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Soil Survey

Lucas County Ohio

By
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Ohio Agricultural Experiment Station, in Charge
and
R. A. WINSTON, F. Z. HUTTON, and W. S. ECKMANN
United States Department of Agriculture

UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF PLANT INDUSTRY
In cooperation with the
Ohio Agricultural Experiment Station

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SOIL SURVEY OF LUCAS COUNTY, OHIO

By G. W. CONREY, Ohio Agricultural Experiment Station, in Charge, and R. A. WINSTON, F. Z. HUTTON, and W. S. ECKMANN, Soil Survey Division,[1] Bureau of Chemistry and Soils, United States Department of Agriculture

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United States Department of Agriculture in cooperation with the Ohio Agricultural Experiment Station

CONTENTS

INTRODUCTION

The soil survey map and report of Lucas County, Ohio, are intended to convey information concerning the soils, crops, and agriculture of the county to a wide variety of readers.

Farmers, landowners, prospective purchasers, and tenants ordinarily are interested in some particular locality, farm, or field. They need to know what the soil is like on a certain piece of land, what crops are adapted, what yields may be expected, and what fertilization and other soil-management practices are needed for best results. Many people do not wish to read the entire soil survey report, and they need not do so to obtain much of the information essential to their purpose.

[1] The Soil Survey Division was transferred to the Bureau of Plant Industry July 1, 1939.

A person interested in a particular piece of land should first locate it on the colored soil map accompanying the report. Then from the color and symbol he can identify the soil in the legend on the margin of the map. By using the table of contents he can find the description of the soil in the section on Soils and Crops. Under each soil type heading is specific information about that particular soil. This includes a description of the landscape—lay of the land, drainage, stoniness (if any), vegetation, and other external characteristics—and the internal or profile characteristics of the soil—its color, depth, texture, structure, and chemical or mineralogical composition. Information about the use now made of the land, crops grown, yields obtained, possible uses, and present and recommended management, is also given.

The section on Productivity Ratings compares the soil types as to productivity for the various crops and suitability for the growth of crops or for other uses.

For the person unfamiliar with the area or region a general description of the county as a whole is given in the first part of the report. Geography, physiography, regional drainage, relief, vegetation, climate, population, transportation facilities, and markets are discussed. A brief summary at the end gives a condensed description of the county and important facts concerning the soils and agriculture.

The agricultural economist and general student of agriculture will be interested in the section on Agricultural History and Statistics and on Productivity Ratings.

Soil specialists, agronomists, experiment station and agricultural extension workers, and students of soils and crops will be interested in the more general discussion of soils in the section on Soils and Crops, as well as in the soil type descriptions. They also will be interested in the section on Productivity Ratings.

For the soil scientist the section on Morphology and Genesis of Soils presents a brief technical discussion of the soils and of the soil-forming processes that have produced them.

COUNTY SURVEYED

Lucas County is in the northwestern part of Ohio at the western end of Lake Erie, which, together with Michigan, forms its northern boundary (fig. 1). Toledo, the county seat, is the largest city in northwestern Ohio. West Sister Island, in Lake Erie, about 20 miles off the mainland, is included in the county. The land area of the county is 342 square miles, or 218,880 acres.

The land surface is in general an almost level plain, sloping gently southeastward toward the Maumee River and northeastward toward Lake Erie. This flat surface is relieved by low, rounded hills, or undulations, of sand occurring in a belt 5 to 10 miles wide, known as the "oak openings," which extends in a northeast-southwest direction from the Michigan State line, near Trilby and Sylvania, to the western border of the county and south from East Swanton to the Maumee River. Northwest and east of the sand-hill belt the surface is almost flat. The plain is cut by several narrow steep-sided valleys, which range in depth from only a few feet along small drainageways to 50 feet along the Maumee River.

The northwestern part of the county, including most of Richfield and part of Spencer Townships, slopes southeastward at a rate of slightly less than 10 feet to the mile until the low sand-hill belt is reached. East of this area and extending to the eastern border of the county is the level plain, interrupted only by the valley of the Maumee River. The land east of the Maumee River slopes northeastward about 5 feet to the mile.

The Maumee River occupies a valley ranging from 35 to 50 feet in depth and from one-fourth to one-half mile in width. The river bluffs are steep but show very little gullying. Above the town of Maumee the river flows over bedrock for a considerable part of its course through the county and forms a series of rapids. The alluvial terraces and flood-plain areas along its course are rather narrow.

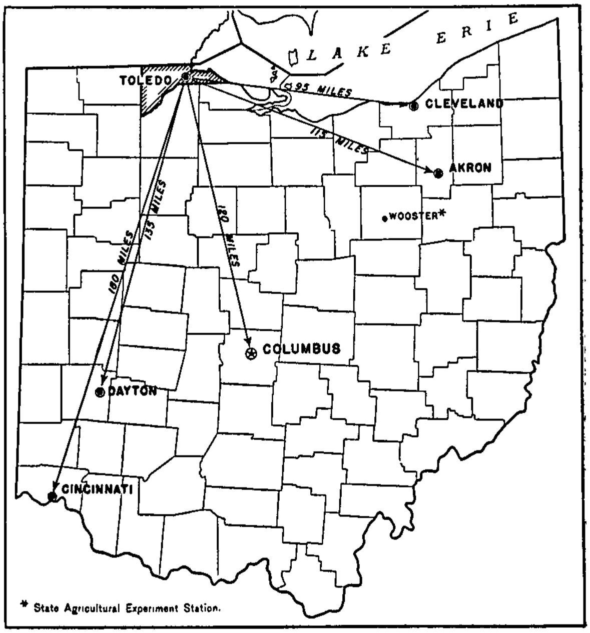

FIGURE 1.—Sketch map showing the location of Lucas County, Ohio.

The entire county drains into Lake Erie. Although the Maumee River is the largest stream in northwestern Ohio and serves as an outlet for the drainage of this section most of the drainage of Lucas County is through streams emptying directly into Lake Erie. The only tributary stream of any size emptying into the Maumee River is Swan Creek, which joins it a few miles from its mouth. Tenmile Creek flows into the Ottawa River, which, in turn, flows into Maumee Bay. Wolf, Cedar, Crane, and other creeks in the eastern part of the county that flow through shallow trenches formerly emptied into lake border marshes, which drained slowly into Lake Erie. Wolf Creek now has an outlet to Lake Erie through a drainage ditch. The marshland near the mouth of Cedar Creek has been reclaimed by a system of dikes, and drainage waters enter canals, from which the water is pumped into the lake. This area is sometimes called the "pump lands."

As a result of the level surface and broad interstream areas much of the county has very poor natural drainage. The eastern part is included in the area known as the Great Black Swamp. Only in places adjacent to stream valleys and in the sand-hill areas is natural drainage good. In recent years a rather complete system of drainage ditches has been constructed to reach all sections, and these ditches serve as outlets for systems of tile drains.

The highest point in the county, in the northwestern corner about a mile south of Treadway, has an elevation of 715 feet above sea level,[2] and the elevation of Lake Erie is 573 feet. This gives a total range in elevation of about 140 feet. Local differences in relief, however, are less than 10 feet in most places, though along some of the valleys of the main streams, they are as much as 50 feet.

Lucas County was organized in 1835. The territory at the west end of Lake Erie had been explored as early as 1673 by French missionaries and as a result was claimed by France. During the next century and a half it passed from France to England and then to the United States. Even after the close of the Revolutionary War and as late as 1795 the British still occupied fortifications at the foot of the rapids in the Maumee River, near the site of the present town of Maumee. The Battle of Fallen Timbers in 1794 broke the power of the Indians, and the rich Maumee Valley was opened to settlement by white men. The early settlers came from New England, Pennsylvania, and Virginia and first made their homes in the vicinity of Maumee, which was laid out as a village in 1817. After 1849 there was a heavy influx of Germans, and today a large part of the rural population is of German extraction. Foreign-born white people make up 10.7 percent of the population, according to the 1930 census.

In 1850 the population of the county was 12,363, of which about 69 percent, or 8,534, was rural. By 1910 it had increased to 192,728, of which 24,231, or about 13 percent, was classified as rural. The 1930 census gives the total population as 347,709, of which 52,403, or 15 percent, was rural. In 1940 the population decreased slightly, to 344,333. Each year a larger area, especially west of Toledo, is included within the city, so that the area in farms has decreased markedly since 1920. Many of the farms west of Toledo are small, and the population per square mile is correspondingly high. Elsewhere, as in the western, southwestern, and eastern parts, the farms are larger, and the rural population is not so dense.

Toledo, the county seat, is situated on Maumee River and Maumee Bay. The population, as reported in the census of 1940, is 282,349. This is the fourth largest city in Ohio. Together with Maumee, which had 4,683 inhabitants in 1940, it accounts for the urban population of the county. All the other settlements are small villages, of which the most important are Sylvania, with a population of 2,199 in 1940, Ottawa Hills, Waterville, and Whitehouse.

Transportation facilities are excellent. Toledo is an important railroad center, from which 14 steam and 2 electric lines radiate. The main line of the New York Central is the chief east-west railroad. Numerous railroads enter Toledo from the south, southeast, and southwest, and several of them continue to Detroit. These lines connect with the main east-west trunk lines. Toledo, with its excellent harbor, is rapidly becoming one of the most important coal-shipping ports on Lake Erie. Improved highways reach all parts

[2] Elevations from U. S. Geological Survey topographic sheets.

of the county; in fact Lucas County has a greater mileage of hard-surfaced highways than any other county in the State. United States Highways Nos. 20, 23, 24, 25, and 223, all main interstate trunk lines, cross the county. Transportation by motortruck is used very extensively, especially by market gardeners. The development of good roads has been a very important factor in the extension of market gardening. Bus lines operate over a number of the main highways. The whole county is well supplied with telephones, schools, and churches.

Toledo is an important manufacturing center. The leading industries include the manufacture of automobiles, automobile ignition and starting systems, spark plugs, plate glass, bottles, bottle-making machinery, iron, and steel, as well as oil refineries, flour mills, and shipbuilding.

CLIMATE

Lucas County has a temperate climate characterized by rather short periods of extreme heat and cold. The weather and climate of the county are controlled in part by the proximity of Lake Erie and in part by the extensive continental land area to the south and west. Probably the latter influence is the more important, on account of the decided prevalence of southwest winds. The proximity of extensive bodies of water often prevents the occurrence of destructive frosts in the spring and fall.

The mean annual temperature recorded at Toledo of 49.8° F. is about the same as that for other counties in northwestern Ohio and somewhat higher than that of several of the counties in the northeastern part. The mean for the summer (June, July, and August) is 71.1° and for the winter 27.8°.

The average annual precipitation at Toledo is 32.03 inches. This is lower than that reported for bordering counties on the west and south. The central and eastern parts of Lucas County are included in a narrow belt bordering Lake Erie,[3] which has an average annual rainfall of less than 33 inches. The rainfall is fairly well distributed throughout the year, but late spring and early summer have the heaviest rainfall. Snowfall, averaging 31.8 inches yearly, is about equally distributed through the winter. It is considerably less than that of counties in the northeastern part of Ohio, where a maximum of slightly over 60 inches has been reported.

The average latest killing frost at Toledo occurs on April 22 and the first on October 18, giving a frost-free period of 179 days. The part of Lucas County near Lake Erie usually has a growing season from 27 to 35 days longer than that of the western part of Lucas County and of Fulton and Wood Counties which adjoin Lucas County on the south and west. However, frost has been recorded at Toledo as late as May 29 and as early as September 9.

Table 1, compiled from the records of the United States Weather Bureau station at Toledo, gives the more important climatic data.

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[3] ALEXANDER, WILLIAM HENRY. A CLIMATOLOGICAL HISTORY OF OHIO. Ohio Engin. Expt. Sta. Bul. 26, 745 pp., illus. 1924.

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at Toledo, Lucas County, Ohio*

[Elevation, 589 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1894)	Total amount for the wettest year (1881)	Snow, average depth
	°*F.*	°*F.*	°*F.*	*Inches*	*Inches*	*Inches*	*Inches*
December	30.4	70	—15	2.35	1.50	4.73	7.1
January	25.8	71	—16	2.16	1.48	.54	9.1
February	27.3	70	—16	2.05	1.92	4.28	7.5
Winter	27.8	71	—16	6.56	4.90	9.55	23.7
March	35.3	83	—3	2.55	1.26	1.90	5.0
April	47.6	89	12	2.65	1.81	1.76	1.4
May	59.4	95	30	3.49	5.36	.45	.1
Spring	47.4	95	—3	8.69	8.43	4.11	6.5
June	68.7	99	38	3.33	1.76	7.36	.0
July	73.2	102	48	3.02	.42	5.45	.0
August	71.3	103	44	2.86	.60	.88	.0
Summer	71.1	103	38	9.21	2.78	13.69	.0
September	64.4	97	30	2.80	2.50	5.33	.0
October	53.4	90	21	2.37	1.69	8.49	.1
November	40.4	74	2	2.40	1.04	4.74	1.5
Fall	52.7	97	2	7.57	5.23	18.56	1.6
Year	49.8	103	—16	32.03	21.34	45.91	31.8

AGRICULTURAL HISTORY AND STATISTICS

The first permanent settlements in Lucas County were along the Maumee River at the foot of the rapids near the site of the town of Maumee. Only a narrow belt of land adjacent to the river was naturally sufficiently well drained for human habitation, and large areas of almost impenetrable swamp (the Great Black Swamp) extended back from the Maumee for many miles.

The Maumee Valley was a great center of Indian activity, and Indian villages and cornfields were scattered along the river. The British maintained an outpost near the city of Maumee (Fort Miami) for some time after the Revolutionary War and gave encouragement to the Indians in their depredations on the white settlers. The hold of the Indians in the territory was broken in 1794 by their defeat in the Battle of Fallen Timbers. In the following years white settlements sprang up in many places along the river just south of Maumee. Maumee, the original county seat, was incorporated in 1817. Toledo, which covers the site of Fort Recovery built in 1800 and the sites of the villages of Port Lawrence and Vistula, was incorporated as a city in 1836.

Agriculture during the pioneer stage was of the subsistence type. Much time was given to hunting and fishing. The abundance of suitable timber encouraged the development of shipbuilding.

Drainage of the lands back from the Maumee River was necessary before any extensive agricultural development was possible. Many miles of large open ditches were constructed to serve as outlets for tile drains. In recent years large tile has been placed in many of these open ditches, located along main highways, and they have been filled. Ward Canal was constructed in the eastern part of the county shortly before 1870 to furnish water transportation to Lake Erie for the lumber industry of this section. Later other canals were dredged and the waters were pumped into Ward Canal, making possible the drainage of large tracts of marshland.

The sandy belt in the western part of the county, known as the oak openings, developed slowly owing to the low fertility of its soil. Considerable tracts are now covered with second-growth timber.

The agriculture of the county formerly consisted largely of a combination of grain and livestock farming. Corn has produced excellent yields on the well-drained black swamplands and has always been the most important grain crop. Wheat ranked second among the grain crops until 1900, but since that date oats have surpassed it in acreage except during the World War. Hay crops have always occupied a large area.

At present the agriculture is diversified. It consists chiefly of general farming, with some dairying and livestock feeding, and some production of special and truck crops. Commercial orchards are maintained within a narrow belt along the Maumee River, especially near Waterville, and along Lake Erie. Production of vegetables under glass is an imporant industry near Toledo.

Tomatoes are canned for soup stock at Holland. A salting station for cucumbers is located at Neapolis.

The value of the county's agricultural products in 1929, as taken from the United States census and listed in the following tabulation, shows the importance of the production of vegetables.

Crop:	*Value*
Grains and hay	$1, 546, 144
Vegetables grown in field and garden	1, 275, 871
Fruits and nuts	171, 473
All other field crops	116, 463
Vegetables, flowers, and plants grown under glass, and flowers grown in the open	741, 233
Other nursery products	36, 950
Total	3, 888, 134

Table 2, giving the acreage of important crops as reported by the United States census, shows the trend in crop production during the last half century.

The crops produced under general farming practices include corn, oats, wheat, barley, and hay. Sugar beets and potatoes are the most important special crops. In the districts of intensive truck farming, tomatoes and sweet corn are the most common crops; but other crops, such as cabbage, melons, onions, and carrots, are of considerable importance.

Most of the corn is fed to livestock on the farm where it is produced. Oats are grown chiefly in rotation with corn. Wheat is an important cash crop. The chief use made of the barley crop is as feed for livestock. Alfalfa and timothy and clover, alone or mixed, produce almost all of the hay, and some sweetclover is grown. Considerable clover is cut for seed. The 1930 census reported 2,171 acres planted for clover seed in 1929, but this item was not reported by the

1935 census. Toledo is the leading clover-seed market in the country. Recent interest has been shown in soybeans, which increased from 318 acres in 1929 to 1,034 acres in 1934.

TABLE 2.—*Acreage of the principal crops in Lucas County, Ohio, in stated years*

Crop	1879	1889	1899	1909	1919	1929	1934
	Acres	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*
Corn	18,112	17,851	33,532	34,004	26,590	19,580	23,300
Wheat	15,724	11,120	7,596	7,518	22,154	12,387	13,514
Oats	7,168	10,337	20,830	22,006	16,129	13,449	13,758
Hay	16,746	19,832	17,059	21,134	18,659	14,636	14,955
Timothy and clover (alone or mixed)				20,024	14,353	7,294	9,229
Alfalfa			19	661	3,599	6,486	4,486
Barley	472	687	817	1,378	2,453	1,813	1,319
Rye	387	2,078	558	1,551	2,405	704	1,741
Buckwheat	684	620	1,300	764	593	740	
Potatoes		3,051	5,061	5,074	2,792	3,176	3,512
Sugar beets				575	2,385	1,524	1,207
Vegetables for sale					2,901	5,964	8,887
Orchards and vineyards						2,842	3,511
	Trees	*Trees*	*Trees*	*Trees*	*Trees*	*Trees*	*Trees*
Apple		123,890	122,062	68,383	48,452	37,125	60,794
Cherry		3,775	15,337	17,991	16,160	10,321	22,488
Peach		9,713	120,309	28,882	49,536	19,091	16,224
Pear		7,751	48,043	17,116	10,672	5,615	7,896
Plum and prune		380	20,499	5,235	7,408	5,206	8,317
	Vines	*Vines*	*Vines*	*Vines*	*Vines*	*Vines*	*Vines*
Grape			311,122	254,337	208,521	175,954	268,107

The large growers of sweet corn truck most of their crop to Detroit by truck. Tomatoes are used for canning, catsup, and soup stock, as well as for immediate consumption. Strawberries were grown on 267 acres in 1934.

Toledo furnishes a good market for all kinds of agricultural products. The excellent system of improved highways, reaching all parts of the county, makes it possible to haul products for considerable distances. Large quantities of vegetables are transported by truck to Detroit. Many small villages serve as shipping points for agricultural products on the network of railroad lines that cross the county in almost every direction.

Fertilizers are used to some extent on most farms. According to the 1930 census, the total expenditure for fertilizer in 1929 was $136,577 on 1,157 farms, or an average of $118.04 a farm. Fertilizers are commonly used on wheat and all the special crops, such as sugar beets and truck crops. Oats and corn are fertilized to less extent than wheat. High-grade mixed fertilizers are now being used for the most part, although 20-percent superphosphate is still popular, especially with general farm crops. Orchards are commonly fertilized with some nitrogen carrier, such as sulfate of ammonia or sodium nitrate.

Farm laborers in Lucas County are white and for the most part American born, but the supply is usually insufficient. Members of the family do most of the farm work. Some Mexican labor has been used in the production of sugar beets. In 1929, 885 farms reported the hire of labor at a cost of $514,955, or an average of $581.87 a farm.

In 1935 the number of farms was 2,730. This does not represent a great change from the number in 1880, which was 2,056. The average size, however, decreased considerably, from 69.3 acres in 1880 to 49.5 acres in 1935, and the proportion of land in farms decreased from 65.1 to 61.8 percent. In recent years small holdings have become more numerous, a trend that has coincided with the expansion of truck farming.

Owners operate 72.1 percent of the farms, tenants 27.6 percent, and managers 0.3 percent, according to the 1935 census.

Farm tenancy is about equally divided between share and cash renters. Generally the renter furnishes one-half of the seed, cattle, and hogs; furnishes all the work animals; pays one-half of the threshing bill; and receives one-half of the income. The proportion of tenancy has not changed significantly in the last 50 years.

Livestock and livestock products are important sources of income on many farms. The number of livestock on farms in census years is given in table 3.

TABLE 3.—*Number of livestock on farms in Lucas County, Ohio, in stated years*

Livestock	1880	1890	1900	1910	1920	1930	1935
Horses	5,352	5,953	7,776	7,811	6,611	3,491	3,615
All cattle	11,841	11,862	14,171	14,883	12,024	7,479	8,611
Cows and heifers [1]	6,007	7,217	8,212	9,474	7,517	4,463	5,161
Hogs	19,114	22,489	19,768	22,390	19,226	12,634	12,446
Sheep	9,159	8,435	6,332	3,309	2,666	2,468	2,583
Poultry	73,843	105,431	131,011	164,339	185,264	[2] 133,867	[2] 149,553

[1] 2 years old or older. [2] Chickens only.

For many years dairying has been carried on in a small way on most farms. At one time small butter factories were widely distributed over the county, but milk is now trucked into the city. A condensary is located at Whitehouse. Butter, cream, and whole milk sold for a total of $393,393 in 1929, when the total production of milk was 2,530,227 gallons. In 1934, 2,292,556 gallons of milk was produced. Dairying is not so important as formerly.

Some beef cattle are fed for market, especially on farms in the northwestern part of the county. They are shipped in from western points in the fall and fed during the winter for the spring market. Hereford and Shorthorn are the leading breeds. A few hogs are raised on most farms where general farming is practiced. Duroc-Jersey and Poland China are the favorite breeds. Several small flocks of sheep are kept, in which Shropshire is the leading breed. The sale of poultry products provides considerable income on many farms. The value of poultry raised in 1929 amounted to $295,406, of which chickens, numbering 294,117, were valued at $279,411. The 937,386 dozen chicken eggs produced was valued at $299,964. In 1934 the number of chickens raised was 274,276, and the production of eggs was 660,455 dozen.

The manufacture of beet sugar is an important industry in northwestern Ohio and southeastern Michigan. One factory formerly operated in Toledo for many years. The beet pulp was used in the preparation of cattle feed.

Most of the farms are well equipped with buildings and machinery, and rural electrification is being extended to many parts of the county. Houses, barns, and fences are well constructed and kept in good repair. The machinery is modern, and tractors and corn binders and huskers are numerous. However, equipment is less adequate throughout the sandy belt in the western part of the county. Most of the vegetable growers use trucks in transporting their crops to market.

SOIL SURVEY METHODS AND DEFINITIONS

Soil surveying consists of the examination, classification, and mapping of soils in the fields.

The soils are examined systematically in many locations. Test pits are dug, borings are made, and exposures, such as those in road or railroad cuts, are studied. Each excavation exposes a series of distinct soil layers, or horizons, called collectively the soil profile. Each horizon of the soil, as well as the parent material beneath the soil, is studied in detail, and the color, structure, porosity, consistence, texture, and content of organic matter, roots, gravel, and stone are noted. The reaction of the soil [4] is determined by simple tests. Drainage, both internal and external, and external features, such as relief or lay of the land, are taken into consideration, and the interrelation of soils and vegetation is studied.

The soils are classified according to their characteristics, both internal and external, special emphasis being given to features influencing the adaptation of the land for the growing of crop plants, grasses, and trees. On the basis of these characteristics soils are grouped into mapping units. The three principal ones are (1) series, (2) type, and (3) phase. In places two or more of these principal units may be in such intimate or mixed pattern that they cannot be clearly shown separately on a map, but must be mapped as (4) a complex. Areas of land, such as coastal beach or made land, that have no true soil, are called (5) miscellaneous land types.

The most important group is the series, which includes soils having the same genetic horizons, similar in their important characteristics and arrangement in the soil profile, and developed from a particular type of parent material. Thus, the series includes soils having essentially the same color, structure, and other important internal characteristics, the same natural drainage conditions, and the same range in relief. The soil series are given names of places or geographic features near which they were first found. Thus, Toledo, Brookston, and Berrien are names of important soil series in Lucas County.

The texture of the upper part of the soil, including that commonly plowed, may vary within a series. Thus within a soil series are one or more soil types, defined according to texture. The class name of the soil texture, such as sand, loamy sand, sandy loam, loam, silt loam, clay loam, silty clay loam, clay, and silty clay, is added to the series name to give the complete name of the soil type. For example, Toledo very fine sandy loam and Toledo silty clay are soil types within the Toledo series. Except for the texture of the surface soil these soil types have approximately the same internal and external characteristics. The soil type is the principal unit of mapping, and because of its specific

[4] The reaction of the soil is its degree of acidity or alkalinity expressed mathematically as the pH value. A pH value of 7 indicates precise neutrality, higher values indicate alkalinity and lower values indicate acidity.

character it is usually the soil unit to which agronomic data are definitely related.

A phase of a soil type is a variation within the type, which differs from the type in some minor soil characteristic that may have practical significance. Differences in relief, stoniness, and degree of accelerated erosion are frequently shown as phases. For example, within the normal range of relief for a soil type, certain areas may be adapted to the use of machinery and the growth of cultivated crops and others may not. Even though there may be no important difference in the soil itself or in its capability for the growth of native vegetation throughout the range in relief, there may be important differences in respect to the growth of cultivated crops. In such an instance the more sloping parts of the soil type may be segregated on the map as a sloping phase or a hilly phase. Similarly, soils having differences in stoniness may be mapped as phases, even though such differences are not reflected in the character of the soil or in the growth of native plants. No phases are mapped in Lucas County.

The soil surveyor makes a map of the county or area, showing the location of each of the soil types, phases, complexes, and miscellaneous land types, in relation to roads, houses, streams, lakes, section and township lines, and other cultural and natural features of the landscape.

SOILS AND CROPS

Lucas County lies within the lake-plain area, which includes a large part of the northwestern part of Ohio and extends into Michigan and Indiana. The soils have developed largely from deposits laid down in the temporary glacial lake that covered a large part of the area toward the close of the glacial period.

The lake-bottom deposits, consisting of silt and clay, occur chiefly in the eastern part of the county, especially east of Toledo. Beach or lake-border deposits of sand form a belt west of Toledo extending in a northeast-southwest direction—the oak openings. In the northwestern part of the county the lake deposits are so thin that the underlying glacial drift comes very close to the surface; in fact, in places there is little or no lacustrine deposit over the glacial material. The weathering of these materials has produced a large number of distinct soil types, differing in both physical and chemical composition. As climatic conditions are essentially uniform throughout the county, these soil differences are the result of variations in parent material and conditions of natural drainage under which the soil developed.

A few of the soils are developed in large areas, whereas many occur in small areas of only a few acres each. In the eastern and northwestern parts of the county, where the land is almost level, the soils are similar over areas of several square miles, and the only variations are those produced by a slight almost imperceptible undulation. Throughout the oak openings in the western part the surface is undulating, and the soils on the low knolls differ from those in the depressions.

Only in the sandy oak openings belt do large areas remain in forest, and even from this area most of the merchantable timber has been cut long ago. Oak predominates on the well-drained sandy areas. Elsewhere many farms still have small wood lots of 5 to 10 acres. On the dark-colored level lands elm predominates, whereas on the light-colored soils beech and maple are common.

The kind of farming carried on is determined largely by the character of the soil. General farming is followed almost universally on the heavy-textured soils, whereas truck farming is especially important on the sandy and medium-textured soils. Corn, the principal crop, is grown on nearly all the soils, but it is grown most extensively on the dark-colored clay soils. Included with corn in rotation, oats also are grown on the heavy-textured soils. The dark-colored clay soils are also preferred for sugar beets. Potatoes are produced chiefly on the somewhat sandy soils.

The loam, very fine sandy loam, and fine sandy loam soils, which occur rather extensively west of Toledo, are ideally adapted to growing truck crops, of which sweet corn is the most important. Early sweet corn is grown chiefly on the dark-colored sandy loam and loam soils, whereas later corn occupies a wide variety of soils. Although tomatoes are grown on sandy loam and loam soils, they are also produced somewhat extensively on dark-colored clay soils. Other common vegetables are grown more or less extensively on the sandy soils in the vicinity of Toledo. A considerable acreage of the muck soils in the eastern part of the county is devoted to onions.

Mainly on the basis of texture, the soils and land types of Lucas County are grouped for convenience of discussion, as follows: (1) Heavy-textured soils, (2) medium-textured soils, (3) light-textured soils, (4) organic soils, and (5) miscellaneous land types. In the following pages the soils are described in detail, the accompanying soil map shows their distribution, and table 4 gives their acreage and proportionate extent.

TABLE 4.—*Acreage and proportionate extent of the soils mapped in Lucas County, Ohio*

Soil type	Acres	Per-cent	Soil type	Acres	Per-cent
Toledo silty clay	41,536	18.9	Wauseon loam	2,496	1.1
Toledo clay loam	6,784	3.1	Millsdale fine sandy loam	576	.3
Toledo silt loam	7,040	3.2	Lucas very fine sandy loam	9,600	4.4
Brookston clay	9,408	4.3	Rimer fine sandy loam	1,024	.5
Brookston clay loam	6,528	3.0	Belmore sandy loam	128	.1
Millsdale clay loam	384	.2	Monclova loam	640	.3
Bono silty clay	2,368	1.1	Monclova fine sandy loam	128	.1
Lucas silt loam	5,056	2.3	Genesee loam	5,440	2.5
Fulton silty clay loam	2,432	1.1	Randolph fine sandy loam	128	.1
Nappanee clay loam	320	.1	Plainfield fine sand	17,600	8.1
Genesee clay loam	3,136	1.4	Plainfield-Newton fine sands	8,640	4.0
Genesee silt loam	1,664	.8	Berrien fine sand	10,112	4.6
Eel silty clay loam	320	.1	Berrien very fine sand	1,280	.6
Toledo very fine sandy loam	23,936	10.9	Newton fine sand	11,776	5.4
Toledo-Berrien complex	3,136	1.4	Maumee loamy fine sand	9,216	4.2
Toledo loam	4,736	2.2	Warners loam	128	.1
Toledo loamy very fine sand	4,032	1.8	Muck and peat	2,048	.9
Wauseon fine sandy loam	6,656	3.0	Lake marsh	3,264	1.5
Wauseon loamy fine sand	1,280	.6	Made land	192	.1
Bono very fine sandy loam	704	.3	Quarries	256	.1
Neapolis fine sandy loam	1,344	.6			
Neapolis loamy fine sand	1,408	.6	Total	218,880	100.0

HEAVY-TEXTURED SOILS

The heavy-textured soils have a silt loam or heavier texture, chiefly clay or silty clay. They comprise the most extensive group of soils and include the heavy members of the dark-colored Toledo, Brookston, Millsdale, and Bono soils and of the lighter colored Lucas, Fulton, Nappanee, Genesee, and Eel soils. They are most extensively developed east and north of Toledo, southwest of Maumee, and in Richfield Township in the northwestern part of the county.

The dark-colored soils of this group occupy nearly level inter-stream areas where natural drainage is very poor. The associated lighter colored and better drained soils occur in gently undulating areas throughout the level tracts, on slopes adjacent to streams, and on flood plains. In places bordering stream valleys the lighter colored soils are subject to serious erosion.

The surface soils of the dark-colored members have a medium to high content of organic matter, as is shown by their dark color. The dark surface soil of both the Toledo and the Brookston series is about 5 or 7 inches thick, whereas the corresponding layer in the Bono soil is thicker and higher in content of organic matter. These soils commonly are neutral in reaction. The subsoils are heavy-textured and highly mottled.

The light-colored members of the group generally are low in organic matter, and the reaction of the surface soil is acid in most places. Between depths of 16 and 24 inches the subsoil is compact and more or less impervious. Below this the lower subsoil layer, which is present between depths of 24 and 30 inches, is highly calcareous.

Because of the heavy texture the clay and silty clay members must be managed with care if a good seedbed is to be prepared, as the range of moisture content at which they can be worked is rather limited. By plowing in the fall the beneficial effects of freezing and thawing during the winter and early spring will be obtained, and a favorable tilth will result. The silt loam, clay loam, and silty clay loam members of the group are more easily worked than the heavier textured members.

The heavy-textured soils are used chiefly for general farming. On the dark-colored soils corn is the most important crop, with oats second, followed by wheat. Where these soils are well drained by artificial means, alfalfa and sweetclover do very well and are grown extensively. Mixed timothy and clover or clover alone is the most important hay crop. Practically the entire sugar-beet crop of the county is produced on these soils, especially on Brookston clay and Toledo silty clay. Here and there farms specialize in growing tomatoes.

The associated lighter colored soils are not so desirable for corn as the darker colored soils, but, where the soils of these two groups are closely associated, they are farmed in about the same manner. The larger areas of the lighter colored soils, especially those bordering the streams, are used more for grain crops. Some areas near stream slopes are in orchards.

Toledo silty clay.—Toledo silty clay, the most extensive soil type in Lucas County, is known locally as elm land. The surface soil to a depth of 5 to 7 inches is very dark grayish-brown to grayish-black silty clay, which, when in good tilth, breaks into granules about three-sixteenths of an inch in diameter. The soil is plastic and sticky when wet and very hard when dry. The subsurface layer, reaching to a depth of 14 or 16 inches, consists of dull-gray plastic silty clay, somewhat mottled with yellowish brown and rust brown. The subsoil is very similar to the subsurface material in texture, but its color is mottled gray and yellowish brown, in which the yellow becomes more pronounced and the mottling more distinct with depth. This rests on mottled yellowish-brown and gray laminated silt and clay at a depth ranging from 36 to 40 inches. A characteristic feature of this soil is its freedom from pebbles, gravel, or coarse sand particles. A few lime or iron concretions are present in the lower part of the subsoil. The reaction of the surface soil is neutral or very slightly acid, whereas the lower part of the subsoil below a depth of 36 to 40 inches is commonly calcareous.

Toledo silty clay occurs very extensively in the area east of Toledo where it covers a very large part of Oregon and Jerusalem Townships. West of the Maumee River the chief areas are northeast and southwest of Toledo and west and southwest of Maumee.

Owing to the level topography both the surface and the internal drainage of Toledo silty clay are naturally very poor; hence artificial drainage is required before the soil can be used for the growth of the ordinary agricultural crops. Ditches and dead furrows aid in removing the excess surface water, but tile drainage is necessary for the satisfactory production of crops. Lines of tile were originally spaced about 6 to 8 rods apart, but in most fields it has proved desirable to place additional lines between those originally installed. A spacing not greater than 2 to 4 rods is desirable, and even then it is sometimes difficult to effect adequate drainage.

Toledo silty clay occupies 18.9 percent of the area of the county. About 85 percent of the land has been cleared, and the rest is in wood lots or permanent woodland pasture. The chief type of agriculture is general farming, and the leading crops are corn, oats, and wheat. Mixed clover and timothy or clover alone are the main hay crops, and a rather large acreage is devoted to alfalfa. Sweetclover is grown extensively for pasture and for soil improvement. The leading special crop is sugar beets, which produces excellent yields under favorable conditions. Tomatoes are grown for canning by a number of farmers.

Corn yields from 40 to 80 bushels, with an average of about 45 bushels an acre. Oats average 45 bushels, wheat 20 bushels, and hay 1 to 3 tons. Sugar-beet yields range from 8 to 18 tons.

It is customary to apply available manure to cornland and to supplement this with an application of superphosphate. Fertilization of corn with a complete fertilizer in the hill or row is becoming popular on many farms. For wheat about 200 pounds of superphosphate or a complete fertilizer, such as 2–14–4,[5] is commonly used. Land in oats is seldom fertilized. For sugar beets an application of 200 to 300 pounds of a 2–12–6 or similar fertilizer is the

[5] Percentages, respectively, of nitrogen, phosphoric acid, and potash.

usual custom. Rather heavy applications of fertilizers are generally made for tomatoes.

Toledo clay loam.—Toledo clay loam is very similar to Toledo silty clay except in texture. The clay loam contains more sand and less clay and therefore is more readily drained than the silty clay. The surface soil to a depth of 7 or 9 inches is very dark-gray or grayish-black clay loam, in which the sandy material is largely very fine sand. This is underlain by mottled gray and yellowish-brown clay loam to a depth of about 20 inches, below which the material is mottled heavy clay loam or sandy clay. The proportion of very fine sand in each of the layers varies from place to place.

Toledo clay loam is not very extensive. The largest areas are in the vicinity of Whitehouse, Holland, and Waterville. The surface is nearly level or gently sloping. Although natural drainage is poor, artificial drainage is easily effected by tiling, owing to the open and porous subsoil.

Approximately 90 percent of this soil is under cultivation and is used chiefly for general farming. About the same crops are grown as on Toledo silty clay, but yields are somewhat higher than on that soil because of the better drainage and more favorable condition of tilth that may be obtained on this soil. Toledo clay loam rates as one of the best soils in the county for the production of crops.

Toledo silt loam.—Toledo silt loam differs from Toledo silty clay in color, texture, and workability. The 8- or 10-inch surface layer is very dark-gray to grayish-black friable silt loam and is rather high in organic matter. This layer is darker colored and thicker than the corresponding layer in Toledo silty clay. To a depth of 16 or 18 inches the subsurface layer is mottled yellowish-brown and gray heavy silt loam. It is underlain to a depth of 36 to 40 or more inches by silty clay loam that is somewhat similar in color. The subsoil ranges from heavy silt loam to silty clay loam. The surface soil is neutral to very slightly acid, whereas the subsoil below a depth of 36 to 40 inches is calcareous.

The main area of Toledo silt loam is north of Toledo in Washington Township, where it occupies several square miles. Other very small areas occur a few miles west and southwest of Toledo and also east of that city near the mouth of the Maumee River. This soil occupies level areas and requires artificial drainage for satisfactory crop production, but tile can be spaced farther apart than in Toledo silty clay.

Practically all of this soil has been cleared and is now under cultivation, except that included in city allotments. Because of its close proximity to Toledo, a large area has been taken over for building purposes. The chief type of agriculture on this soil is general farming, although many farmers are producing some truck crops. Corn, wheat, and oats are the chief crops, and yields are somewhat higher than on Toledo silty clay because of the more favorable physical condition of this soil. Sugar beets are grown, but the yields are not so good as on the heavier textured soils. A variety of garden crops are grown, of which sweet corn and tomatoes are probably the most important at present, although this soil does not produce sweet corn as early as some of the sandier soils. Because of the friable character of the surface soil Toledo silt loam is easily managed. Methods of fertilization are similar to those used on Toledo silty clay.

Brookston clay.—The 5- to 7-inch surface layer of Brookston clay consists of very dark grayish-brown heavy clay loam or clay, which tends to break up into granules about one-eighth to one-fourth inch in diameter. The subsurface layer, to a depth of 12 inches, is bluish-gray plastic heavy clay streaked with dull yellow. Both the surface and subsurface layers contain appreciable quantities of sand and gravel and do not have the smooth greasy plasticity of Toledo silty clay, which contains, in addition to an approximately equal quantity of clay, a much greater proportion of silt. The upper part of the subsoil is mottled dull-gray and yellowish-brown plastic clay, the yellowish-brown color becoming more pronounced with depth. Below a depth of 24 to 28 inches is mottled yellowish-brown and yellowish-gray clay, which at a depth of 30 to 40 inches rests on somewhat friable calcareous clay till containing numerous rounded limestone pebbles. Throughout the soil mass small pebbles are present, although not numerous, whereas they are entirely lacking in Toledo silty clay. There are a few boulders and cobblestones here and there in the Brookston soil but none in the Toledo. Although fairly uniform throughout its extent, Brookston clay shows some slight variations. In areas adjacent to Brookston clay loam it tends to be somewhat more sandy than is typical, in fact the boundaries between the two soils are rather indefinite. The reaction is approximately neutral.

Brookston clay occurs in the northwestern part of the county in Richfield and Spencer Townships, where it adjoins an extensive area of the same soil in Fulton County. It occupies rather large, nearly level, uniform areas in association with Brookston clay loam and Wauseon fine sandy loam. In this section the slightest variation in relief is generally accompanied by a change either in texture or in color of the soil. Natural surface and internal drainage of the Brookston soils are very poor.

The total area of this soil is not large, but because of its high productivity it ranks as one of the best soils of the county. Over 90 percent of the land has been cleared and more or less thoroughly tile-drained. Of the original heavy forest of elm, silver maple (soft maple), black ash, bur oak, and basswood, only a few wood lots remain. These are commonly pastured.

General farming is the prevalent type of agriculture, and the leading crops are corn, oats, wheat, and clover, usually grown in rotation in the order given. Sugar beets are produced rather extensively, as it is commonly recognized that Brookston clay is especially well suited to this crop. Alfalfa is an important crop, and sweetclover is grown to a limited extent. A moderate acreage is given over to barley each year, and the acreage in soybeans is increasing. Dairying, feeding of beef cattle, and hog raising are important agricultural activities. Most of the hay and grain produced is fed on the farm. Corn yields from 40 to 70 bushels, oats 30 to 60 bushels, wheat 15 to 25 bushels, mixed clover and timothy hay about 1½ tons, alfalfa 2½ tons, and sugar beets 8 to 15 tons an acre.

The common practice is to apply all available manure to the cornland. Many farmers supplement this with a hill or row application of a 4–12–4 or 4–10–6 fertilizer at the rate of from 100 to 125 pounds an acre. Wheatland commonly receives 200 pounds of superphosphate or a mixed fertilizer, such as 2–14–4 or 0–14–6. Fields of sugar beets are given an application of 250 to 300 pounds of 2–12–6, or of fertilizer having a similar analysis.

Adequate drainage is a primary requirement on this soil. In many fields drainage is inadequate owing to the use of small tile and the spacing of the tile too far apart. No tile smaller than 4 inches in diameter should be used; a depth of about 30 inches and a spacing of tile lines 4 or 5 rods apart are desirable. This soil drains somewhat more readily than does Toledo silty clay.

Brookston clay loam.—This soil differs from Brookston clay chiefly in texture. Its greater content of sand throughout makes it drain somewhat more readily than Brookston clay. The surface soil to a depth of 6 to 10 inches is dark-gray to dark brownish-gray friable clay loam, containing some fine gravel. This is underlain by a distinctly gritty heavy clay loam or clay, mottled yellowish gray, yellowish brown, and gray. Below a depth of 20 to 24 inches the subsoil is pale-yellow clay loam streaked with gray, and it contains considerable coarse sand, medium sand, and fine gravel. Friable calcareous gravelly clay loam is reached at a depth of 30 to 36 inches.

Brookston clay loam does not show the uniformity that characterizes Brookston clay. A few areas, somewhat sandier than typical but too small to be shown separately on a small-scale map, are common. The lower part of the subsoil also is variable, being distinctly sandy and gravelly in places. Elsewhere the subsoil is similar to that of Brookston clay, only the upper 10 to 15 inches containing sufficient sand to be a clay loam.

This soil is associated with Brookston clay and Wauseon fine sandy loam in the northwestern corner of the county. One area is mapped in Providence Township near the Maumee River. The surface is undulating to nearly level, but it is not so flat as that of Brookston clay. Natural surface and internal drainage are poor but for the most part not so poor as in the Brookston clay.

Brookston clay loam ranks as an excellent agricultural soil. Practically all of the land has been cleared and tiled. Probably not over 5 percent is still in timber. Methods of cultivation and crops grown are much the same as those on Brookston clay, but Brookston clay loam is generally considered somewhat the more productive and the easier to handle of the two soils.

Millsdale clay loam.—This soil differs from Brookston clay loam in that bedrock (limestone) underlies it at a depth of 24 to 30 inches. The 6- or 8-inch surface soil is dark grayish-brown clay loam. It is underlain by mottled yellow and bluish-gray clay loam or clay, which rests on the limestone bedrock. Fine gravel, rounded boulders, and angular limestone fragments are common on the surface and throughout the subsoil. In a few places the plow strikes limestone. The subsoil is highly calcareous.

Millsdale clay loam is of very limited extent, and of little agricultural importance. The principal areas are west of Sylvania and north of Silica in the vicinity of the limestone quarries. Several small areas southeast of Whitehouse, where the soil resembles Toledo clay loam rather than Brookston, are included.

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The agricultural value of this soil is similar to that of Brookston clay loam in places where the limestone substratum lies at sufficient depth to allow adequate drainage. Where the soil cannot be drained it is commonly used for hay or pasture.

Bono silty clay.—Bono silty clay represents a gradation between Toledo silty clay and the organic soils, peat and muck, and it is comparatively high in organic matter, although the organic layer is rather shallow. The surface soil, to a depth of 8 to 12 inches, is black or very dark grayish-black heavy plastic silty clay. In places the topmost inch in the unplowed soil is mucky. The subsoil is dark-gray very heavy plastic silty clay mottled with yellowish brown and rust brown. Below a depth of 20 inches the material is mottled yellowish-olive, gray, and rust-brown silty clay, which continues with little change to a depth of 40 inches or more.

This soil occurs chiefly in the extreme eastern part of the county bordering areas of muck and peat. It occupies flat areas where natural drainage is very poor. Many of these areas are rather difficult to drain because of their low position.

About 50 percent of the land is under cultivation, and the rest is used for hay. Corn is the principal crop, and where drainage is good, yields of 50 to 75 bushels an acre are obtained. Wheat and oats give fair returns, but in most years lodging very seriously reduces yields. Excellent hay crops of mixed timothy and clover are produced where the drainage is fair to good. Very little fertilizer is used on this soil.

Lucas silt loam.—The 8-inch surface soil of Lucas silt loam is grayish-brown silt loam. In places the texture approaches very fine sandy loam. This is underlain to a depth of 12 or 14 inches by yellowish-brown silt loam slightly streaked with gray. The lower part of the subsoil is variable. Along the Maumee River dull yellowish-brown compact silty clay rests on calcareous clay till at a depth of 30 to 40 inches. Here and there on slopes the till is exposed. The lacustrine deposits are thicker in places at some distance back from the Maumee River, and here the subsoil below a depth of 30 to 40 inches or more is laminated silt and clay, with some layers of very fine sand. In areas bordering the Toledo soils a gradational soil that resembles the Fulton in color is included, but because of its limited extent it is not shown as a separate type.

Also included on the map with Lucas silt loam because of its small size is an area just north of Waterville where the surface soil to a depth of 8 inches is grayish-brown fine-textured loam, underlain to a depth of 18 or 20 inches by yellowish-brown loam, below which is yellowish-brown clay loam containing considerable very fine sand. This rests on calcareous clay till 30 inches below the surface. The surface soil is slightly acid in reaction.

Lucas silt loam occurs along the border of the uplands adjacent to the Maumee River and some of its tributaries, where the water table is sufficiently low to afford good internal drainage. The relief is gently sloping. The escarpment between the uplands and bottom lands is included with this soil.

Along the Maumee River a considerable proportion of this soil area is given over to allotments. A number of orchards and vineyards return good yields of fruit. Areas back from the Maumee

River are utilized for general farm crops, together with some truck crops and orchards. Because of its loose friable surface layer this soil is easily worked and with adequate fertilizer treatment makes a very good soil for growing truck crops.

Fulton silty clay loam.—This soil is somewhat similar to Nappanee clay loam in color but differs in texture and in that it has no coarse pebbles or gravel throughout the soil. It is commonly spoken of as clay land. The surface soil to a depth of 6 or 8 inches is grayish-brown to brownish-gray silty clay loam or light silty clay, resting on mottled gray and yellowish-brown silty clay. Below a depth of 18 or 20 inches is heavy impervious silty clay, mottled with yellowish brown and gray. The subsoil is somewhat lighter in texture below a depth of 26 to 28 inches but is still silty clay loam or light silty clay, containing in places a few white calcareous concretions. The substratum of mottled gray and yellowish-brown slightly calcareous laminated silt and clay lies from 36 to 40 inches below the surface. It rests on calcareous clay till at a depth of 4 to 15 feet. Included with this soil are some small areas near the Maumee River where the mottling is somewhat less pronounced than typical. The surface and subsurface layers are acid in reaction.

Fulton silty clay loam occurs in the eastern part of the county in association with Toledo silty clay. It occupies slight elevations above the general level of the area and has fair surface drainage but very poor underdrainage. Because of the tight impervious subsoil it is difficult to drain by tiling.

About 75 percent of the land is cleared and is farmed in conjunction with the associated Toledo silty clay, and about the same crops are grown, although yields are much lower than on the Toledo soil. Corn produces about 30 to 40 bushels an acre, oats 35 to 40 bushels, wheat 15 to 18 bushels, and hay 1¼ tons. Areas near the Maumee River are utilized in part for orchards and vineyards, although this soil is not so desirable for these purposes as Lucas silt loam. Because of its heavy texture and low content of organic matter, the Fulton soil is rather difficult to work; it tends to puddle when wet and to form very hard clods when dry. The application of manure containing much straw is very helpful in loosening the surface soil.

Nappanee clay loam.—Nappanee clay loam is the light-colored soil associated with Brookston clay in the northwestern part of the county. To a depth of 8 inches the surface soil is grayish-brown heavy loam or clay loam containing considerable very fine sand. This is underlain to a depth of 16 inches by mottled yellowish-brown and yellowish-gray heavy clay loam, which gives way to mottled dull-brown and yellowish-gray heavy impervious clay. Below a depth of 24 to 30 inches the material is highly calcareous clay till. In places stiff plastic clay lies within a few inches of the surface. On some slopes the surface soil has been removed, and the heavy subsoil is exposed. Although the soil is calcareous at a slight depth, the surface soil is generally acid. Rounded pebbles and a few cobblestones occur on the surface and throughout the soil.

Only a very small total area of this soil is mapped. This occurs north and west of Raab in Richfield Township, where it occupies either slightly elevated tracts or areas adjacent to drainageways. Surface drainage is fair; internal drainage, owing to the tight impervious subsoil, is very poor; and artificial drainage by tiling is more difficult than in Brookston clay.

Approximately 75 percent of this soil is under cultivation, and the rest is in wood lots in which the timber growth consists chiefly of white oak, red oak, hickory, and beech. Corn, wheat, oats, and hay are the principal crops. The soil is fairly good for the production of grain—oats yielding about 40 bushels an acre and wheat 20 bushels --but it is fair to poor for growing corn. Mixed hay yields 1 to 1½ tons an acre. Because of the acid reaction of this soil, some liming is required for good stands of alfalfa or sweetclover. This soil is usually farmed in conjunction with the adjoining areas of Brookston clay.

Genesee clay loam.—The surface soil of Genesee clay loam is brown or dark grayish-brown clay loam from 10 to 15 inches thick. This is underlain by dull yellowish-brown heavy loam to a depth of 36 inches or more. Considerable variation exists in the areas included with this soil on the map. In places the lower part of the subsoil is heavy-textured and shows some mottling. Along the Maumee River south of the village of Maumee, bedrock (limestone) occurs at a depth of 36 to 40 inches. In some places the surface soil is somewhat more sandy than is typical. The land is occasionally covered by water during floods.

The chief uses of this soil are for corn, hay, and pasture. Corn yields 40 to 50 bushels and most hay about 1½ tons an acre. Alfalfa, however, produces 3 to 4 tons.

Genesee silt loam.—This soil consists of dark-brown to grayish-brown silt loam to a depth of 10 or 12 inches, underlain by yellowish-brown heavy silt loam to a depth of 3 feet or more. In the northwestern part of the county the alluvial deposit rests on calcareous clay 24 to 30 inches below the surface. The land is sometimes covered by floodwaters.

Genesee silt loam occurs in the flood plains of Halfway, Tenmile, Swan, and Cedar Creeks. The crops grown are about the same as those on Genesee clay loam, but yields are somewhat lower as the silt loam is somewhat lighter colored and lower in organic matter than the clay loam.

Eel silty clay loam.—The 8- or 10-inch surface soil of Eel silty clay loam is grayish-brown silty clay loam, underlain to a depth of 16 inches by light grayish-brown silty clay loam. Below this the material is mottled brown and grayish-brown heavy silty clay loam. Natural drainage is poor.

Areas of this soil border Crane and Cedar Creeks in the eastern part of the county. Most of the land is cleared and is used chiefly for pasture and for the production of corn.

MEDIUM-TEXTURED SOILS

The group of medium-textured soils includes soils of the Toledo, Wauseon, Bono, Neapolis, Millsdale, Lucas, Rimer, Belmore, Monclova, Genesee, and Randolph series. All these soils with the exception of the Randolph are comparatively high in organic matter. The Bono soils are somewhat darker colored than the other members of the group; the Genesee soils are intermediate in color, and the Lucas, Rimer, Belmore, Monclova, and Randolph soils are rather light colored. Toledo very fine sandy loam is the most extensive soil of the group.

The darker colored soils occur chiefly near the eastern and western borders of the oak openings and to less extent east of the Maumee River near Toledo. Truck growing and general farming are the principal uses for these soils. These darker colored soils are productive and, because of their sandiness, are easily managed. The lighter colored soils are associated with the darker colored soils of similar texture, especially adjacent to the streams, where natural drainage is fair to good. They generally are farmed in conjunction with the darker soils though some of the sloping areas adjacent to streams are utilized for pasture. The productivity of the lighter colored soils is not so high as that of the darker colored soils of similar texture.

Toledo very fine sandy loam.—Toledo very fine sandy loam has an 8- to 10-inch layer of very dark-gray to grayish-black friable very fine sandy loam, underlain by yellowish-gray very fine sandy loam to a depth of 16 or 18 inches. This rests on yellowish-gray loam or clay loam that is mottled with gray. This, in turn, passes into dingy yellowish-brown silty clay at a depth of 40 to 50 inches. The subsoil is variable, ranging from very fine sand to loam. The lower part of the subsoil, or substratum, commonly consists of alternating layers of very fine sand, silt, and clay.

A belt of Toledo very fine sandy loam extends across the county just east of the oak openings, where the relief is level to very gently undulating. This soil also occurs east of the Maumee River near Toledo and in several small areas on the western border of the oak openings between Sylvania and East Swanton. Natural drainage is poor, but the open porous subsoil may be artificially drained with ease.

Toledo very fine sandy loam is considered one of the best soils in the county. Practically all of it has been cleared and is under cultivation. In the area west of Toledo truck-crop growing, for which this soil is most excellently suited, is the chief type of farming. Although all kinds of truck crops adapted to the section are grown, sweet corn probably is the predominating crop. In recent years a considerable proportion of this area has been laid out into allotments and is being built up very rapidly.

In Providence Township in the southwestern part of the county this soil is used largely for general farming. Corn, the most important crop, yields 40 to 50 bushels an acre, oats 35 to 40 bushels, wheat 18 to 20 bushels, mixed timothy and clover hay 1 to 1½ tons. Some potatoes are grown, especially in the vicinity of Whitehouse, with yields ranging from 150 to 200 bushels an acre. Because of its almost ideal physical make-up, this soil is easily worked. Crops seldom suffer from drought, as they often do on the deep sandy soils and sometimes do on the heavy clay soils.

Toledo-Berrien complex.—This complex has been mapped northwest of East Swanton, southwest of Holland, and in Providence Township. It includes areas of Toledo very fine sandy loam containing numerous bodies of Berrien very fine sand, that are too small to show on the small-scale map. In cultivated fields Berrien very fine sand consists of an acid grayish-brown very fine sand to a depth of 6 or 8 inches. This is underlain by pale-yellow or brownish-yellow very fine sand, which grades into a similar material mottled with rusty brown. Calcareous clay lies at a depth of 2½ to 4 feet. A plowed field shows a dominance of the very dark-gray soil, with numerous small bodies of brown and yellow. The complex also includes areas of Toledo very fine sand, which represents a gradation from the Berrien soil to the dark-colored Toledo very fine sandy loam.

The topography is very gently undulating. The Berrien soil occupies very low knolls, which, in places, rise only a few inches above the surrounding areas of dark-colored soils.

About 95 percent of this soil complex is under cultivation. It is used largely for general farming, although it is very well suited to truck growing. Because of the spotted character of the fields the stands of crops are not so uniform as on Toledo very fine sandy loam, and the yields are somewhat lower, especially on the light-colored areas.

Toledo loam.—Toledo loam differs from Toledo very fine sandy loam in that it contains sufficient clay to make it somewhat more coherent, but it is much more friable and more easily worked than Toledo clay loam. The surface soil, to a depth of 8 or 10 inches, is very dark-gray or grayish-black heavy very fine sandy loam or loam. The marked absence of coarse soil particles or gravel distinguishes this soil from Wauseon loam, which contains considerable coarse sand and gravel. The upper part of the subsoil is dark-gray loam streaked with yellowish brown and rust brown. Below a depth of 18 or 20 inches is mottled yellowish-brown and gray loam or clay loam, which rests on silty clay at a depth of 24 to 40 inches.

Toledo loam is developed chiefly east of the oak openings from Bailey and Whitehouse to Holland. A few areas are near the western border of the oak openings and east of the Maumee River near Toledo. The relief is level, and natural drainage is very poor. Where artificially drained, it is an excellent soil for general farming. Practically all of it has been cleared and drained and is in a high state of cultivation. The general farm crops common to the section are grown. Corn yields 50 to 60 bushels an acre, wheat 20 to 30 bushels, and oats 35 to 45 bushels. Good stands of red clover and of alfalfa are established easily, and good yields are obtained. Sugar beets are produced to some extent, but the heavier soils generally are preferred for this crop. Potatoes are grown on this soil in the vicinity of Whitehouse, and yields of 175 to 225 bushels an acre are obtained.

Toledo loamy very fine sand.—Toledo loamy very fine sand differs from Toledo very fine sandy loam in that on the average it is somewhat lighter textured and not so uniform. The surface soil consists of very dark-gray or grayish-black loamy fine sand 8 to 12 inches thick. The subsoil and substrata are much like those of Toledo very fine sandy loam.

Numerous small areas of Toledo very fine sand occupying slight elevations within areas of this soil are included with it on the map. Other areas are about 3 miles southeast of Sylvania and in Providence Township. Being lighter in texture, this inclusion lacks the coherence of Toledo very fine sandy loam and Toledo loamy very fine sand with which it is associated. The surface soil, to a depth of 8 or 10 inches, is very dark-gray slightly loamy very fine sand underlain by mottled yellow and gray very fine sand. This grades, at a depth of about 20 inches, into mottled yellowish-brown and gray very fine sand, which continues to a depth of 36 inches or more. The subsoil is somewhat variable in texture, but it is in few places heavier than loamy very fine sand. A heavier substratum commonly occurs at a depth of 40 to 50 inches.

Typical Toledo loamy very fine sand occurs chiefly in Providence Township, 2 miles west of Midway, southwest of Silica, and east of the Maumee River near Toledo. The topography is very gently undulating, and natural drainage is poor.

This soil is not so desirable for general farming as Toledo very fine sandy loam, but it probably is almost as satisfactory for truck gardening. Areas west of Toledo are used largely for the latter purpose; those elsewhere are devoted, for the most part, to general farming. Yields are slightly lower in the included areas of very fine sand.

Wauseon fine sandy loam.—The surface soil of Wauseon fine sandy loam consists of a 7- to 9-inch layer of very dark-gray loamy fine sand or fine sandy loam, underlain by grayish-brown, mottled with gray, fine sandy loam to a depth of 15 to 18 inches. The subsoil is loam that grades into mottled yellowish-brown and gray sandy clay at a depth of 22 to 24 inches. Below a depth of 26 to 30 inches the material is brown highly calcareous compact clay loam or clay, containing a few slightly weathered gray limestone pebbles, or interstratified water deposits in which clay predominates. This soil is in reality a 2- to 3-foot layer of sandy material resting on clay, which in places is glacial till similar to that from which Brookston clay is developed; in other places it is of lacustrine origin. The thickness of the sandy layer varies considerably, but it is nearly everywhere less than 3 feet. In many places the clay of the substratum is interstratified with sandy and silty materials. Rounded pebbles are scattered over the surface and throughout the subsoil in some areas.

This soil occurs chiefly in the northwestern part of the county, where it is associated with Brookston clay and Brookston clay loam. It occupies gently sloping or undulating areas that in most places are somewhat elevated above the level of the associated heavy soils. Natural drainage is poor, but the soil can be drained readily except in places where the clay layer lies near the surface.

About 90 percent of this soil is under cultivation. It is farmed in conjunction with the associated Brookston soils, which are used chiefly for general farming. Potatoes and truck crops are grown to a limited extent. With adequate drainage this makes an excellent truck soil. Corn yields 35 to 45 bushels an acre, oats 40 bushels, wheat 20 bushels, soybeans 18 bushels, mixed clover and timothy hay about 1½ tons, and potatoes about 150 bushels.

Wauseon loamy fine sand.—Wauseon loamy fine sand is intermediate in character between Wauseon fine sandy loam and Newton fine sand. The 8-inch surface soil is dark grayish-brown loamy fine sand to light fine sandy loam, and it is underlain by mottled yellow and gray loamy fine sand. In places the subsoil is slightly coherent fine sand. Silt loam or silty clay is reached at 36 to 40 inches below the surface.

This soil occurs along the borders of the areas in the oak openings where the sand is shallower and somewhat more loamy than is typical of the soil in the oak openings. The land is level, and natural drainage is fair.

In productivity this soil ranks higher than Newton fine sand but lower than Wauseon fine sandy loam. About 75 percent of the land is under cultivation. East of the oak openings in the northern part of the county it is devoted largely to truck gardening to which it is well suited. Elsewhere general farm crops are produced.

Bono very fine sandy loam.—Bono very fine sandy loam is similar to Toledo very fine sandy loam in texture but differs from it in having a much higher content of organic matter. The surface soil, to a depth of 12 to 15 inches, is grayish-black very fine sandy loam underlain to a depth of 20 inches by gray loamy very fine sand slightly streaked with rust brown. This rests on mottled gray and yellowish-brown loamy very fine sand, which gives way to mottled gray and yellowish-brown silt loam or silty clay at a depth of 36 to 40 inches.

In the area east of Neapolis the soil as mapped includes a light-textured variation in which the surface soil is grayish-black loamy fine sand. A second variation has an 8- to 10-inch surface layer of loam. This is underlain by gray heavy loam or light clay loam streaked with rust brown. Below a depth of 24 to 28 inches the material is mottled gray, rust-brown, and yellowish-brown clay loam, which continues to a depth of 40 or more inches. Other features are similar to the typical soil except that yields are slightly greater.

Typical areas of Bono very fine sandy loam occur chiefly in Providence Township as low depressions along drainageways near the border of the oak openings. The soil has a level surface and very poor natural drainage.

About 60 percent of this land is under cultivation. Untiled areas are used for hay and pasture, but where drained adequately the land is well adapted to corn and certain truck crops. Corn yields 40 to 45 bushels an acre, oats 35 to 40 bushels, and mixed clover and timothy hay about 1½ tons. Cabbage is grown to some extent on this soil, and good yields are obtained.

Neapolis fine sandy loam.—To a depth of 10 or 12 inches Neapolis fine sandy loam is grayish-black loamy fine sand or fine sandy loam containing much organic matter. This is underlain by gray fine sandy loam streaked with rusty brown, which becomes somewhat heavier textured with depth. A heavy impervious silty clay is reached from 30 to 40 inches below the surface.

This soil is developed in depressions along drainageways in the western part of Providence Township, northwest of Whitehouse, and in the vicinity of Holland. Its low position and tight impervious lower subsoil layer make natural drainage very poor; in fact the former condition of this soil was that of a semiswamp.

About 50 percent of the land has been cleared and is under cultivation. Truck growing and general farming are the principal uses. In common with other dark-colored sandy soils, this soil, south of Neapolis, is devoted to growing cabbage and, north of Whitehouse, to truck crops in general. With adequate drainage this soil should be admirably adapted to certain classes of truck crops that grow to advantage on soils high in organic matter.

Neapolis loamy fine sand.—Neapolis loamy fine sand is distinguished from Neapolis fine sandy loam by the somewhat lighter texture of the upper horizons. The surface soil is grayish-black highly organic loamy fine sand. The subsoil is light-gray loose fine sand, which rests on stiff impervious silty clay or clay at a depth of 24 to 30 inches.

This soil occurs in the vicinity of Whitehouse and in the western part of Providence Township, where it occupies depressions along minor streams. Other areas border Prairie Ditch in Harding and Spencer Townships. The areas are level and very poorly drained in their natural condition. In some places it is difficult to obtain an outlet for tile drains.

This soil is used largely for the production of truck crops, to which purpose it is well adapted. Artificial drainage is required before satisfactory crops can be produced. Corn and hay yield well, but small grains tend to lodge badly.

Wauseon loam.—Wauseon loam resembles Wauseon fine sandy loam in all respects except texture. The 6- to 10-inch surface layer consists of dark grayish-brown friable loam. This is underlain to a depth of 22 to 28 inches by mottled yellow and gray loam to light clay loam. Below this the material is mottled yellow and gray clay loam or sandy clay. Heavy calcareous clayey glacial drift lies at a depth of 30 to 40 inches. Rounded pebbles are scattered over the surface and throughout the soil.

This soil is characterized by lack of uniformity in the subsoil, which ranges from fine sandy loam to gritty clay loam or clay. Small areas of Wauseon fine sandy loam that are too small to show on the scale of mapping used are included with Wauseon loam.

Irregular areas of Wauseon loam are associated with Brookston soils in the northwestern part of the county. The relief is undulating to level, the slight elevations being the most sandy parts. Natural drainage is poor, but, because of the open porous character of the upper part of the subsoil, good artificial drainage is readily established.

About 95 percent of this land is cultivated and used chiefly for general farming. Wauseon loam is considered a productive soil, and about the same crops are grown as on Brookston clay and Brookston clay loam. It is not so desirable for sugar beets as are the heavier Brookston soils, but it is commonly considered a better soil for grain than those soils as it can be thoroughly drained. In addition to general farm crops, some potatoes and truck crops are grown on this soil, for which crops it is superior to the heavier textured Brookston soils.

Millsdale fine sandy loam.—Millsdale fine sandy loam differs from Wauseon fine sandy loam in that limestone bedrock occurs within 1 to 3 feet of the surface. The 8-inch surface soil is dark grayish-brown fine sandy loam containing numerous small angular limestone fragments and a few crystalline pebbles or cobblestones. This is underlain by yellowish-brown streaked with gray fine sandy loam or loam. The depth to bedrock varies, but it averages about 24 inches. Above the rock in most places there is a 4- to 10-inch layer of sandy clay that may be partly glacial drift and partly residual in origin.

This inextensive soil occupies nearly level areas near Silica and south of Whitehouse. Natural drainage is fair to poor. Where bedrock lies very near the surface, artificial drainage is difficult. Such areas are subject to drought during part of the summer.

The common crops are corn, oats, wheat, and hay. Areas in building lots may be used in part for gardens. In general yields are lower and more uncertain than on Wauseon fine sandy loam.

Lucas very fine sandy loam.—The surface soil of Lucas very fine sandy loam consists of dark-brown or brown friable loamy very fine sand or very fine sandy loam from 8 to 10 inches thick. It is underlain to a depth of 16 inches by yellowish-brown very fine sandy loam, which gives way to yellowish-brown very fine-textured loam. This grades at a depth of 24 to 30 inches into silt loam containing considerable very fine sand. Below a depth of 36 to 40 inches the material is laminated silt, clay, and very fine sand. In places bordering the Toledo soils the soil is slightly mottled and represents a gradation toward Fulton very fine sandy loam.

A few areas of a light-textured variation of this soil west of Sylvania and 1½ miles southeast of Richards are not shown separately on the map. In these areas the surface soil to a depth of 8 inches is brown loamy very fine sand. This is underlain to a depth of 24 inches by yellowish-brown very fine sand, below which the lower part of the subsoil is similar to that of the typical soil.

Lucas very fine sandy loam borders the alluvial soils along streams in Adams, Sylvania, and Washington Townships. The level to sloping areas are fairly well to well drained. Because of its open porous character water soaks into the soil rapidly even where the surface is comparatively level.

About 75 percent of the land is under cultivation. It is used chiefly for truck crops, but appears to be well adapted to fruit also. There are several apple and peach orchards. For general farm crops it is superior to Rimer fine sandy loam.

Rimer fine sandy loam.—The surface soil of Rimer fine sandy loam is brown or grayish-brown friable fine sandy loam. It is underlain by yellowish-brown loamy fine sand or fine sandy loam to a depth of 16 or 18 inches, below which is dull yellowish-brown heavy fine sandy loam or loam. The lower subsoil layer, beginning at a depth of 24 to 30 inches, ranges from loam or silt loam to silty clay. Where this soil borders the dark-colored Toledo soils, there are some areas that have a mottled subsoil and that would be shown separately as Fulton fine sandy loam if they were more extensive.

Rimer fine sandy loam occurs chiefly in Springfield and Adams Townships bordering the flood plain of Swan Creek. The surface is level to gently sloping. Where the soil is typically developed, both surface and internal drainage are good. Areas adjacent to the Toledo soils that have a mottled subsoil, however, have only fair internal drainage. Such areas can be drained very easily by tiling.

About 75 percent of this land is under cultivation. The areas along Swan Creek are devoted chiefly to truck crops, small fruits, and orchard fruits, for which it is well suited. In the general-farming districts the soil is farmed in conjunction with associated dark-colored soils. Here, potatoes are an important special crop.

Belmore sandy loam.—The 8-inch surface soil of Belmore sandy loam is brown or dark-brown slightly gravelly sandy loam or light loam. This is underlain by yellowish-brown loam containing some gravel. Below a depth of 24 to 30 inches the material is calcareous clay till, similar in texture to that from which Brookston clay is developed.

This soil occupies low ridges or knolls in Richfield Township, where it marks the site of an old beach ridge with an elevation slightly more than 690 feet above sea level. Natural drainage is good.

The total area of Belmore sandy loam is very small. This soil is farmed in conjunction with the adjoining Brookston soils. Corn yields from 30 to 35 bushels an acre, oats 30 to 35 bushels, wheat 15 to 18 bushels, and hay 1 to 1¼ tons. Potatoes and most garden vegetables do especially well.

Monclova loam.—To a depth of 10 to 12 inches Monclova loam consists of dark-brown heavy fine sandy loam or loam, underlain by dingy yellowish-brown heavy loam. This rests on stratified gravel and sand at a depth of 24 to 30 inches. Limestone bedrock lies from 3 to 4 feet below the surface. In places the upper subsoil has a reddish cast.

This soil is developed on terraces or second bottoms along the Maumee River in the vicinity of Waterville. The relief is level, and natural drainage is good. These areas are overflowed only at extreme flood stages. Monclova loam is used for the production of corn, wheat, and hay, which yield from 40 to 60 bushels, 25 to 30 bushels, and about 1 tons (alfalfa), respectively, an acre. This soil should be well suited to the production of truck crops.

Monclova fine sandy loam.—The principal difference between Monclova fine sandy loam and Monclova loam lies in the somewhat more sandy character of the first-mentioned soil. The surface soil ranges from 10 to 15 inches in thickness and consists of very dark grayish-brown fine sandy loam. It is underlain by dull-brown fine sandy loam to a depth of 24 inches, below which the material is brown or yellowish-brown fine sandy loam. Stratified sand and gravel are reached at a depth of 30 to 36 inches below the surface, and limestone bedrock is reached from 5 to 8 feet below the surface.

Monclova fine sandy loam occurs on terraces along the Maumee River near Maumee. It is even less extensive than the loam. The land is level to gently undulating, and natural drainage is good. These areas seldom are covered by floodwaters.

The chief crops are corn, wheat, and alfalfa, which return somewhat lower yields than on Monclova loam. The soil is well suited to the production of truck crops, although at present only a small part is used for this purpose.

Genesee loam.—The areas mapped as Genesee loam are variable. Throughout the oak openings the surface soil ranges from brown loamy fine sand to loam, is 10 inches thick, and is underlain by yellowish-brown fine sandy loam or loam. Along the Maumee River it is dark-brown heavy fine sandy loam or loam containing somewhat more organic matter than is typical. The subsoil is brown or yellowish-brown loam. In places between Maumee and Waterville limestone lies within 36 inches of the surface. The soil is flooded at times.

The areas in the western part of the county are used largely for pasture. Corn is the most important clean-cultivated crop. Along the Maumee River the land is used for corn, pasture, and for alfalfa. Here corn yields from 40 to 60 bushels and alfalfa 3 to 4 tons an acre. Yields are lower on the sandier areas in the western part of the county.

Randolph fine sandy loam.—Randolph fine sandy loam has an 8-inch surface soil of brown loamy fine sand or fine sandy loam, underlain by yellowish-brown fine sand or medium sand to a depth of 12 to 15 inches. Below this is yellowish-brown sandy clay, which rests on limestone bedrock at a depth of 20 to 24 inches. Limestone fragments, pebbles, cobblestones, and boulders are scattered over the surface and throughout the subsoil. Because of its very limited extent this soil is of little importance agriculturally.

The typical soil occupies a very small area southwest of Sylvania and south of Centennial. The surface is gently sloping, and drainage is fair to good. About 90 percent of the area is under cultivation and is used for general crops, potatoes, and truck crops. One apple orchard has been planted.

The soil mapped as Randolph fine sandy loam on West Sister Island would be mapped as Randolph stony loam if its area were larger. It consists of a 2- to 12-inch layer of brown loam overlying limestone. Numerous limestone blocks are present on the surface, and outcrops are common. In places the depth to bedrock is as much as 20 to 24 inches, and a layer of yellowish-brown loam or clay loam underlies the brown loam surface soil. Only a few acres on the southern part of the island, where the soil material is thickest, have been cleared. Part of the cleared land is used for the production of vegetables.

LIGHT-TEXTURED SOILS

The group of light-textured soils includes light- and dark-colored sands of the Plainfield, Berrien, Newton, and Maumee series. The Plainfield and Berrien soils are well drained, light-colored, and low in organic matter. The depth of the sand ranges from 5 to 20 feet in the Plainfield soils and 4 to 5 feet in the Berrien. The Newton and Maumee soils are dark-colored and comparatively high in organic matter. They occupy depressions or low-lying areas and are naturally poorly drained.

These soils are utilized for general farming and truck growing, but their productivity is rather low. A considerable area that has not yet been completely cleared furnishes low-grade pasturage for livestock.

Plainfield fine sand.—The surface soil of Plainfield fine sand to a depth of 6 or 8 inches is brown loose incoherent fine sand. This is underlain by brownish-yellow fine sand to a depth of 24 inches, below which the material is pale yellowish-brown fine sand. The sand continues to a depth of 20 to 30 feet throughout much of the area, and a maximum depth of 50 feet is reported. It rests on calcareous clay till similar to that from which Brookston clay is developed. Throughout much of its extent the sandy material is made up of more than 50 percent of fine sand. In some areas northeast of Sylvania, where the texture approaches a medium sand, however, the assortment is less noticeable than elsewhere. The reaction is acid.

Plainfield fine sand occurs throughout the oak openings. The areas along Tenmile and Swan Creeks are fairly large, but elsewhere they are small and irregular and are associated with bodies of such dark-colored soils as Newton fine sand and Maumee loamy fine sand. The topography is undulating to almost level. A few areas form low ridges. Wind erosion has been active in places, producing blow-outs from 10 to 50 feet in diameter. Drainage is good to excessive, and the soil tends to be somewhat droughty, especially in the ridge areas. Where this soil occurs at only a slight elevation above Newton fine sand, the water table may be fairly close to the surface until the lower lying soils are drained.

About 50 percent of the land is cleared and cultivated; the rest is forested with a rather sparse growth of white oak, black oak, yellow oak, and pin oak. Although fairly extensive, it is of minor agricultural importance because it is one of the poorer soils of the county.

The general farm crops common to the section are grown on this soil. Corn is the most important crop and yields fairly well in years of average or heavy rainfall. Wheat yields from 10 to 15 bushels an acre. Oats are grown with only fair success because of the droughtiness of the soil. Rye is more certain as a grain crop. Yields of mixed clover and timothy hay are rather light. Special crops, such as potatoes, melons and other truck crops, strawberries, and buckwheat are grown with fair success. Bush fruits are grown to a limited extent. In years of average or excessive rainfall fair crops are obtained, but in years with subnormal precipitation crops are damaged very seriously.

Numerous areas adjoining the associated Newton fine sand furnish a fair quality of pasture. Dairying is carried on in a small way. Some cattle and sheep are fed, but, because of the poor quality of the pasture this enterprise is not very successful.

A considerable part of the area has been laid out into small farms, but because of the low productivity of the soil attempts at small farming operations are only moderately successful on the deep Plainfield fine sand. It must be recognized that the soil east of the oak openings is entirely different in character, and that the success attained on these finer textured and more fertile soils cannot be duplicated on Plainfield fine sand.

Plainfield-Newton fine sands.—This classification includes intermixed areas of Plainfield fine sand and Newton fine sand that are too small to be shown separately on the soil map with the scale used. The usual condition is that of numerous 1- to 3-acre bodies of Plainfield sand within areas of Newton fine sand. This complex occurs in all parts of the oak openings, but the most extensive areas are north and west of Monclova, north of Holland, and northeast and south of East Swanton.

Areas of Plainfield-Newton fine sands have an undulating relief, and drainage is poor. Probably not over 40 percent of the land is under cultivation. Considerable areas have been cleared but are now used for pasture. Because of its variability, it is less desirable than either Plainfield fine sand or Newton fine sand, which occur in fairly large uniform areas. About the same crops are grown as on the normal Plainfield and Newton soils, but average yields are somewhat lower. Because of its undesirability, areas have been cleared only after the more uniform areas of sandy soils have been put under cultivation.

Berrien fine sand.—Berrien fine sand differs from Plainfield fine sand in that the thickness of the sand over the clay substratum is in most places less than 5 feet, whereas in the latter soil it is in most places 10 feet or more. Because of the shallower depth of the sand to the clay substratum, the supply of moisture available to crops is somewhat greater. This condition was reflected by the somewhat heavier growth of timber that originally covered the soil, and is now evident by the greater yields of crops. The surface soil to a depth of 6 or 8 inches is brown fine sand, underlain to a depth of 24 inches by brownish-yellow fine sand, below which the material is pale-yellow fine sand, slightly streaked with gray. This is underlain by fine-textured material, either silt or clay, at a depth of 3½ to 7 feet. Where the underlying fine-textured layers occur at comparatively slight depths, the gray mottling below a depth of 24 to 30 inches is more pronounced.

The most extensive development of Berrien fine sand is east of Sylvania in the north-central part of the county, where it occupies nearly level to gently undulating areas. Drainage is good, but the soil does not tend to be so droughty as does Plainfield fine sand.

About 85 percent of this soil is cleared. A large part of the area east of Sylvania has been laid out into allotments, and a considerable proportion is built up. Much of the land is used for home gardens or for market gardening. With adequate fertilizer treatment very good yields of the common garden crops are obtained—somewhat higher than on the Plainfield soil.

Berrien very fine sand.—Berrien very fine sand is similar to Berrien fine sand except in texture. The surface soil to a depth of about 10 inches is brown very fine sand, underlain by yellowish-brown very fine sand to a depth of 24 inches. Below this the material is pale yellowish-brown very fine sand, which rests on laminated silt, very fine sand, and clay at a depth of 40 to 50 inches. Immediately above the fine-textured material the very fine sand commonly shows streaking with gray and rust brown.

This soil is not very extensive. It occurs in association with Toledo very fine sandy loam and Toledo loamy very fine sand, where it occupies small, low knolls. It occurs chiefly in Providence Township in the southern part of the county.

Berrien very fine sand is generally farmed in conjunction with the associated soils. In Providence Township it is used chiefly for general crops, although it is well suited to truck crops. Yields are lower than on the dark soils with which it is associated.

Newton fine sand.—Newton fine sand has a dark brownish-gray fine sand surface soil fairly high in organic matter. The sand particles are light gray intermingled with the dark-colored organic matter. This layer is underlain by mottled yellowish-brown, brownish-gray, and yellow fine sand to a depth of 16 inches. Between depths of 16 and 24 inches the texture of the soil is about the same as that in the material above, but the color is pale yellow, mottled with gray and in places with bright yellow. Below this the material is compact fine sand mottled yellow, gray, and brown, the yellow becoming more prominent with depth. The proportion of yellow and gray in the subsoil is variable; in places where yellow is very pronounced the iron coatings of the soil particles give a slight coherence, or loaminess, to the sand. Throughout most areas of this soil the thickness of the sand exceeds 10 feet. The reaction is acid throughout.

This soil is most extensive in the oak openings northwest of Holland and south and east of East Swanton, where it occupies low-lying areas in association with Plainfield fine sand. The land is level, and natural surface and internal drainage are very poor. Where a satisfactory outlet can be obtained, the soil is drained fairly easily because of the open porous character of the subsoil.

About 40 percent of the land has been cleared, and the rest supports a growth of timber consisting of aspen, cottonwood, elm, and willow. Cleared areas that are allowed to remain uncultivated for a time soon become covered with aspen.

This soil is only moderately productive. The leading crops are corn, rye, oats, wheat, and mixed clover and timothy for hay. With adequate drainage fair yields are obtained—somewhat higher than those on Plainfield fine sand. Buckwheat, cabbage, and cucumbers are grown to some extent. Where the land is laid out in small farms, other truck crops are produced with fair success. The undrained areas are used for hay and pasture.

Maumee loamy fine sand.—Maumee loamy fine sand differs from Newton fine sand in that the surface soil is much darker as a result of its higher content of organic matter, and the subsoil is a more pronounced gray. The surface soil, to a depth of 8 or 10 inches, is grayish-black fine sand made up of white sand particles and black mucky organic material. In the virgin soil the topmost 2 or 3 inches are commonly a sandy muck. The subsoil is gray fine sand streaked with yellow and rust brown. The yellow color increases with depth. In some areas the lower subsoil layer is medium sand. In the natural condition the waterlogged sandy subsoil is spoken of as quicksand.

This soil is confined to the oak openings, where it is associated with Plainfield fine sand and Newton fine sand. The largest area is in Harding and Spencer Townships, on both sides of Wiregrass Ditch, which is a low-lying flat area, originally an open swamp. Other areas occur in low places in association with Plainfield fine sand. Natural drainage is very poor, and in many areas it will be difficult to obtain a satisfactory outlet for tile.

Only about 25 percent of the land is under cultivation. About 5 percent of the large area in Harding and Spencer Townships is used for the production of crops; the rest supports a growth of sedges, aspen, willow, and alder.

Adequate drainage is necessary before cultivated crops can be grown on this soil. Corn and hay are the principal crops, and cabbage, onions, and other truck crops requiring a soil high in organic matter are grown with fair success. Undrained areas, if utilized, are in hay or pasture.

ORGANIC SOILS AND LAKE MARSH

Organic soils of limited extent occur throughout the county, the largest areas being in the eastern part near Lake Erie. Lake marsh includes a number of different soils that are not differentiated on the map because of their inaccessibility.

Warners loam.—Warners loam is a shallow muck underlain by marl. It consists of an 8- to 10-inch layer of impure muck resting on a 4- to 6-inch layer of marl, which is underlain by organic soil.

This soil occurs chiefly in one small area along Prairie Ditch in the western part of the county. Where drained it is used for the production of corn and hay; undrained areas are used for pasture. It is similar in agricultural value to areas of shallow muck.

Muck and peat.—These soils consist of dark-brown or black organic material to a depth of 1 to 3 feet. The area north of Bono is very dark-brown to black very finely divided organic material, 12 to 36 inches thick, underlain by bluish-gray silty clay similar to the subsoil of Bono silty clay. The organic material in the area north of Toledo is somewhat more fibrous and is dark brown. The organic soils in the western part of the county are somewhat more shallow and are underlain by gray sand.

With good drainage and adequate fertilization, these soils produce excellent yields of corn, hay, onions, and celery. All the area north of Bono is drained by pumping and is used chiefly for growing corn and onions. The area north of Toledo is not thoroughly drained, and only a small part is used for crop production. The small areas in the western part of the county, where drained, are utilized chiefly for corn and truck crops. Rather heavy applications of a fertilizer high in phosphorus and potash are used on these soils for onions, and large yields are obtained in favorable years.

Lake marsh.—Lake marsh includes areas that support a marsh vegetation, such as grasses, sedges, reeds, and cattail, and are covered with water all or part of the year. The soils include areas of Toledo and Bono silty clays and areas of peat and muck. These are not used for agriculture at present. Many areas could be drained by building dikes and pumping off the water. They are greatly desired for duck ponds by hunting clubs or for muskrat farms by fur trappers.

MISCELLANEOUS LAND TYPES

Made land.—Made land consists of areas that have been filled in with earth obtained from excavations of various sorts. This land type has no definite soil profile and the kinds of material used for the fills varies considerably. The largest areas are in and around Toledo.

Quarries.—Several large limestone quarries, chiefly north of Silica, are shown on the map with appropriate symbols. The stone obtained from the quarries is used for industrial purposes, for road metal, and for agricultural lime.

PRODUCTIVITY RATINGS

In table 5 the soils of Lucas County are listed alphabetically, and estimated average acre yields of the principal crops on each soil are shown.

These estimates may not apply directly to specific tracts of land for any particular year, as the individual soil areas of the same soil types as shown on the map vary somewhat, management practices differ slightly, and climatic conditions fluctuate from year to year. On the other hand, these estimates serve to bring out the relative productivity of the soils, although substantiating yield data by soil types and management practices are inadequate. The right-hand column of table 5 gives information regarding the principal crops grown or the use made of each soil.

In order to compare directly the yields obtained on the various soils of Lucas County with those obtained in other parts of the United States, figures for yields have been converted to indexes based on standard yields and are shown in table 6. The soils are listed in the approximate order of their general productivity under improved practices for corn, wheat, oats, alfalfa, sugar beets, and truck crops.

An index of 50 indicates that the soil is about half as productive for the specified crop as is the soil with the standard index. The standard yield for the crop is given at the head of each respective column. It is to be noted that no standards are given for truck crops or pasture. Obviously, no standard can be given for truck crops, which includes several individual crops. These indexes are very general and are given only for purposes of general comparison. The indexes for pasture have not been based on the standard of 100 cow-acre-days that have been used in reports in other parts of the United States, but it is probable that they do not differ greatly. Soils given amendments, such as lime and commercial fertilizers, or special practices, such as artificial drainage and irrigation, and unusually productive soils of small extent may have productivity indexes of more than 100 for some crops. Many of the soils of Lucas County have an index exceeding 100 because of the comparatively high yields obtained as a result of artificial drainage and the use of other good management practices.

The principal factors affecting the productivity of land are climate; soil, including its many physical, chemical, and biological characteristics; slope; drainage; and soil management, including the use of amendments. No one of these factors operates separately from the others, although one may dominate. In fact, the factors listed may be grouped simply as the soil factor and the management factor, since slope, drainage, and most of the aspects of climate may be considered characteristics of a given soil type and since the soil type as such occupies specific geographical areas characterized by a given range of slope and climatic conditions. Crop yields over a long period of years furnish the best available summation of the associated factors and are therefore used where available.

The general productivity of a soil is indicated by a grade number. It is to be noted that the grade number 1+ refers to a weighted average above 100. Since it is difficult to measure mathematically either the exact significance of a crop in the agriculture of an area or the importance or suitability of certain soils for particular crops, too much significance may be given to the order in which the soils are listed. On the other hand, the arrangement does give information as to general productivity, which is also indicated in more general terms in the second column.

The productivity tables do not present the relative roles that soil types, because of their extent and the pattern of their distribution, play in the agriculture of the county, but they do show the relative productivity of individual soils. They cannot picture the total quantitative production of crops by soil areas without the additional knowledge of the acreage of the individual soil types devoted to each of the specified crops.

TABLE 5.—*Estimated prevailing and attainable average yields per acre of important crops on the soils of Lucas County, Ohio* [1]

Soil (soil types, complexes, and land types)	Corn		Wheat		Oats		Mixed hay		Red clover hay		Alfalfa hay		Soybeans	Sugar beets		Principal use, type of farming, or crops
	A	B	A	B	A	B	A	B	A	B	A	B	A	A	B	
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Bu.*	*Tons*	*Tons*	
Belmore sandy loam	28	38	15	28	28	38	1.0	2.0	1.0	2.0	2.0	3.0	12	-----	-----	General farming.
Berrien fine sand	26	36	14	22	26	38	.5	1.2	.7	1.5	-----	2.2	10	-----	-----	Truck crops, residences.
Berrien very fine sand	30	40	15	28	28	40	.5	1.5	.7	1.5	-----	2.2	10	-----	-----	General farming.
Bono very fine sandy loam	40	55	18	28	40	50	1.2	2.5	1.0	2.0	2.0	3.0	20	8	12	Corn, truck crops, hay, pasture.
Bono silty clay [2]	38	55	18	26	32	45	1.2	2.5	1.0	1.6	1.5	2.7	20	8	12	Corn, hay.
Brookston clay loam	44	60	18	30	40	50	1.7	2.5	1.5	2.0	2.7	3.7	20	9	15	General farming.
Brookston clay	40	58	16	28	40	50	1.5	2.5	1.3	2.0	2.5	3.5	20	8	14	Do.
Eel silty clay loam	35	45	14	20	28	38	1.5	2.5	1.0	1.5	2.0	3.0	18	-----	-----	Pasture, corn.
Fulton silty clay loam	32	45	17	26	30	45	1.0	1.7	.7	1.4	1.0	2.5	18	7	10	General farming.
Genesee loam [2]	40	55	14	25	28	38	.7	1.2	1.0	1.5	2.7	3.7	20	-----	-----	Corn, pasture, alfalfa.
Genesee silt loam	45	65	18	25	35	40	1.2	2.5	1.2	1.8	3.0	3.7	25	-----	-----	Corn, hay, pasture.
Genesee clay loam	45	65	15	25	30	40	1.2	2.5	1.2	1.8	3.0	3.7	22	-----	-----	Do.
Lake marsh	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	Hunting and trapping.
Lucas very fine sandy loam	35	50	22	35	28	40	1.0	1.8	1.0	1.7	2.0	2.5	18	-----	-----	Truck crops, fruit.
Lucas silt loam	38	52	24	32	30	42	1.0	2.0	1.0	2.0	2.5	3.2	20	9	12	General farming, fruit, truck crops.
Made land	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	
Maumee loamy fine sand [2]	35	50	15	25	20	30	.7	1.7	.7	1.7	1.0	2.7	15	-----	-----	Idle, pasture, hay.
Millsdale fine sandy loam [2]	35	45	17	25	25	35	.7	1.7	.7	1.7	1.5	2.5	18	-----	-----	General farming.
Millsdale clay loam [2]	40	55	18	30	40	45	1.5	2.0	1.0	1.7	2.5	3.0	20	8	12	General farming, pasture.
Monclova fine sandy loam	35	50	15	25	27	35	1.2	2.0	1.2	2.0	2.5	3.5	15	-----	-----	General farming.
Monclova loam	40	55	24	32	30	45	1.5	2.2	1.5	2.0	2.6	3.6	18	-----	-----	Do.
Muck and peat [2]	40	65	-----	-----	20	30	1.7	2.5	1.2	2.5	-----	-----	18	4	9	Truck crops, corn.
Nappanee clay loam	34	47	20	30	38	50	1.4	2.0	1.2	1.7	2.0	3.0	18	8	11	General farming.
Neapolis loamy fine sand [2]	40	55	15	27	35	45	1.0	1.8	1.0	1.8	2.0	3.0	15	6	9	Truck farming.
Neapolis fine sandy loam [2]	40	55	15	27	35	45	1.2	2.0	1.2	2.0	2.0	3.0	18	7	10	Truck farming, general farming.
Newton fine sand [2]	30	42	18	27	23	35	.5	1.5	.7	1.5	1.0	2.5	12	-----	-----	Wood lots, general farming.
Plainfield fine sand	23	32	12	20	25	35	.5	1.2	.5	1.2	-----	2.0	10	-----	-----	General farming, wood lots.
Plainfield-Newton fine sands [2]	20	30	10	18	22	32	.4	1.0	.4	1.0	-----	1.8	8	-----	-----	General farming, pasture, wood lots.
Randolph fine sandy loam	30	40	16	26	25	35	1.0	2.0	1.0	2.0	2.0	3.0	12	-----	-----	General farming, truck farming.
Rimer fine sandy loam	35	50	18	26	28	38	1.0	2.0	.7	1.7	1.2	2.7	15	7	9	General farming, truck farming, fruit.
Toledo loamy very fine sand	35	50	18	28	23	35	.7	1.5	.7	1.5	1.0	2.5	15	-----	-----	Truck farming, general farming.
Toledo very fine sandy loam	45	60	20	32	37	50	1.0	2.0	1.0	2.0	2.0	3.2	20	7	12	Do.
Toledo loam	44	60	20	32	35	50	1.2	2.2	1.0	2.2	2.0	3.0	20	7	12	General farming.
Toledo silt loam	44	60	20	32	35	50	1.2	2.5	1.0	2.2	2.0	3.2	20	8	14	General farming, truck farming.

Toledo clay loam	44	60	18	30	35	50	1.2	2.5	1.0	2.2	2.0	3.2	20	9	15	General farming.
Toledo silty clay	40	55	18	28	32	48	1.0	2.5	.7	2.0	2.0	3.0	20	8	14	Do.
Toledo-Berrien complex	40	55	18	30	35	50	.8	1.7	.8	1.7	1.8	3.0	15	------	------	Do.
Warners loam [2]	40	55	20	32	35	50	1.4	2.5	1.2	2.0	2.0	3.2	18	------	------	Pasture, corn, hay.
Wauseon loamy fine sand	36	48	18	28	23	35	.7	1.5	.7	1.5	1.0	2.5	15	------	------	General farming, truck farming.
Wauseon fine sandy loam	40	60	20	32	35	48	1.0	2.0	1.0	2.0	2.0	3.5	18	7	12	General farming.
Wauseon loam	45	60	20	32	35	50	1.2	2.2	1.2	2.2	2.0	3.0	20	7	12	Do.

[1] Estimates are based on the combined opinion of specialists of the State extension staff and agronomists of the Ohio Agricultural Experiment Station staff and are taken in part from the following publication: CONREY, G. W., JONES, EARL, DODD, D. R., and SLIPHER, J. A. PRODUCTIVITY OF OHIO SOIL TYPES. Ohio Agr. Expt. Sta. Agron. Dept. Pub. 48, [33] pp., 1938. [Mimeographed.]

Column A shows yields under prevailing farm practices and conditions, which include the occasional use of legumes (less often than every third year); the use of about 1½ tons of manure plus 60 pounds of single-strength fertilizer per acre per year; and artificial drainage by ditch and tile of the soils commonly drained.

Column B shows yields expected under an improved management program, including the use of a perennial or biennial legume for 2 years in 4 years or for 1 year in 3, manure and/or crop residues averaging 2 tons per acre per year, not less than 100 pounds of single-strength fertilizer per acre per year; some liming to maintain the pH in the soil at 6.5; and the standard drainage for the soil type.

[2] A large part of this soil is not drained or cultivated; drainage of depressed areas not feasible because of lack of gradient.

[3] Genesee loam as mapped in Lucas County is variable. These estimates are for the better areas.

TABLE 6.—*Productivity ratings of the soils of Lucas County, Ohio* *

Soil[1]	Productivity index[2] for—																			General productivity grade		Remarks
	Corn (100=50 bu.)		Wheat (100=25 bu.)		Oats (100=50 bu.)		Mixed hay (100=2 tons)		Red clover hay (100=2 tons)		Alfalfa hay (100=4 tons)		Soybeans (100=25 bu.)	Sugar beets (100=12 tons)		Truck crops[3]	Pasture[4]				
	A	B	A	B	A	B	A	B	A	B	A	B	A	A	B	B	A	B	B[5]	B[6]	
Toledo clay loam	90	120	70	120	70	100	60	125	50	110	50	80	80	75	125	90	40	100	1+	Very high productivity.	Weighted averages of the crop-productivity indexes under column B for corn, wheat, oats, alfalfa, sugar beets, and truck crops range from 90 to 106.
Toledo very fine sandy loam	90	120	80	130	75	100	50	100	50	100	50	80	80	60	100	100	50	90	1+		
Brookston clay loam	90	120	70	120	80	100	85	125	75	100	70	95	80	75	125	90	40	100	1+		
Toledo silt loam	90	120	80	130	70	100	60	125	50	110	50	80	80	65	115	90	40	90	1+		
Toledo loam	90	120	80	130	70	100	60	110	60	110	50	75	80	60	100	90	50	90	1+		
Bono very fine sandy loam[7]	80	110	70	110	80	100	60	125	50	100	50	75	80	65	100	90	50	90	1		
Brookston clay	80	115	65	110	80	100	75	125	65	100	65	90	80	65	115	80	40	100	1		
Wauseon loam	90	120	80	130	70	100	60	110	60	110	50	75	80	60	100	80	50	90	1		
Neapolis fine sandy loam[7]	80	110	60-	110	70	90	60	100	60	100	50	75	70	60	85	90	50	80	1		
Wauseon fine sandy loam	80	120	80	130	70	95	50	100	50	100	50	90	70	60	100	80	50	90	1		
Toledo silty clay	80	110	70	110	65	95	50	125	35	100	50	75	80	65	115	80	30	100	1		
Millsdale clay loam[7]	80	110	70	110	80	90	75	100	50	85	65	75	80	65	100	70	40	100	1		
Neapolis loamy fine sand[7]	80	110	60	110	70	90	50	90	50	90	50	75	60	50	75	80	30	70	1		
Lucas silt loam	75	105	95	130	60	85	50	100	50	100	65	80	80	75	100	70	60	80	1		
Monclova loam	80	110	95	130	60	90	75	110	75	100	65	90	70	----	-----	80	60	70	1		
Genesee silt loam	90	130	70	100	70	80	60	125	60	90	75	95	100	----	-----	80	80	90	2	High productivity.	Weighted averages of the crop-productivity indexes under column B range from 70 to 90.
Genesee clay loam	90	130	60	100	60	80	60	125	60	90	75	95	90	----	-----	70	50	60	2		
Genesee loam[8]	80	110	55	100	55	75	35	60	50	75	70	95	80	----	-----	80	70	80	2		
Bono silty clay[7]	75	110	70	105	65	90	60	125	50	80	40	70	80	65	100	60	30	50	2		
Toledo-Berrien complex	80	110	70	120	70	100	40	85	40	85	45	75	60	----	-----	80	30	60	2		
Muck and peat[7]	80	130	----	-----	40	60	85	125	60	125	----	-----	70	35	75	100	30	80	2		
Warners loam[7]	80	110	80	130	70	100	70	125	60	100	50	80	70	----	-----	60	20	90	2		
Rimer fine sandy loam	70	100	70	105	55	75	50	100	35	85	30	70	60	60	75	60	50	60	3		
Nappanee clay loam	70	95	80	120	75	100	70	100	60	85	50	75	70	65	90	70	50	70	3		
Fulton silty clay loam	65	90	70	105	60	90	50	85	35	70	25	65	70	60	85	60	50	70	3		
Lucas very fine sandy loam	70	100	90	140	55	80	50	90	50	85	50	65	70	----	-----	70	60	70	3		
Toledo loamy very fine sand	70	100	70	110	45	70	35	75	35	75	25	65	60	----	-----	80	30	70	3		
Monclova fine sandy loam	70	100	60	100	55	70	60	100	60	100	60	90	60	----	-----	70	50	60	3		
Maumee loamy fine sand[7]	70	100	60	100	40	60	35	85	35	85	25	70	60	----	-----	80	20	60	3		
Wauseon loamy fine sand	70	95	70	130	45	70	35	75	35	75	25	65	60	----	-----	70	40	70	3		
Eel silty clay loam	70	90	55	80	55	75	75	125	50	75	50	75	70	----	-----	50	60	80	3		

Newton fine sand [7]	60	85	70	110	45	70	25	75	35	75	25	65	50	----	----	60	30	60	4	Moderate productivity.	Weighted averages of the crop-productivity indexes under column B range from 50 to 70.
Randolph fine sandy loam	60	80	65	105	50	70	50	100	50	100	50	75	50	----	----	60	50	60	4		
Belmore sandy loam	55	75	60	110	55	75	50	100	50	100	50	75	50	----	----	60	40	50	4		
Berrien very fine sand	60	80	60	110	55	80	25	75	35	75	----	55	40	----	----	55	25	45	4		
Millsdale fine sandy loam [7]	70	90	70	100	50	70	35	85	35	85	40	65	70	----	----	60	40	70	4		
Berrien fine sand	50	70	55	90	50	75	25	60	35	75	----	55	40	----	----	50	20	40	5		
Plainfield fine sand	45	65	50	80	50	70	25	60	25	60	----	50	40	----	----	40	30	50	5		
Plainfield-Newton fine sands [7]	40	60	40	70	45	65	20	50	20	50	----	45	30	----	----	30	30	50	6	Moderate to low productivity.	Weighted average of the crop-productivity indexes is 45.
Lake marsh	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	10	Very low productivity.	
Made land	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	10		

[1] Includes soil types, complexes, and land types, arranged in descending order of their general productivity.

[2] The soils are given indexes that indicate the estimated average production of each crop on each soil as a percentage of the standard; the standard has an index of 100 and represents the approximate average yield per acre of the crop without the use of amendments on the more extensive and better soil types of the regions of the United States in which the crop is most widely grown. The yield of each crop represented by the index of 100 is shown in the respective columns. Indexes are rounded in terms of fives or tens.

The indexes in column A are for estimated average yields under prevailing farm practices and conditions, which include the occasional use of legumes (less often than every third year); the use of 1½ tons of manure plus 60 pounds of single-strength fertilizer per acre per year, and artificial drainage by ditch and tile of the soils commonly drained.

The indexes in column B are for estimated attainable yields under an improved farm-management program, including the use of a perennial or biennial legume for 2 years in 4 years or for 1 year in 3, manure or residues or both averaging 2 tons per acre per year, not less than 100 pounds of single-strength fertilizer per acre per year, some liming to maintain pH in the soil at 6.5, and the standard drainage for the soil type.

[3] The indexes for truck crops are very general and are given only for purposes of general comparison as they are not based on the production of any one crop.

[4] The indexes for pasture have been prepared on the basis that 100 is the index of the best soils for pasture in Ohio and not on the basis of a standard of 100 cow-acre-days, which has been used in indexing other soils.

[5] The grade number indicates the general productivity of the soil as determined by the weighted average of the productivity indexes for various crops, as follows: Corn 30, wheat 10, oats 10, alfalfa 10, sugar beets 10, and truck crops 30. When the weighted average is above 100 the soil is given a grade of 1+; when the average is between 90 and 100, a grade of 1, and when the average is between 80 and 90, a grade of 2.

[6] A generalized statement of the productivity of the soils.

[7] A large part of this soil is not artificially drained or cultivated.

[8] Genesee loam as mapped in Lucas County is variable. Estimates are for the better areas.

* From Soil Survey report for Lucas County, Ohio, by G W Conrey. et al 1943.

Economic considerations have played no part in determining the crop-productivity indexes. The indexes therefore cannot be interpreted into land values except in a very general way. It is important to realize that productivity, as measured by yields, is not the only consideration that determines the relative worth of a soil for growing crops. Distance to market, relative prices of farm products, and other factors influence the value of land. The ease or difficulty of tillage and the ease or difficulty with which productivity is maintained are examples of considerations other than productivity that influence the general desirability of a soil for agricultural use. In turn, steepness of slope, presence or absence of stone, resistance to tillage offered by the soil because of its consistence or structure, and size and shape of areas are characteristics of soils that influence the relative ease with which they can be tilled. Likewise, inherent fertility and susceptibility to erosion are characteristics that influence the ease of maintaining soil productivity at a given level. Productivity, as measured by yields, is, however, influenced to some degree by all these factors, and others, such as moisture-holding capacity of the soil and its permeability to roots and water. Therefore, these factors are not to be considered entirely separately from productivity, but, on the other hand, schemes of land classification to designate the relative suitability of land for agricultural use must give some separate recognition to them.

MORPHOLOGY AND GENESIS OF SOILS

Soil is the product of the forces of weathering acting on soil materials deposited or accumulated by geologic agencies and of other processes of soil development. The characteristics of a soil at any given place depend on the physical and mineralogical composition of the parent soil material; the climate under which the soil material has accumulated and existed since accumulation; the plant and animal life in and on the soil; the relief or lay of the land; and the length of time the forces of soil development have acted on the soil material. External climate is less important in its effects on soil development than is internal soil climate, which depends not only on temperature, rainfall, and humidity but on the physical characteristics of the soil or soil material and on the relief of the land. The relief, in turn, strongly influences drainage, aeration, runoff, erosion, and exposure to sun and wind.

Lucas County is in the north-central part of the region of Gray-Brown Podzolic soils, which includes a large part of east-central United States. The well-drained upland soils are typical of soils developed in a timbered area under the influence of a humid temperate climate where the rainfall has been sufficient to compensate the loss of moisture by evaporation and surface runoff and in addition to afford sufficient water for a more or less constant downward movement through the soil. Where the drainage is fair or good the soils are light in color as they were formed under a dense forest cover that was unfavorable for the accumulation of much organic matter in the soils.

The area of which Lucas County is a part has been included by Fenneman[6] in the eastern lake section of the Central Lowland province of the Interior Plains. It is part of a broad lacustrine plain bordering Lake Erie. Because of the nearly level surface, natural drainage is very poor over most of the county, so that the development of soils in normal to well-drained situations has been confined to a limited area.

The parent materials from which the soils have developed are either lacustrine or glacial in origin. These deposits rest on limestone, the underlying rock formation, in all parts of the county. The depth to bedrock is variable. In a belt extending from north to south across the county just west of Sylvania and Waterville, bedrock outcrops in places and lies within 2 or 3 feet of the surface over a considerable area. Elsewhere the depth of the soil is 10 feet or more. A mantle of glacial drift, composed largely of limestone material, covers the bedrock; and this, in turn, is covered by lacustrine deposits, except in the northwestern part of the county where glacial drift is exposed at the surface. The lacustrine deposits include deep sands in the section known as the oak openings in the western part of the county, very fine sands and silts east of the oak openings and west of Toledo, and silt and clay east of Toledo and in an area southwest of Maumee. Alluvial deposits along the streams cover a very small total area.

Practically all of the county originally supported a heavy forest growth. Much of the eastern part is included in the Great Black Swamp, which for the most part once supported a heavy growth of trees in which elm was the dominant species.

Sampson and Transeau[7] describe the original vegetation of Lucas County east of the Maumee River as swamp forest, interspersed with numerous small areas of a beech-maple association on low ridges. The swamp-forest association, which occurred on level low-lying areas, included elm, black ash, silver maple, pin oak, swamp white oak, sycamore, black tupelo, locally called sour gum, yellow birch, and on slightly better drained areas, bur oak, white oak, and big shellbark hickory. The beech-maple association, which occupied slightly elevated areas, included beech and hard maple, along with tuliptree, black walnut, butternut or white walnut, red oak, yellow oak, and butternut hickory. The sandy oak openings area in the western part of the area supported a more or less open white oak-black oak forest and the dry oak-hickory type.

On the basis of their most striking and widely developed characteristics the soils may be classed as (1) well-drained soils with well-developed profiles and (2) soils with profiles strongly affected by poor drainage. Soils of the first group occur on the uplands adjacent to stream valleys, on sandy ridges, and on knolls; and those of the second group occur on the extensive, flat, very poorly drained interstream areas. Some of the well-drained very sandy soils and the

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[6] FENNEMAN, NEVIN M. PHYSIOGRAPHIC DIVISIONS OF THE UNITED STATES. Annals Assoc. Amer. Geog. 6: 19–98, illus. 1917.

[7] SAMPSON, H. C., and TRANSEAU, E. N. ORIGINAL PLANT ASSOCIATIONS AS INDICES TO BIOTIC HABITATS WITH SPECIAL REFERENCE TO THE CORN BORER. *In* The European Corn Borer and its Environment. Ohio Agr. Expt. Sta. Bul. 429, pp. 157–161, illus. 1928.

alluvial soils of stream flood plains show comparatively little development of a profile.

Lucas silt loam, derived from laminated silts and clays of lacustrine origin, is typical of the first group of soils, which have developed under fair to good drainage. The profile of this soil from the surface downward is as follows:

A_0. Leaf litter, 1½ inches thick, composed of partly decomposed leaves of deciduous trees. The pH value is 6.1.

A_1. 0 to 2 inches, dark grayish-brown friable silt loam. The pH value is 6.2.

A_{11}. 2 to 5 inches, grayish-brown friable silt loam. The pH value is 5.6.

A_2. 5 to 12 inches, pale yellowish-brown friable silt loam. The pH value is 4.9.

A_3. 12 to 16 inches, yellowish-brown silt loam. The pH value is 4.7.

B_2. 16 to 24 inches, yellowish-brown silty clay loam with brownish-gray coatings on the faces of breakage pieces. The material breaks into irregular-shaped blocks one-fourth to one-half inch in diameter. The pH value is 7.2.

B_3. 24 to 36 inches, yellowish-brown light silty clay loam with gray coatings on the faces of breakage pieces. Blocky structure not so well developed as in the horizon above. The pH value is 7.5.

C_1. 36 to 70 inches, yellowish-brown silty clay loam showing faint lamination. The pH value is 7.9.

C_2. 70 to 94 inches, pale-yellow fine sand.

C_3. 94 to 100 inches, laminated silty clay containing some calcareous concretions.

This profile is characteristic of the typical mature soil developed from the silty lacustrine deposits. Where the parent material is heavier in similar topographic positions, mottling comes within 8 or 10 inches of the surface.

The profiles of the Fulton soils differ from those of the Lucas in that the surface soil is grayish brown and the A_3 and lower horizons highly mottled. The Nappanee soils are similar in color to the Fulton, but they have been formed from calcareous glacial drift, and contain some rounded pebbles throughout the profile, whereas the Fulton soils, formed by the weathering of lacustrine deposits, contain no coarse material.

The group of soils with profiles strongly affected by poor drainage include the Toledo and Bono soils, developed from lacustrine silts and clays; the Wauseon, Newton, and Maumee soils, developed from lacustrine sands; and the Brookston and Millsdale soils formed from calcareous glacial drift. The surface of these soils is level. The dark color of the surface soil and highly mottled colors of the subsoil are indicative of development under poor drainage.

The essential characteristics of the soils of this group, the parent materials of which are fine-textured, is shown in the following description of Toledo silty clay. This soil was examined about 8 miles east of the city of Toledo.

1. Leaf litter, one-half inch thick, having a pH value of 6.5.
2. 0 to 1½ inches, very dark-gray heavy silty clay loam. The material has a fine granular structure and breaks into pieces ranging from one-sixteenth to one-eighth inch in diameter. The pH value is 6.7.
3. 1½ to 3½ inches, dark-gray silty clay which breaks into pieces ranging from one-fourth to one-half inch in diameter.
4. 3½ to 5 inches, dark-gray silty clay streaked with yellowish gray and yellowish brown. The material breaks into pieces ranging from one-half to three-fourths inch in diameter. It has a pH value of 6.8.
5. 5 to 12 inches, mottled yellowish-gray and yellowish-brown silty clay, breaking into ½- to 1-inch pieces. The pH value is 6.9.

6. 12 to 25 inches, mottled yellowish-gray and yellowish-brown silty clay, breaking into 1- to 2-inch pieces. The reaction is the same as that in the overlying layer.
7. 25 to 40 inches, mottled yellowish-gray and yellowish-brown silty clay, breaking into 2- to 3-inch pieces. The reaction is precisely neutral.
8. 40 to 44 inches, yellowish-brown silty clay, with pale olive-drab coatings on breakage faces. Calcareous concretions are numerous. The material is faintly laminated and has a pH value of 7.1.
9. 44 to 50 inches, distinctly laminated silty clay with calcareous silty material in the horizontal planes. A few calcareous concretions are present. The pH value is 7.3.

Toledo silty clay is typical of the Great Black Swamp area, which includes most of eastern Lucas and parts of Ottawa, Sandusky, and Wood Counties, where the soils are derived from lacustrine deposits made up largely of clay and silt. The parent materials of Toledo silt loam are lacustrine silts, and those of Toledo very fine sandy loam are very fine sand and silt. The dark layer is somewhat thicker—from 6 to 8 inches—than is characteristic of Toledo silty clay as developed elsewhere.

Bono silty clay differs from Toledo silty clay in having a grayish-black surface soil with a much higher content of organic matter and a much thicker organic layer, ranging from 8 to 12 inches. The gray color is more dominant throughout the subsoil than in the Toledo soil.

Wauseon, Neapolis, Newton, and Maumee soils are developed from sandy parent materials. Clay is present from 24 to 36 inches below the surface in the Wauseon and Neapolis soils. The Newton and Maumee soils occur chiefly in the sandy oak openings in the western part of the county in association with Plainfield fine sand and Berrien fine sand, where the sand is from 5 to 20 feet thick. The color of the surface of the Newton soil is very dark gray, whereas that of the Maumee is grayish black.

The Brookston soils resemble the Toledo in color, content of organic matter, and thickness of the organic layer, but differ from them in that they are formed from calcareous glacial till, as is shown by the presence of subangular or rounded pebbles throughout the soil mass.

The Millsdale and the Brookston soils are similar in profile characteristics and in the nature of their parent materials, except that limestone bedrock occurs in the Millsdale at a depth of 24 to 36 inches.

Plainfield fine sand is representative of the soils formed from deep sands, which show relatively little development of a profile. The following is a description of the soil profile, as observed 3 miles west of Monclova:

1. Leaf litter, one-half inch thick having a pH value of 6.2.
2. 0 to 1 inch, dark grayish-brown fine sand having a pH value of 6.0.
3. 1 to 3 inches, grayish-brown fine sand. The pH value of this material is 5.6.
4. 3 to 7 inches, brown fine sand having a pH value of 5.5.
5. 7 to 24 inches, yellowish-brown fine sand having a pH value of 5.7.
6. 24 to 40 inches, pale yellowish-brown fine sand. The material has a pH value of 6.0

Except in color this soil shows no evidence of the development of a B horizon because it has been formed from a nearly pure fine sand, in which there is little material to weather to produce clay.

Berrien fine sand is similar to Plainfield fine sand except that the subsoil is paler yellowish brown below a depth of 24 inches and some mottling appears below a depth of 40 to 50 inches. The sand rests on clay at a depth of 4 to 5 feet.

Recent alluvial deposits in the flood plains of streams show little development of definite soil characteristics. Both the Genesee and Eel soils are light in color; but the former has a well-oxidized profile, whereas the latter is mottled throughout.

SUMMARY

Lucas County is in northwestern Ohio at the western end of Lake Erie. It occupies a level plain, broken in the western part by low knolls and ridges. The total area is 342 square miles. The climate is characterized by a mean annual temperature of 49.8° F., an average precipitation of 32.03 inches, an average annual snowfall of 31.8 inches, an average frost-free season of 179 days near Lake Erie, and a somewhat shorter frost-free season in the southern part.

The present-day agriculture consists of general and truck farming. Under the general-farming system, the chief crops are corn, small grains, hay, and special crops, such as sugar beets and potatoes; under the truck-farming system, sweet corn, tomatoes, and a great variety of vegetable crops are produced.

The soils of the county have developed under the influence of a humid, temperate climate and a heavy forest cover. The characteristic mature soils are included with the Gray-Brown Podzolic soils. The parent materials are lacustrine and glacial deposits, the former ranging in texture from fine sands to heavy clays and the latter consisting of heavy clay till.

The most extensive soils are the dark heavy-textured soils. Those formed from lacustrine deposits include Toledo silty clay, Toledo clay loam, Toledo silt loam, and Bono silty clay. Brookston clay, Brookston clay loam, and Millsdale clay loam are formed from glacial till. Areas of these soils are level and were originally very poorly drained. They are utilized chiefly for general farming.

The associated light-colored heavy-textured soils include Lucas silt loam and Fulton silty clay loam, developed from lacustrine materials, and Nappanee clay loam, developed from glacial till. These soils are generally farmed in conjunction with the associated dark-colored soils but are of lower agricultural value. Areas on slopes adjacent to stream valleys occasionally are utilized for permanent pasture.

The dark-colored loam and sandy loam soils are represented by Toledo loam, Toledo very fine sandy loam, Toledo loamy very fine sand, Bono very fine sandy loam, Neapolis fine sandy loam, Wauseon loam, Wauseon fine sandy loam, and Millsdale fine sandy loam. These soils are used extensively for truck crops, although the heavier members are used extensively for general farming.

The associated light-colored loam and sandy loam soils include Lucas very fine sandy loam, Rimer fine sandy loam, Belmore sandy loam, Randolph fine sandy loam, Monclova loam, and Monclova fine sandy loam. These soils are utilized for general farming and truck crops. Some of the best orchard sites are on these soils.

The sand soils are Plainfield fine sand, Berrien fine sand, and Berrien very fine sand, which are light in color, and Newton fine sand and Maumee loamy fine sand, which are dark. A considerable area of the deep sand soils is still in forest. The agricultural value of these soils is comparatively low, but some areas are utilized for general farming and truck farming, and bush fruits are produced to a small extent.

The alluvial soils include the Genesee and Eel soils, which are used for the production of corn and hay and for pasture.

The organic soils are Warners loam and muck and peat. Truck crops and corn are produced on these soils. Lake marsh, made land, and quarries are not used for agriculture.

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Areas surveyed in Ohio shown by shading. **Reconnaissance surveys shown by northwest-southeast hatching; crosshatching indicates areas covered by both detailed and reconnaissance surveys.**

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