mottled layer is not more than 6 or 8 inches in thickness and seems to be a transition zone between the friable material above, which is rather thoroughly oxidized and leached, and a more plastic and less completely weathered silty clay loam below. The surface is rolling, and good, natural drainage has been established. The material is of doubtful origin; while it is loesslike in its properties and may be loess, more probably it is the residue left from the mature weathering of a thin mantle of very old till or from limestone and shales, such as now occur at a depth of 4 to 8 feet.

Only the silt loam of the Cincinnati series occurs in Hamilton County. It is the most extensive type in the county, occupying approximately one-fourth of its area. It also has an important development in other counties of southwest Ohio and in the southeastern corner of Indiana. Probably a similar soil will be found south of the Ohio River extending for some distance into Kentucky and in other regions not yet surveyed.

The surface soils of the Rossmoyne series are grayish brown or light brown; the subsoils to a depth of 16 to 20 inches are brownish yellow, and beneath this, to a depth of 3 feet or more, gray and yellowish brown mottled. The Rossmoyne soils are similar in origin to those of the Cincinnati series, but they are not so well drained and the subsoil mottling comes nearer the surface and is much more pronounced. They are confined to level and gently rolling areas, usually along crests of drainage divides. The series is represented by one type, the silt loam, and this is much less extensive than the Cincinnati silt loam.

The surface soils of the Clermont series are light gray to nearly white. The subsoils are gray, mottled with yellow and brown, and have a compact, puttylike structure. Both the surface soil and sub-

soil are in a decidedly acid condition. The series is developed in close association with the Cincinnati and Rossmoyne soils, being confined to the flattest, most poorly drained areas. In Hamilton County the series is not important, only small areas of the silt loam having been mapped, but there is a large development of Clermont soils in Clermont and Brown Counties.

In the Fairmount series the surface soils are brown to dull brown, with a greenish-yellow cast. The subsoils are yellowish brown to greenish yellow, very plastic and sticky, and moderately to strongly calcareous. The Fairmount soils are residual from limestone and soft calcareous shales and occupy areas where bedrock is within a few feet of the surface and in places outcrops. The silty clay loam member is represented in Hamilton County, being the second most extensive of the upland types.

The Miami series includes types with brownish-gray to light-brown surface soils and yellowish-brown, heavier textured subsoils, usually specked and streaked with brown and black iron stains. The surface is undulating to rolling and good natural drainage has been established, except in slight sags approaching the condition of the Clyde soils. The Miami soils have been formed by the weathering of calcareous till. The surface soils and the subsoils to a depth of 2½ to 3 feet do not contain enough lime to react with mineral acids, but the material is less thoroughly leached of lime than is the case in the Cincinnati silt loam, and at greater depths than stated the material is strongly calcareous. The loam, silt loam, and silty clay loam members occur in Hamilton County.

The Crosby soils are similar in origin to those of the Miami series, but differ in having poorer drainage, lighter gray surface soils in a distinctly acid condition, gray mottled subsurface layers, and somewhat more compact and plastic subsoils. They are flat to very gently undulating in topography. The series is represented by the silt loam, which occurs in considerable areas along the northern border of the county between the Miami and Whitewater Rivers.

The Clyde series is characterized by dark brownish gray to black surface soils and gray, drab or mottled gray and yellowish, plastic subsoils. These types occur in flat and depressed areas where, as the result of poor drainage, a large quantity of organic matter has accumulated in the surface soils, imparting the characteristic dark color. As developed in Hamilton County they are derived from calcareous till, probably reworked to some extent under the swampy conditions that prevailed in most areas. The soil as a rule is not in an acid condition and the deep subsoil is distinctly calcareous. The Clyde series has only a very limited development in Hamilton County and is represented by the silty clay loam type. This type is closely

associated with the Miami and Crosby soils, occupying minor depressions.

The Fox series includes brown to reddish-brown surface soils and yellowish-brown to reddish-brown subsoils, resting upon beds of gravel and sand at depths of 18 to 36 inches. These types occupy terrace and outwash-plain areas, level or nearly so in topography and naturally well drained. They are derived from water-laid deposits of mixed origin, though to a large extent from limestone, as is evidenced by the high percentage of limestone in the underlying beds of gravel. The series is represented in Hamilton County by the fine sandy loam, loam, and silt loam types.

The Knox series consists of brownish-gray to brown surface soils resting upon yellowish-brown subsoils of similar or somewhat heavier texture. They are undulating to very irregularly rolling in topography and have good natural drainage. The series is of very little importance in Hamilton County, the areas represented having resulted from wind action, probably on material first laid down by water. Only one type, the Knox fine sandy loam, is mapped.

The Genesee series consists of grayish-brown to dark-brown surface soils resting upon lighter brown to brownish, mottled subsoils of similar or somewhat heavier texture. These soils occur as first bottoms along all the important drainage ways of the county. They are level to slightly undulating in topography and have fair drainage, except that they are subject to occasional overflows. The series is represented by the loam, silt loam, sand, and clay loam types. The sandy members of the series are prevailingly light brown to grayish brown, and the clay loam and silt loam members dark brown in color.

In the following table are given the name and the actual and relative extent of each of the soils mapped in Hamilton County:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Cincinnati silt loam	98,816	38.0	Miami silty clay loam	2,624	1.0
Fairmount silty clay loam	64,576	24.8	Clermont silt loam	2,368	.9
Genesee silt loam	22,912	8.8	Knox fine sandy loam	1,024	.4
Rossmoyne silt loam	20,160	7.7	Genesee sand	768	.3
Miami silt loam	15,104	5.8	Genesee clay loam	704	.3
Fox fine sandy loam	9,664	3.7	Clyde silty clay loam	512	.2
Genesee loam	6,464	2.5	Miami loam	384	.1
Fox silt loam	6,336	2.4			
Crosby silt loam	4,736	1.8	Total	260,480	
Fox loam	3,328	1.3			

CINCINNATI SILT LOAM.

The soil of the Cincinnati silt loam, to a depth of 12 to 16 inches, is a brown, smooth, mellow silt loam, becoming somewhat lighter in color when dry. Generally the surface 6 or 8 inches is distinctly brown, while below this there is a variation from light brown to yellowish brown, with no mottlings. The subsoil in the upper part is a brownish-yellow, heavy silt loam, but grades within a few inches into a more compact, brownish-yellow or light yellowish brown, friable silty clay loam or heavy silt loam, which extends to a depth of 3 feet or more with little or no change in color or texture. In places, especially in the flattest areas, the subsoil becomes looser in structure and somewhat mottled below a depth of about 24 inches. This mottled layer is seldom over 6 inches in thickness, giving way below to a heavier and tougher, dull yellowish brown or brownish-drab silty clay loam.

The variation in color is dependent upon the thoroughness of the drainage. Where the drainage is exceptionally good, oxidation has been more active and the soil has a faint reddish cast, while, on the other hand, in places where the drainage is not thorough the aeration and oxidation have been impeded, and the soil is grayer in color and grades toward the Rossmoyne and Clermont types. Usually the limestone bedrock underlies the type within 4 to 6 feet of the surface.

The Cincinnati silt loam is typically and extensively developed in the eastern and central parts of the county, and inextensively in the western half. It is encountered in broad, continuous areas and as a capping on the narrow ridges in the more eroded sections.

The topography ranges from gently rolling to rolling. Where the slopes are very steep erosion is so active that very little soil material has accumulated, and this is not thoroughly oxidized and leached, as is the case with the typical soil. Surface drainage is good and underdrainage fair to good, except in the flatter areas.

About 80 per cent of this type is under cultivation. The small uncleared areas found here and there in most cases have a growth of small oak and maple trees and are used as woodlots or permanent pasture land.

The Cincinnati silt loam is suited to the production of the general-farming crops, and most of it is utilized for this purpose. Areas not in cultivation afford excellent pasturage. Corn probably leads in acreage, with wheat, grasses, oats, and vegetables as other important crops, in the order named. Bluegrass does exceptionally well. Most of the corn grown on this type is fed to stock on the farm or sold as green corn in Cincinnati. Wheat, the main money crop, is sold to the local grain elevators and flour mills. Most of the market-garden crops grown are sold in Cincinnati.

Corn yields from 30 to 60 bushels, wheat 15 to 25 bushels, oats 30 to 60 bushels, and grasses 1 to 2 tons per acre.[1]

There are many small orchards of apples, peaches, cherries, and plums on this type. Although a considerable quantity of this fruit is marketed in Cincinnati, it is grown primarily to supply the home.

There are some large dairy farms on the type, with silos and well-equipped barns, while the majority of the farmers keep at least a few cows and sell milk and cream. Beef cattle are generally marketed at the stock yards in Cincinnati.

Heretofore very little attention has been paid to the systematic rotation of crops on this type, with the result that it is generally deficient in organic matter, especially in the older fields. At present, however, the growing and plowing under of legumes and other green-manure crops is receiving increased attention.

One of the most successful rotations practiced at present consists of (first year) corn, (second) wheat or oats, and (third) timothy and clover. Where truck crops have a place in the rotation and quick results are desired, commercial fertilizers high in nitrogen and phosphoric acid may be profitably used.

Commercial fertilizers are used only to a small extent, barnyard manure and refuse from breweries being the two fertilizers mainly used. Within the last three years liming has become quite popular and crushed limestone is used on many of the farms, with excellent results.

The price of land of the Cincinnati silt loam ranges from $50 to $125 an acre, depending upon improvements and the distance from Cincinnati and smaller towns.

The soil of the Cincinnati silt loam is generally acid to a depth beyond the reach of the roots of most plants and for the successful growing of such crops as alfalfa and clover the addition of lime is necessary. Ground limestone applied at the rate of 1½ to 2 tons per acre gives good results.

At present the farmers of the county, as a rule, do not fully realize the agricultural value of this type. Many of the fields that are considered worn out could easily be built up and restored to their former productive condition by adopting better methods of farming. With deep plowing, liming, the incorporation of vegetable matter, systematic crop rotation, and artificial drainage, this could be made one of the best general-farming soils in the county.

[1] Statements in the soil descriptions as to crop yields are based on information obtained from farmers.

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

Mechanical analyses of Cincinnati 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.*
271829	Soil	0.2	0.9	0.6	2.7	4.6	75.2	15.4
271830	Subsoil	.9	1.5	.7	3.7	7.6	58.1	27.3

ROSSMOYNE SILT LOAM.

The Rossmoyne silt loam consists of 12 to 18 inches of a brown or grayish-brown, smooth, friable silt loam, grading below into a yellowish-brown or brownish-yellow, friable silty clay loam, and this at a depth of 16 to 20 inches into a mottled gray and yellowish-brown silty clay loam. Occasionally below 30 inches the mottling becomes less pronounced and a yellowish-brown, friable silty clay predominates. The type occupies an intermediate position between the Cincinnati and Clermont silt loams. The surface soil is very similar in color to that of the Cincinnati silt loam and darker brown than that of the Clermont silt loam, while the subsoil is decidedly more mottled than the subsoil of the Cincinnati and less compact and impervious than that of the Clermont.

The Rossmoyne silt loam has a rather extensive development through the central and eastern sections of the county. Some of the largest areas occur at Rossmoyne, Blueash, and in the northeastern corner of the county.

The type is confined almost entirely to the crests of ridges and broader drainage divides, and the topography ranges from nearly level to slightly undulating. Surface drainage is fairly well established, but underdrainage is poor. Parts of the type have been drained by tiles and open ditches, but a large proportion of it is still in need of better drainage.

About 80 per cent of this type is under cultivation. A considerable acreage is in permanent pasture, while some important areas are occupied almost entirely by city lots.

Corn, oats, wheat, rye, clover, and truck crops, such as potatoes, beans, tomatoes, rhubarb, strawberries, and cabbage, are the crops grown. The soil is especially well suited to oats, and a considerable acreage is devoted to this crop. Corn yields 30 to 60 bushels, wheat 15 to 20 bushels, and oats 35 to 60 bushels per acre. Orchard crops, such as apples, peaches, cherries, and plums, are grown mainly for home use and do fairly well. Timothy gives heavy yields. Bluegrass thrives.

Increasing attention is being paid to dairying on this type and nearly every farmer has a few dairy cows.

Farmers on this type have only recently begun the systematic rotation of crops. Practically the same fertilizers are used as on the Cincinnati silt loam. A greater quantity of ground limestone is used, owing to the more acid condition of the subsoil.

The type is easily tilled and does not require heavy equipment. Many of the farmers are progressive and have well-constructed, painted houses and barns.

Farm land of the Rossmoyne silt loam sells for $65 to $125 an acre, depending upon location, drainage, and improvements.

Like its associated type, the Cincinnati silt loam, this type is deficient in organic matter and lime and is greatly improved by the growing and plowing under of leguminous crops, such as clover and soy beans, and by liming. Barnyard manure is especially desirable on soil of this character.

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

Mechanical analyses of Rossmoyne 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.*
271805	Soil	0.4	2.0	1.2	3.4	7.6	69.4	16.2
271806	Subsoil	.0	.6	.4	1.4	7.2	63.2	27.1

CLERMONT SILT LOAM.

The surface soil of the Clermont silt loam is a smooth, compact, gray to almost white silt loam, 12 to 15 inches deep. When wet it is gray, with a brownish cast, but when dry it is almost white. On close examination the material shows a distinct mottling with yellowish brown, and occasional small iron concretions are found on the surface and intermingled with the soil. The subsoil, to a depth of 3 feet, is a gray, mottled with yellowish-brown and brown, compact, puttylike silty clay loam. Occasionally drab and bluish-drab colors are encountered in the lower part of the 3-foot section. Although the Clermont silt loam can not be said to have a typical hardpan, it has a subsurface layer, at a depth of 10 to 15 inches, consisting of whitish, floury silt loam. This material has a rather greasy feel and seems greatly to retard water and air circulation. Under proper moisture conditions the soil is easily cultivated, but when either too wet or too dry big clods are turned up and it is almost impossible to crush these into a desirable seed bed.

The Clermont silt loam has only a small development in Hamilton County. Some of the largest areas mapped lie along the Butler

County line northwest of Loveland, east of Norwood, east of Carthage, southwest of Mount Healthy, and along the Clermont County line near Cherry Grove.

The type occupies flat to slightly depressed areas, where water remains for several days after heavy rains, and has a level topography.

Poor drainage and the acid condition of the soil are two of the more serious drawbacks to the cultivation of this type. Owing to the flat surface, drainage outlets with sufficient fall are hard to find, but occasionally tile drains can be connected with some of the minor drainage ways or gullies that ramify through the county.

The Clermont silt loam is rated as one of the poorer upland soils in the county and under natural conditions it gives very low yields. Only about 20 per cent of the area mapped is under cultivation, the remainder being used largely as pasture land. The forest growth consists of oak, maple, and ash. Corn, wheat, and timothy are the three main general-farming crops grown. Corn yields 15 to 30 bushels and wheat 10 to 15 bushels per acre. During the course of the soil survey a number of cornfields were seen where yields apparently would not average 5 bushels to the acre. These fields were very poorly drained, the corn turning yellow and tasseling when only 2 to 5 feet high. Timothy and other hay grasses do better and are more extensively grown than any other crops.

The price of land on this type ranges from $25 to $75 an acre, depending upon location, drainage, and improvements.

Before it can be profitably cultivated, this type requires thorough drainage, the incorporation of organic matter, and liming. Two to five tons of ground limestone per acre should be applied. Areas on which the cost of establishing artificial drainage is prohibitive are best used for pasturage.

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

Mechanical analyses of Clermont 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.*
271803	Soil	0.4	1.6	1.0	4.0	9.0	67.9	16.1
271804	Subsoil	.1	.2	.4	2.2	6.6	57.0	33.6

FAIRMOUNT SILTY CLAY LOAM.

In the typical development of the Fairmount silty clay loam the surface soil is a brown to yellowish-brown silty clay loam to silty clay with a depth of 5 to 7 inches. When moist it is sticky and quite plastic and usually has a slightly greenish shade, but on drying out it becomes very tough and hard, cracks badly, and has a

grayish color. The subsoil is a brownish-yellow to greenish-yellow, sticky, plastic silty clay, resting upon limestone and calcareous shales at less than 3 feet. Slabs of limestone occur in varying quantities on the surface and through the soil mass, and limestone ledges outcrop in places. The soil and subsoil material is moderately calcareous.

There are important variations in the type which, on account of their mode of occurrence and small extent, it was impracticable to map separately. One of these variations is intermediate in character between the typical soil and the Cincinnati silt loam, the surface material consisting of a light-brown silt loam to heavy silt loam, 6 to 8 inches deep, and the subsoil of a brownish-yellow, compact, silty clay loam, underlain at a depth of 18 to 24 inches by a dull brownish yellow, plastic, silty clay loam to silty clay. Usually limestone and calcareous shales form bedrock at a depth of 3 or 4 feet, while occasional fragments of limestone occur on the surface and through the soil section. The surface soil and upper subsoil are not calcareous, but the crops and native vegetation indicate that the material is less thoroughly leached of lime than the typical Cincinnati silt loam.

Throughout the Fairmount silty clay loam, also, are small areas of dark-brown, mellow silt loam extending to a depth of 3 feet or more. Here occasional small fragments of limestone occur on the surface and intermingled with the soil.

The Fairmount silty clay loam occupies all the steeper slopes throughout the uplands of the county, except in the glaciated section along the northern boundary. In the rough, hilly country about Cincinnati and through the western part of the county it is the principal upland type. Farther east it includes the steeper slopes along the Ohio and Little Miami Rivers and some of the creeks that have cut deeply back into the highlands. Some of the slopes occupied by the type rise abruptly from the valley plains to a height of 150 to 300 feet. The light-textured variation occurs in patches, for the most part on the more gentle slopes. The included areas of deep silt loam occur as narrow bands or belts, usually at the base of the slopes, representing colluvial wash or creep from the higher areas.

The Fairmount silty clay loam is the second most extensive type in the county, and although hilly and rough in topography it is important agriculturally. Probably 50 per cent of it is under cultivation. Of the uncultivated portion only the roughest and stoniest areas have been left uncleared, while the remainder is used for permanent pasture. Black walnut, maple, and oak constitute the principal tree growth on the forested areas.

The cultivated land is used chiefly for the production of alfalfa and corn. A considerable acreage is devoted to wheat, while clover, oats, and grasses are crops of less importance. It is estimated that between 60 and 75 per cent of the alfalfa and most of the tobacco produced in the county are grown on this type. The greater part of the tobacco is grown on the steep slopes in the western part of the county. The best results with alfalfa, as well as with corn, clover, and grasses, are obtained on the colluvial-wash areas at the base of slopes and on the heavier clay loam areas where the soil carries an abundance of lime, the lighter areas with lower lime content being comparable in natural productiveness with the Miami silt loam, although less desirable on account of their rough topography. Cherries and apples do well and occasional small orchards are to be seen.

Dairying and the raising of beef cattle are industries of considerable importance. The beef cattle and dairy cows are sheltered and fed through the winter months and pastured during the summer.

Corn yields 25 to 60 bushels, wheat 12 to 25 bushels, and clover hay 1 to 1½ tons per acre on this soil. Alfalfa makes 3 or 4 cuttings a year and yields from 1 to 1½ tons at a cutting. Tobacco yields from 1,000 to 1,500 pounds per acre.

Owing to the tough, plastic nature of this soil and its steep topography, it is very difficult to till. The implements used are generally of the one-horse type. In many places alfalfa is grown on such steep slopes that it has to be cut by hand. Scarcely any commercial fertilizer is used, and liming is not practiced generally, although some farmers make applications for alfalfa on the lighter silty areas. Commercial fertilizers high in nitrogen and phosphoric acid have been found to give good results with tobacco.

The value of land of this type ranges from $50 to $125 an acre, depending upon topography, quantity of stone on the surface, and distance from Cincinnati.

MIAMI LOAM.

The surface soil of the Miami loam is a light-brown loam, 12 to 14 inches deep. When dry the surface material of plowed areas is light gray. In depressions or other situations where organic matter has accumulated the color is dark gray to brown. The subsoil is a yellowish-brown loam to silty clay loam. Usually at a depth of 2½ to 3 feet the subsoil becomes somewhat more gritty and may contain a small quantity of partially rounded gravel and angular rock fragments, mostly of limestone. As is the case with the other Miami types, the deep subsoil effervesces freely when treated with mineral acids. Over a part of the type the surface soil contains considerable sand and the subsoil is heavier than where typically developed.

This type is inextensive in Hamilton County. The only area mapped is situated about a mile southwest of New Haven and contains 384 acres.

In general the topography varies from nearly level to rolling. Drainage is good, except in some of the flattest areas, which require artificial drainage.

Practically all of this type is under cultivation to corn, clover, and grasses, the yields being somewhat lower than on the Miami silt loam. Land of this type sells for $50 to $125 an acre.

Liming and the incorporation of vegetable matter are necessary for the highest agricultural development of the type.

MIAMI SILT LOAM.

The Miami silt loam consists of 12 to 14 inches of grayish-brown silt loam, becoming light brownish gray when dry. Usually the soil is somewhat deeper on the crests of ridges and over the level or depressed areas than on the slopes, where a considerable quantity of the silty material has been washed off. The subsoil is a yellowish-brown, compact silty clay loam, containing brown and black iron stains. At a depth of about 2½ feet the subsoil becomes more friable, slightly gritty, and grayish in color, and at about 36 to 40 inches the material is distinctly calcareous. A few crystalline bowlders and fragments of limestone occur on the surface and through the soil section.

The Miami silt loam occurs in the northern part of the county, the largest area, which is roughly wedge shaped, extending about 9 miles along the Butler County line and tapering to a point just south of Wyoming. A few smaller areas lie farther to the west, near the Miami River. The line of division between the Miami silt loam and the Cincinnati silt loam is rather abrupt and very noticeable.

The topography of the Miami silt loam is undulating to gently rolling, the slopes being steep enough in most cases to insure good drainage. Owing to the irregularities of the surface, numerous small ponded areas occur in which there is an accumulation of partially decayed organic matter, giving the surface soil a distinctly black or dark-brown color. Such areas are in reality Clyde silty clay loam, and the larger ones are so mapped.

The areas of the Miami silt loam in Hamilton County form the southern extension of a broad development of this type in Butler County and other counties to the north. It is highly valued for agriculture in all these counties and practically all of it is under cultivation. In Hamilton County corn is the chief crop. Wheat, oats, and timothy also are extensively grown, while clover and alfalfa are crops of less importance. The total acreage devoted to timothy alone, timothy and clover mixed, clover alone, and alfalfa probably exceeds that of corn.

Oats and wheat are usually sowed upon corn-stubble land. Quite often the land is thoroughly prepared by plowing, but disk-harrowing without plowing is also practiced. Nearly all the oats are fed on the farm, while the wheat and part of the corn are sold.

Not much attention is given to cattle raising or feeding, but hogs are an important source of revenue on a majority of the farms. A large number of the farmers keep a few dairy cows and sell milk, while some have large dairy herds and well-equipped barns, with silos.

Corn on the Miami silt loam yields 40 to 65 bushels per acre, wheat 15 to 25 bushels, oats 25 to 60 bushels, and timothy 1½ to 2½ tons of hay. Alfalfa makes three or four cuttings a year and yields 1 ton to 1½ tons at a cutting.

Commercial fertilizers are used only to a small extent. Where liberal applications of fertilizer high in nitrogen and phosphoric acid were made for corn and wheat heavy yields have been obtained. Although the soil is neutral, or only slightly sour, alfalfa and clover land is usually limed, with good results.

The farm implements used in the cultivation of the Miami silt loam are somewhat heavier and more modern than those used on the Cincinnati silt loam. A big disk plow, requiring 2 or 3 heavy draft horses, is quite commonly used. A few gasoline tractors also are employed. The farm buildings are as a rule well constructed and painted.

Many of the farmers on this type do not practice the systematic rotation of crops, and as a result the yields are gradually decreasing. A rotation that has met with success is as follows: Corn one year or more, oats one year, and winter wheat one year, followed by timothy and red clover mixed or clover alone. The last crop is plowed under, and the following spring the field is seeded to alfalfa, in which it is generally left for 3 or 4 years. Fields that have been put in alfalfa for 3 years show an increase in corn production of 20 to 30 per cent. Excellent results have been obtained by applying barnyard manure to the corn land, either on the sod before turning it under or on the plowed land before harrowing.

The price of farm land on the Miami silt loam ranges from $50 to $150 an acre, depending upon improvements and location.

Owing to the suitability of this soil for the production of such crops as alfalfa, clover and various grasses, and corn, the opportunities for extension of dairying and stock raising are exceptionally good.

MIAMI SILTY CLAY LOAM.

The Miami silty clay loam consists of a light-brown to grayish-brown silt loam to light silty clay loam, 5 to 8 inches deep, resting upon a dull yellowish brown, compact, and somewhat plastic silty

clay loam. At a depth of 24 to 30 inches the subsoil grades into a brownish-gray or grayish-brown, more friable clay loam or silty clay loam, which is calcareous enough to effervesce freely when treated with mineral acids. Occasional fragments of limestone chert and crystalline rocks occur on the surface and through the soil mass, the quantity usually increasing with depth.

The Miami silty clay loam in Hamilton County is not representative of the extensive development of the type farther north in Ohio and Indiana, where it is the predominant soil, derived from a heavy, calcareous till. In this county the surface soil is darker brown and the subsoil is lighter in texture and more uniformly oxidized than elsewhere, the soil being intermediate between the Miami silt loam and the typical Miami silty clay loam.

The Miami silty clay loam is confined to the glaciated section of the county along the northern border, and is developed mainly in the vicinity of Glendale and Springdale. Without doubt, this type before being brought under cultivation was essentially the same as the Miami silt loam, its heavier texture being due to the thinning, and in places the entire removal of the surface soil, by erosion. The type occupies rolling areas and slopes steep enough to afford good surface drainage, yet smooth enough to permit cultivation.

Nearly all of this type is cleared and under cultivation, corn being the chief crop grown, followed by wheat, oats, timothy, clover, and alfalfa. Bluegrass thrives and affords good pasturage on uncultivated areas.

The ordinary selling price of land of the Miami silty clay loam ranges from $50 to $100 an acre.

The ordinary crop yields on this type are not so high as on the Miami silt loam. The soil is very deficient in organic matter and requires heavy applications of manure for best results. Areas that are badly gullied and can not be properly protected from erosion are best used as permanent pasture lands.

The results of mechanical analyses of samples of the soil and subsoil of the Miami silty clay loam follow:

Mechanical analyses of Miami 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.*
271822	Soil	0.2	1.3	0.8	4.3	4.8	71.3	17.2
271823	Subsoil	.4	1.4	1.2	6.9	8.0	53.1	28.6

CROSBY SILT LOAM.

The surface 8 to 12 inches of the Crosby silt loam is a brownish-gray silt loam. This grades into a light-gray to yellowish-brown, mottled silt loam which extends to a depth of 16 to 20 inches. When

dry the surface material becomes light gray in color. The upper few inches of the subsoil is a mottled yellow and gray silty clay loam, which grades into a light yellowish brown, compact silty clay loam, and this, at a depth of 2½ to 3 feet, into a more friable and somewhat calcareous silty clay loam to clay loam. As a rule the surface soil is somewhat darker in cultivated fields than in forested areas, where it is light gray mottled with yellow and brown. On some of the slightly elevated areas the gray surface soil is only 6 to 8 inches deep and the brown mottlings of the subsurface layer are more pronounced than usual.

Small iron concretions occur on the surface and through the soil and upper subsoil. Owing to the ashen color of the surface soil, the type is locally referred to as "crawfishy" or "white-flat" land.

In some of the slightly depressed areas the soil is almost white, while in other similar areas it is decidedly black. These black spots are seldom over 4 acres in size. The soil, to a depth of about 10 inches, is a very dark gray to black silt loam, underlain by a bluish or slate-colored, heavy, plastic clay, showing mottlings of brown. Below 20 inches the subsoil is decidedly mottled with yellow and drab. Areas of the dark soil that were of sufficient size to separate were mapped as the Clyde silty clay loam.

A few sandy ridges or slight knolls occur in places throughout the type. On these the soil is a brown fine sandy loam and the subsoil is yellowish brown, usually with a reddish tinge, resembling the subsoils of the Bellefontaine series.

The Crosby silt loam is developed in the northwestern part of Hamilton County, mainly bordering the Butler County line.

The topography ranges from flat to slightly undulating. The type is only slightly elevated above the adjacent terrace soils along the Whitewater River. Small, poorly drained depressions are numerous throughout the type.

Only about 65 per cent of the type is cultivated, the remainder being used almost entirely for pasturage. The principal crops are corn, wheat, timothy, and red clover. Stock raising and dairying are carried on to only a small extent, although the type is well suited for these industries.

Corn yields 30 to 60 bushels, clover 1½ to 2 tons, and timothy 1 ton or more per acre. Wheat does fairly well, yielding 12 to 16 bushels per acre. While red clover is very successfully grown, alfalfa does not do well and satisfactory results can not be expected unless the soil is heavily limed.

The price of land of this type ranges from $50 to $125 an acre, depending upon improvements and location.

The Crosby silt loam is sour, especially in the surface soil, and also is deficient in organic matter. To improve the soil it is necessary to

establish artificial drainage and to incorporate barnyard manure, in addition to practicing systematic crop rotations in which the legumes have a prominent place. More stock should be kept in order to furnish a larger supply of manure.

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

Mechanical analyses of Crosby 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.*
271833	Soil	0.6	1.9	0.8	3.0	3.9	71.0	18.8
271834	Subsoil	.2	1.4	1.0	5.5	8.5	57.5	25.6

CLYDE SILTY CLAY LOAM.

The surface soil of the Clyde silty clay loam consists of a dark-brown to black silty clay loam, from 12 to 18 inches deep. When dry the surface soil has a grayish cast; when wet it is black in color and rather plastic in structure. The subsoil to a depth of 27 inches is a dark grayish brown silty clay loam, having a greenish cast, while below this depth it is a drab silty clay, mottled with light yellow and gray. The deep subsoil in the most poorly drained areas may be a dark-bluish sticky clay.

The Clyde silty clay loam is of very small extent in Hamilton County. It is developed in basinlike depressions where the natural drainage is poor and is closely associated with the Miami soils, having its largest development in the vicinity of Glendale and Springdale, and along the Butler County line northwest of New Baltimore.

With the exception of a few small swampy areas, practically all the type has been drained and is under cultivation, being used principally for the production of corn and red clover. Corn is planted year after year without any attention to the rotation of crops, and yields 40 to 80 bushels per acre. Clover yields from 1½ to 2½ tons of hay per acre. Oats and wheat have never been important crops on this type, although they make large yields.

Very little if any fertilizer is used on the Clyde silty clay loam at present and it is not considered necessary to practice systematic crop rotations in order to maintain its productiveness.

It is difficult to give the exact market value of land of this type, owing to the fact that there are no farms composed entirely of it, but the estimated price is $75 to $150 an acre.

The Clyde silty clay loam is naturally a strong, productive soil, and adequate drainage is the chief need in bringing it under cultiva-

tion. The soil requires careful handling for best results, as it is likely to bake or clod if worked when either too moist or too dry.

KNOX FINE SANDY LOAM.

The surface soil of the Knox fine sandy loam is a brown to grayish-brown fine sandy loam, 12 to 18 inches deep. The subsoil is a yellowish-brown to brown fine sandy loam to fine sandy clay. Minute grains and small fragments of white chert are rather abundant in the subsoil.[1]

This type has only a small development in the county, and lies adjacent to stream bottoms and terraces. Some of the largest areas occur in the vicinity of Elmwood Place, Carthage, and Bond Hill.

The topography ranges from almost level to gently rolling. A few patches occupying shoulderlike positions on steep slopes have a rather rough surface. The loose, friable structure of the soil material to a depth of several feet and the high elevation of the type above present stream courses insure good natural drainage over the greater part of the type.

About 20 per cent of the Knox fine sandy loam is under cultivation, the remainder of the agricultural land being in pasture. A part of the type is included in the suburbs of Cincinnati.

Cultivated areas are devoted almost exclusively to the production of truck crops, such as cantaloupes, melons, tomatoes, beans, Irish potatoes, and sweet potatoes. Small patches are planted to corn, mostly of an early sweet variety, sold for roasting ears. Bluegrass thrives on the pastured areas.

Land of this type sells for $50 to $200 an acre, depending upon its location.

FOX FINE SANDY LOAM.

The surface soil of the Fox fine sandy loam consists of a brown fine sandy loam, 12 to 15 inches deep. The subsoil is a brown to slightly reddish brown, compact loam to clay loam, underlain by stratified beds of gravel at a depth of 24 to 36 inches. As in the case of the Fox loam and silt loam, a large proportion of the underlying gravelly material is from limestone, although the soil mantle is not calcareous. The surface soil has a very gritty feel, due to the presence of sharp, coarse sand or fine gravel.

The Fox fine sandy loam occupies second bottoms and higher terrace or benchlike areas along the main watercourses, the most important areas lying along Mill Creek and in the fork of the Whitewater River and Dry Fork. Some of the areas along the Whitewater River occupy the second, third, fourth, and fifth terraces.

[1] The soil is not typical Knox, differing from it in texture, structure, and color of subsoil. The surface soil is somewhat lighter colored than true Knox and the lime content of the subsoil is considerably lower. Its classification in the Knox series is temporary.

Here the subsoil is prevailingly of a redder color than in the low-lying areas.

The topography ranges from level to gently undulating and drainage is in most cases well developed. A few of the low-lying areas may be inundated for brief periods during exceptionally high floods, but these are of rare occurrence.

A large area of the Fox fine sandy loam lies within the city limits of Cincinnati. Of the agricultural land probably 50 per cent is used in the production of Irish potatoes and a variety of other vegetables for the Cincinnati market, and the remainder is used for general farming, with corn as the chief crop. Market gardening, which formerly was carried on extensively on this type through the Mill Creek Valley, is largely confined to the areas in the western part of the county. Dairying is not important.

Most of the farms on this type are well equipped and in a high state of cultivation. Some system of crop rotation is practiced by the majority of farmers. All of the barnyard manure produced is applied to the soil, and complete mixtures of commercial fertilizer are in common use, especially in the production of market-garden crops.

Corn yields 40 to 75 bushels, wheat 12 to 20 bushels, oats 35 to 65 bushels, and potatoes 100 to 175 bushels per acre. All the vegetables grown do well.

The selling value of land of the Fox fine sandy loam type ranges from $100 to $175 an acre, depending upon the improvements and distance from Cincinnati.

While prosperous agricultural conditions prevail on this type, considerable improvement in agriculture would follow the devoting of more attention to the systematic rotation of crops and the plowing under of green manures. Apparently, more of the type could be used very profitably in the production of truck and market-garden crops, including sweet potatoes, Irish potatoes, and cantaloupes.

FOX LOAM.

The surface soil of the Fox loam consists of a brown loam having a slightly reddish cast and varying from 10 to 12 inches in depth. The subsoil is a brown to reddish-brown sandy clay loam, underlain at a depth of about 20 inches by a stratum of gravel, which usually continues to a depth of several feet and carries a high percentage of limestone. When dry the surface soil has a yellowish-brown tinge. The surface material usually contains enough sand to give it a slightly gritty feel, and in places it contains some gravel.

The Fox loam is rather extensively developed in the western part of the county, occurring as a terrace soil along the Whitewater River

and its Dry Fork. It is level in topography but has good natural drainage.

Owing to its friable structure, the soil is easily worked, and it is fairly retentive of moisture. It is considered an excellent soil for farming and about 95 per cent of the land is under cultivation. Corn, wheat, oats, clover, alfalfa, various grasses, and market-garden crops, including potatoes, are grown on this type, Corn and wheat are the principal crops. Very little of the Fox loam is used for pasturage, and stock raising and dairying are of little importance.

Corn yields 40 to 60 bushels, wheat 15 to 25 bushels, and oats 35 to 60 bushels per acre. Alfalfa and clover both produce heavy yields, and Irish potatoes frequently yield from 100 to 150 bushels to the acre.

The methods of fertilization, crop rotation, and cultivation followed on this type are similar to those practiced on the Fox fine sandy loam and silt loam.

Land of the Fox loam sells for $100 to $150 an acre, depending upon the location and improvements.

FOX SILT LOAM.

The surface soil of the Fox silt loam, to a depth of 10 to 12 inches, is a brown, mellow silt loam, appearing light brown or yellowish brown when dry. The subsoil consists of a yellowish-brown, friable silty clay loam, grading at a depth of 24 to 30 inches into a clay loam of similar color. This within a few inches rests upon stratified beds of gravel, grit, and sand carrying a high percentage of limestone material. In places there is a sprinkling of rounded gravel on the surface and intermingled with the soil material. The largest areas approaching the condition of a true gravelly soil are indicated on the map by gravel symbol.

The Fox silt loam covers an area of 9.9 square miles. It occurs in several areas along the Little Miami, Miami, Whitewater, and Ohio Rivers, and through the Mill Creek Valley. It is a terrace soil, nearly level in topography, and lying well above overflow. The type is naturally well drained.

The Fox silt loam is a very desirable soil and has been held in high favor since the early settlement of the region. It is easily cultivated and kept in good tilth and is sufficiently retentive of moisture to insure good crops nearly every year. Most of the type now, however, is occupied by villages and towns. All of the areas still available for farming are under cultivation, being used chiefly in the production of corn, wheat, and oats. Alfalfa, clover, and tobacco are less important crops. A variety of vegetables for the local market is grown on small areas. A few farms are devoted mainly to dairying and some of the corn grown is cut green for ensilage.

Corn yields 20 to 65 bushels, wheat 15 to 25 bushels, and oats 30 to 60 bushels per acre. Alfalfa does not seem to do so well on this type as on the Fox loam, but yields of three-fourths ton to 1½ tons per acre at a cutting are reported.

All the available barnyard manure is applied to the land and considerable commercial fertilizer is used, particularly in connection with the growing of vegetables. The market gardeners make acreage applications of 500 to 750 pounds of high-grade complete fertilizer. Farm land of this type sells for $75 to $125 an acre.

The Fox silt loam is generally deficient in organic matter and requires frequent, heavy applications of barnyard manure and the turning under of leguminous crops for best results.

GENESEE SAND.

The Genesee sand consists of a loose, incoherent to slightly loamy, brownish-gray sand of medium to fine texture, resting at a depth of 25 to 36 inches or more upon heavier and darker material, like that of the Genesee silt loam and clay loam. In places considerable gravel is strewn over the surface and intermingled with the sand.

The Genesee sand is a first-bottom type of very small extent. Only a few small areas are mapped, lying in the overflow plains of the Miami and Whitewater Rivers.

The surface is level to billowy and all the areas are well drained, though subject to occasional overflows.

Most of the material giving rise to the Genesee sand type in Hamilton County was deposited during the flood of 1912, when fields of rich, alluvial soil were completely covered by loose sand and rendered practically useless for a time.

This type is not retentive of moisture, and for this reason crops are liable to injury during dry periods. At present a very large percentage of the type is lying idle. A few patches are used for corn, cantaloupes, watermelons, and early truck crops, with fair to good results. Some farmers have sowed alfalfa, but the yields have not been satisfactory.

Owing to the patchy occurrence of this sandy soil, no definite price can be placed upon it. It is considered one of the poorer agricultural types in the county and is probably worth about $25 to $50 an acre.

In order to obtain profitable results on this soil, it is essential that organic matter be incorporated in large quantities, either by turning under green crops or by applying barnyard manure. Sweet clover thrives and should be more extensively grown. With heavy fertilization, early truck crops could be profitably grown.

GENESEE LOAM.

The surface soil of the Genesee loam is a light-brown to medium-brown loam, 12 to 18 inches deep, and the subsoil is a light-brown or yellowish-brown to medium-brown fine sandy loam to loam. Neither the structure nor texture of the subsoil can be said to be uniform, as layers of very fine sand, clay loam, and silt loam may be encountered at varying depths.

The type occupies first bottoms subject to frequent overflows and has its greatest development along the Miami River and the Whitewater River and Dry Fork.

The topography is level to slightly ridgy, the ridges usually being more sandy than the level areas. Natural drainage is fair.

Over 90 per cent of this type is under cultivation. Corn, the main crop grown, yields from 40 to 80 bushels to the acre. Alfalfa and clover are grown to a small extent and give large yields, but there is danger of these crops being drowned out during overflows.

The soil is well suited to late truck crops, including cabbage, cucumbers, and tomatoes.

Land of the Genesee loam sells for $75 to $150 an acre.

GENESEE SILT LOAM.

The Genesee silt loam consists of 12 to 15 inches of brown silt loam, underlain by a brown to grayish-brown silty clay loam, having a slightly greenish cast in the lower part. The surface soil when plowed and thoroughly dried out has a yellowish-gray to yellowish-brown color.

Over half the first-bottom land of the county consists of the Genesee silt loam. The most important areas lie along the Little Miami, Miami, and Whitewater Rivers and Mill Creek. The topography is level and the type is subject to occasional overflows.

Considering its level topography and low-lying position, the type is fairly well drained. There are some small depressions, however, where water may stand on the surface for several days after rains and overflows.

The Genesee silt loam is considered one of the most productive soils in the county, and about 85 per cent of it is under cultivation.

Corn is the main crop, and yields 60 to 100 bushels per acre. Overflows keep the soil covered with a coating of silt and finely divided vegetable matter and consequently no artificial fertilizers are necessary. Fields that have been planted to corn for the last 50 to 75 years show no diminution in the yields.

Farm land of this type sells for $100 to $200 an acre, depending upon the location and the protection from overflows.

GENESEE CLAY LOAM.

The Genesee clay loam is a brown to dark-brown clay loam to silty clay loam, 12 to 15 inches deep, underlain by a dark-gray, faintly mottled silty clay loam, which grades at about 25 inches into a grayish-brown clay loam, mottled with yellow and drab. Upon drying out the surface soil becomes brownish gray.

The Genesee clay loam is an alluvial type, occupying level and slightly depressed areas through the overflowed bottoms of Little Miami River and Mill Creek. One small area occurs in the Miami bottom. On account of its low-lying position and heavy texture, it is poorly drained. Practically all the type is under cultivation, the areas most in need of drainage having been tiled.

The type is used almost exclusively for corn, which gives yields of 50 to 85 bushels to the acre. Fields on this type have been planted to corn for the last 50 years without appreciable diminution of yields. Alfalfa has been tried on a small scale and seems to do well, although it is liable to be drowned out.

Land of the Genesee clay loam sells for $100 to $175 an acre.

This type does not seem to require commercial fertilizer. Barnyard manure would probably cause some increase in yields, but the principal need in farming this soil is artificial drainage.

SUMMARY.

Hamilton County is situated in the extreme southwestern part of Ohio. It has an area of 407 square miles, or 260,480 acres.

The topography ranges from level or nearly flat to hilly, ridgy, and rough. That section of the county adjacent to the Ohio, Miami, and Whitewater Rivers and Mill Creek is badly eroded and has a rough surface. In elevation the county ranges from 445 to 939 feet above sea level.

The county is drained by the Ohio, Miami, Little Miami, and Whitewater Rivers and their numerous small tributaries. The drainage in general is well established.

The mean annual temperature of the county is 55.2° F., while the absolute maximum temperature recorded is 105° and the absolute minimum −17°. The average yearly precipitation amounts to 40.91 inches. There is a normal growing season of about 194 days.

Hamilton County has a total population of 460,732, 11.6 per cent of which is rural. Cincinnati, the county seat and largest city, had a population in 1910 of 363,591. The county has numerous manufacturing industries and is well supplied with transportation facilities. The public roads rank among the best in the State.

The agricultural development of Hamilton County began in the early part of the nineteenth century. Corn has always been the

most important crop grown. At the present time hay ranks second in point of acreage, and vegetable crops third, followed by wheat and oats. Irish potatoes are an important crop, and considerable fruit is produced. Barley, rye, and tobacco are grown to a small extent.

Dairying is an important industry in parts of the county. In 1909 there were 38,241 animals sold or slaughtered in the county.

Commercial fertilizers are used to a considerable extent and many farmers practice some system of crop rotation.

In 1910 there were 4,129 farms in the county, of which 67.5 per cent were operated by the owners. The average size of farms was 47.9 acres.

The price of farm land ranges from $50 to $150 an acre.

Ten soil series, including seventeen soil types, are mapped. These are classed in three general groups—the upland, terrace, and bottom-land soils. The upland soils comprise the Miami, Crosby, Fairmount, Knox, Cincinnati, Rossmoyne, Clyde, and Clermont series; the terrace soils the Fox series; and the bottom-land soils the Genesee series.

The Miami loam, silt loam, and silty clay loam are rather inextensively developed and occur on the level to gently rolling uplands in the northern part of the county. They have been formed by the weathering of calcareous till. These soils are very productive and make good yields of corn, wheat, clover, and alfalfa.

The Crosby silt loam is similar in origin to the Miami silt loam, but less desirable on account of poor drainage.

The Knox fine sandy loam consists of wind-blown sandy material deposited on slopes and ridges adjacent to stream courses. The type is inextensive and is not naturally very productive. Cantaloupes, watermelons, and truck crops, the main crops grown, do well.

The Fairmount silty clay loam is a residual soil from limestone, and for that reason is well suited to lime-loving plants. The type occupies for the most part steep slopes and hillsides having good surface drainage. Alfalfa, corn, tobacco, and clover do well on this type.

The Cincinnati silt loam comprises extensive stretches of smooth, rolling country through the central and eastern sections of the county. The type also occurs capping the ridge tops in the rougher areas. It is a smooth, friable soil, rather low in organic matter and deficient in lime. At present it supports a much less prosperous agriculture than the Miami soils, but is easily improved and can be brought to a high state of cultivation. It produces fair to good yields of oats and potatoes. Bluegrass thrives and affords excellent pasturage.

The Rossmoyne silt loam occupies level to gently rolling country, and is developed mainly in the northeastern part of the county. The type is only fairly well drained, but is well suited to the production of oats, corn, and wheat.

The Clermont silt loam occupies flat country and is very poorly drained. The soil is acid and greatly in need of lime. Where it is tile drained and limed fair yields of corn and oats are obtained.

The Clyde silty clay loam is inextensive. It occupies depressed areas through the glacial uplands. The soil is well supplied with lime and, where well drained, produces good yields of alfalfa, clover, wheat, and corn.

The Fox fine sandy loam, loam, and silt loam occupy a terrace position adjacent to stream courses. The heavier soil of the series is used principally for corn and other general-farming crops and the lighter soil largely for potatoes and other market-garden products.

The Genesee sand, loam, silt loam, and clay loam owe their origin to the deposition of recent-alluvial material by streams. They occupy first bottoms and are well supplied with organic matter. These soils are well suited to the production of corn and are used very largely for this crop.

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[PUBLIC RESOLUTION—No. 9.]

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

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

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

Approved, March 14, 1904.

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

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