U. S. DEPARTMENT OF AGRICULTURE.

BUREAU OF SOILS—MILTON WHITNEY, Chief.

IN COOPERATION WITH THE STATE OF INDIANA DEPARTMENT OF GEOLOGY, EDWARD BARRETT, STATE GEOLOGIST.

SOIL SURVEY OF PORTER COUNTY, INDIANA.

BY

T. M. BUSHNELL, OF THE U. S. DEPARTMENT OF AGRICULTURE, IN CHARGE, AND WENDELL BARRETT, OF THE INDIANA DEPARTMENT OF GEOLOGY.

W. E. McLENDON, INSPECTOR, NORTHERN DIVISION.

[Advance Sheets—Field Operations of the Bureau of Soils, 1916.]

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS,
Washington, D. C., December 24, 1917.

SIR: I have the honor to transmit herewith the manuscript report and map covering the survey of Porter County, Ind., and to request that they be published as advance sheets of the field operations of the Bureau of Soils, 1916, as authorized by law.

The selection of this area was made after conference with the State officials cooperating with the Bureau in the work of surveying and classifying the soils of Indiana.

Respectfully,

MILTON WHITNEY,
Chief of Bureau.

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

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SOIL SURVEY OF PORTER COUNTY, INDIANA.

By. T. M. BUSHNELL, of the U. S. Department of Agriculture, In Charge, and WENDELL BARRETT, of the Indiana Department of Geology.—Area Inspected by W. E. McLENDON.

DESCRIPTION OF THE AREA.

Porter County, Ind., is located in the northwestern corner of the State, about 40 miles from Chicago. It is bounded on the west by Lake County, on the south by Jasper County, from which it is separated by the Kankakee River, on the east by Laporte County, and on the north by Lake Michigan.

The county has an area of 415 square miles, or 265,600 acres. It is roughly rectangular in shape, with a uniform width east and west of 15 miles and a maximum length of about 34 miles, the northern and southern boundaries being irregular.

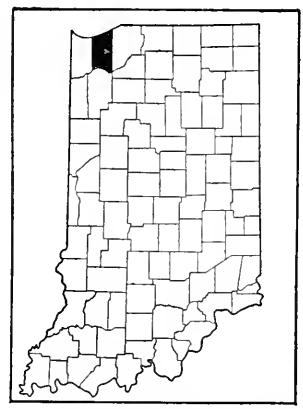

FIG. 1.—Sketch map showing location of the Porter County area, Indiana.

Porter County has three main physiographic divisions: (1) the plain of glacial Lake Chicago, (2) the Valparaiso morainic system and associated till plains, and (3) the outwash plain and lake plain of the Kankakee Basin.

The glacial Lake Chicago plain adjoins Lake Michigan. It is about 2 miles wide at the eastern boundary of the county, and 8½ miles wide where it crosses the western boundary. Bays of this lake extended up Salt Creek Valley nearly to the Pennsylvania Railroad, and eastward along the Calumet River to Laporte County.

The Valparaiso morainic system traverses the county in a northeast and southwest direction. It has a width of 14 miles on the western and about 10 miles on the eastern county line.

The remainder of the county, comprising the southeastern part, belongs to the Kankakee Basin.

In general, the topography of the Lake Chicago Plain is level, but the surface configuration is locally varied by wind action. Along the lake front there is a continuous strip of sand dunes, which in

places reach a height of nearly 200 feet. In the eastern end of this division the dune belt averages one-half mile in width, and has few depressions, but is backed by a long, continuous strip of low land. Adjoining this strip the lake sands have covered the glacial deposits for a considerable distance. North and west of Baileytown the dunes are somewhat lower, and the belt includes marshy depressions.

The topography of the Valparaiso Moraine and associated ground moraine is extremely varied. Much of it is fairly level or gently undulating. A comparatively rough belt extends in a general southwesterly direction from Burdick through Woodville Junction and south of Sedley. It is most rugged southwest of Woodville Junction, where the hill slopes are often quite steep and gullied. This belt is marked by a general rise of over 100 feet from the low land north of it to the higher land to the south. In it are the headwaters of many small streams flowing northward. There are some extensions of this broken belt into the higher and more nearly level land, notably along the Baltimore & Ohio Railroad southeast of Woodville Junction, and along the Salt Creek Valley.

The undulating till plain lying southwest of Valparaiso has a general slope toward the south and southeast. The Kankakee Plain is very flat throughout.

Level bottom lands from a few feet to over one-fourth mile wide occur along the streams of the county. Often near the headwaters they are not well defined and not strictly alluvial, but along the large creeks they occupy definite valleys lying 2 to 15 feet below the general level of the surrounding country. Through the morainic belt numerous depressions are found, ranging from a few acres to several hundred acres in size. More than a dozen small lakes occur in such depressions in this county.

The general elevation of the flatter lands in the south end of Porter County is about 652 to 700 feet above sea level. The elevation of the Valparaiso Moraine is more than 800 feet in the higher part north and northeast of Valparaiso. At the summit in section 30, township 36, range 5, the elevation is 888 feet. Lake Michigan is about 585 feet above sea level.

The belt of sand dunes along the Lake Michigan beach probably averages more than 100 feet in height, with isolated peaks rising 100 feet higher. West of Dune Park these sand hills are somewhat lower and broken with marshes. Just back of the dune belt the continuous marshy strip about a mile wide is 20 feet above lake level. East of Baileytown the moraine fronts on this marshy belt and rises 40 feet or more above it. The beach lying at the foot of the moraine continues southwestward to the county line. At the junction with Salt Creek the Calumet River crosses this beach and enters the low, marshy strip. West of Baileytown the moraine is not in evi-

dence, but the beach marks a rise of about 15 or 20 feet to a flat plain which formerly was a part of the lake bed. The deposits on this plain consist chiefly of clays, although west of Salt Creek they are veneered with sands as far south as the Elgin, Joliet & Eastern Railroad.

The next higher beach line of the old lake evidently existed along the sandy, rugged belt running northeast from Sedley. However, at the foot of this line of hills the action of glaciation, erosion, and deposition have left a complicated mixture of glacial and lake materials with a rather uneven topography.

Along the western county line the heavy lake deposits extend almost to the Grand Trunk Railway. A morainic arm protrudes northward from Wheeler almost to the Elgin, Joliet & Eastern Railroad. A bay of the glacial lake extends southward along Salt Creek Valley almost to the Pennsylvania Railroad. The shore line then swings back toward Chesterton, and a long, narrow bay extends eastward to the Laporte County line. In this bay there are many sandy deposits, evidently deltas from streams flowing out of the moraines. It seems probable that when the lake stood at the level of this highest beach its waters drained through the great gaps in the moraine west of Valparaiso or along where the Baltimore & Ohio Railroad now has its line east of Woodville Junction.

While the rise to the top of the main morainic ridge is rapid along this northern border the ridge blends into the outwash plains and Kankakee marshes along the southern border with no abrupt topographic change.

The crest of the main Valparaiso Moraine divides the drainage of the county and of the continent. North of it all the waters find their way into Lake Michigan through the Calumet River, which crosses Porter County in an east-west direction. Numerous small streams head in the moraine and flow northward or northwestward to the Calumet River. The principal creeks are Coffee and Salt Creeks. The latter is peculiar in that it heads in the outwash plain south of the moraine and after flowing a short distance southward turns back through the gap and flows northwestward through the hills.

Plans have been made for dredging an outlet for the Calumet River through the dune strip near Dune Park. In that way the drainage waters would reach the lake in less than 1½ miles, instead of flowing to the natural outlet at South Chicago. The channel would be deepened so that the current would be reversed, and the waters of Deep River in Lake County would flow eastward to the new outlet. The proposed Lake Erie to Chicago ship canal is routed through the Salt Creek gap in the Valparaiso Moraine, which is only 80 feet above lake level.

South of the main divide the smaller streams, most of which have been dredged, flow in a general southerly direction until they approach

the Kankakee River, where they turn toward the west and flow into that stream, which is a tributary of the Mississippi River.

Surface drainage is quite complete through the morainic belt, except for minor depressions. It is also fairly good in the lake plains, although in the Kankakee Basin it is largely effected by dredged ditches and smaller laterals. The higher outwash soils are well drained through their porous substratum. In the lake plain in the northwestern part of the county the stream channels are cut down about 15 to 30 feet, at which depth there are evidences of more porous strata. However, these sand beds are too deep to afford underdrainage. The drainage of a large part of the county could be improved by the extension of the ditches and the use of tile.

Porter County was organized in 1836. The early settlers were largely from other parts of Indiana and the eastern States. Eighty years ago much of the land was occupied by Indians of the Pottawatamie, Chippewa, Sac, and other tribes. In later years there was a considerable influx of settlers of Swedish, Norwegian, and German descent. Recently farmers from Illinois have come into the county and settled on the black lands.

The census of 1880 gives the urban population of Porter County as 4,461, and the rural population as 12,766. In 1910 the urban population was 6,987 and the rural population 13,553, or about 33 persons per square mile.[1] Of the population classed as rural probably 3,000 reside in small towns. The most densely populated districts are found around the old settlements such as Valparaiso, Chesterton, and Hebron. The population of the Kankakee region, which has more recently been reclaimed, is relatively sparse. There are very few houses north of the Chicago, Lake Shore & South Bend traction line, along Lake Michigan.

Valparaiso, the county seat, has a population of 6,987, according to the 1910 census. It was established before Chicago, and is a well-improved, prosperous town. Valparaiso University is located here. Chesterton, in the northern part of the county, is a prosperous town of about 1,400. In Porter, an adjoining town, there are several factories. Hebron has a population of about 850. Hebron and Kouts are in the southern part of the county. Wheeler, McCool, Crocker, Burdick, Boone Grove, and Malden are small railroad towns.

Porter County is traversed in a general east and west direction by 10 main-line railroads and several branch railroad lines and traction lines. From north to south these are the branch line of the Chicago & Indiana Southern Railroad to Dune Park, the main double-track line of the New York Central Railroad, the Chicago, Lake Shore & South Bend Electric line, the double-track main line of the Baltimore & Ohio Railroad, the Wabash main line, the Elgin, Joliet & Eastern

[1] The census classes only the population of towns of over 2,500 as urban.

Railway (Chicago outer belt line), the Michigan Central double-track main line, the Gary & Interurban Traction line, the Pennsylvania Railroad double-track main line (Fort Wayne route), the New York, Chicago & St. Louis Railroad main line, the Grand Trunk Railroad, the Chesapeake & Ohio of Indiana, the Chicago & Erie Railroad (double track), the Pennsylvania Railroad (Pittsburgh, Cincinnati, Chicago & St. Louis), and the Chicago & Eastern Illinois Railroad. Branches of the Gary & Interurban Traction line between Chesterton and Valparaiso afford the only north and south rail transportation in the county. An auto-bus line has been established between Valparaiso and Kouts. The Pere Marquette Railroad enters the county from the northeast and runs to Chicago over the Lake Shore line from Porter. There are several transfer and connecting points within the county.

A complete system of limestone-surface roads radiates from Valparaiso. Improved roads are numerous in Portage, Westchester, Union, and Boone Townships. The southeastern part of the county is less well supplied, but the system is being rapidly extended to all sections. Some of the roads are surfaced with gravel. Over sandy lands the roads are sometimes improved by adding clay, and in clay areas they are sometimes surfaced with sand. Other roads are merely graded and surfaced with the materials at hand. Most of the roads follow land lines, although there are a number of diagonal, short-cut roads. The Lincoln Highway passes through Valparaiso. The only good road to the Lake Michigan beach is north of Chesterton at Waverly Beach. Indistinct trails cross the sand dunes at several places.

Rural mail delivery and telephone lines reach all parts of the county.

Valparaiso, Chesterton, Kouts, Hebron, Malden, Wheeler, and other towns are markets for the agricultural products grown in their vicinities. Prices are governed by the market in Chicago. Large quantities of dairy products are shipped to Chicago from this county.

CLIMATE.

There is no Weather Bureau station in Porter County, but the records of the station at Hammond, Lake County, are fairly representative of local climatic conditions. The mean annual temperature is 49° F. The summer mean temperature is about 71° F., and the winter mean about 25° F. Many and sudden variations in temperature occur. The monthly range may be as great as 80°. The highest temperature recorded at Hammond is 104° F., and the lowest —23° F.

The rainfall averages about 31 inches per annum, with the heaviest precipitation in the spring and summer. May is the wettest month.

There is considerable variation in the monthly rainfall from year to year, which has more or less effect on crop yields. The snowfall averages nearly 42 inches annually. It is heaviest in February.

There is an average growing season of 173 days. The average date of the last killing frost in the spring is April 27, and of the first in the fall, October 17. The latest date of killing frost recorded is May 26, and the earliest, September 19.

The following table is compiled from the records of the Weather Bureau station at Hammond:

Normal monthly, seasonal, and annual temperature and precipitation at Hammond, Lake County.

Month.	Temperature.			Precipitation.			
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year (1899).	Total amount for the wettest year (1892).	Snow, average depth.
	°F.	°F.	°F.	Inches.	Inches.	Inches.	Inches.
December	26.9	60	−17	2.20	1.51	3.97	7.6
January	23.7	67	−20	2.24	.55	1.07	10.4
February	23.2	63	−23	2.29	.71	1.83	15.0
Winter	24.6	67	−23	6.73	2.77	6.87	33.0
March	37.1	82	0	2.54	1.09	2.31	4.4
April	47.5	88	12	2.83	.13	4.60	1.0
May	58.1	98	27	4.04	4.07	8.59	T.
Spring	47.6	98	0	9.41	5.29	15.50	5.4
June	68.2	99	36	3.10	1.36	9.93	0
July	73.1	104	39	2.77	3.15	2.21	0
August	71.5	102	43	2.25	1.07	.88	0
Summer	70.9	104	36	8.12	5.58	13.02	0
September	65.6	102	29	2.84	2.99	2.52	0
October	53.8	89	19	1.81	1.25	2.64	.1
November	39.2	77	1	2.31	2.50	2.80	3.1
Fall	52.9	102	1	6.96	6.74	7.96	3.2
Year	49.0	104	−23	31.22	20.38	43.35	41.6

AGRICULTURE.

The first agriculture of this region consisted of the growing of maize by the Indians. The earliest white settlers were fur traders. The first settlement of whites in the area now embraced in Porter County was made at Baileytown in 1822. A settlement was made southeast of Chesterton in 1833, and this became an important stopping place on a stage line to Chicago.

The original land survey was made in 1830–1831. Settlers gradually drifted in from the east, and the country passed through the usual pioneer development. A gradually increasing acreage was cleared and cultivated. Wheat was grown and ground at small mills established on the creeks, and flour practically displaced corn meal as the staple food. At first flax was cultivated, but later sheep were introduced and wool became the chief source of material for clothing. Cattle were raised in increasing numbers on the prairies and marsh land. There was the usual tendency to occupy first the lighter and the forested soils, because they were easier to handle with the primitive implements employed than the heavier soils and prairie lands, and in addition the timbered areas furnished game, firewood, and building material.

In 1850 the Michigan Central and the Lake Shore Railroads were extended through Porter County to Chicago. The Pennsylvania Railroad was built in 1858 and was soon followed by other lines to Chicago.

With the advent of the railroads settlement became more rapid and all the land was soon homesteaded. The use of binders and other improved farm machinery became general in the seventies, and this led to a great increase in the production of oats and wheat, although corn has always been the leading cultivated crop of the county. In the marsh lands the cutting of wild hay and the grazing of cattle were the leading and practically the only industries up to 15 or 20 years ago. The acreage devoted to marsh hay steadily increased up to 1890, but by 1900 it was greatly reduced, cultivated grasses, consisting of timothy or timothy and clover mixed, displacing the marsh grasses in the cropping system.

The following table, compiled from the census reports for 1880 to 1910, inclusive, indicates the general trend in the production of the chief crops:

Production of principal crops.

Crop.	1880		1890		1900		1910	
	Acres.	*Bushels.*	*Acres.*	*Bushels.*	*Acres.*	*Bushels.*	*Acres.*	*Bushels.*
Corn	33,650	838,331	28,224	820,088	28,760	1,333,500	45,899	1,675,972
Oats	13,450	412,625	20,620	700,038	24,865	798,450	26,910	976,695
Wheat	13,991	290,858	10,630	156,237	5,666	32,950	10,694	232,702
Rye	1,213	14,828	2,389	36,262	2,751	39,520	3,316	51,616
Barley	63	1,347	37	759	25	420	10	168
Buckwheat	303	2,519	230	3,037	213	2,270	312	5,142
Potatoes	.....	180,723	2,064	173,354	1,652	110,750	2,217	219,340
		Tons.		*Tons.*		*Tons.*		*Tons.*
Hay and forage	27,136	37,905	51,519	66,305	41,177	55,724	42,048	52,717

In addition to the area in potatoes and a small acreage in sweet potatoes, the census of 1910 reports a total of 558 acres in vegetables. A total of 42,848 apple trees, 19,382 peach trees, and 15,493 grapevines is reported, with a small acreage in berries, chiefly strawberries. There are several thrifty pear orchards in the county. A number of special crops are grown in a small way.

The following table indicates the status of the live-stock industry as reported in 1910:

Domestic animals, Porter County, 1910 census.

Animals sold or slaughtered:		Number on farms and ranches:	
Calves, sold or slaughtered	7,201	Milch cows	11,981
Other cattle, sold or slaughtered	4,254	All other cattle	9,960
Horses and mules, sold	799	Horses	8,214
Swine, sold or slaughtered	17,886	Hogs	17,216
Sheep and goats, sold or slaughtered	2,346	Sheep	7,781

The production of cereals combined with dairying and stock raising is the dominant type of agriculture in Porter County. Corn is the most important crop. It is grown as a cash crop on many farms, especially in the southeastern part of the county, and furnishes the bulk of both rough and grain feed on many stock and dairy farms. Timothy hay is fed to work horses and to some extent to cattle on the farms. Some hay is sold and finds a ready market both in local towns and in Chicago. Oats constitute an important horse feed, and a part of the crop is sold. The straw is largely consumed by stock or used for bedding. Wheat is almost strictly a cash crop. No other crops compare in importance with corn, hay, oats, and wheat.

The Indiana Bureau of Statistics in 1913 reports that among the counties of the State, Porter County ranks third in acreage and yield of timothy, sixth in acreage of marsh hay, ninth in acreage of potatoes, and eighth in acreage of buckwheat.

Dairying developed in this section under the stimulus of the Chicago market, so that the counties of Porter and Lake hold almost equal rank as leaders in this industry among Indiana counties. Although Porter was sixth in the number of cows milked, it was third in gallons of milk produced in 1913. The dairying consists almost entirely of the production of whole milk for the retail trade. While over 4,600,000 gallons of milk were produced in 1913, only 21,671 gallons of cream were sold, and 227,821 pounds of butter made. The 1914 figures showed a decided increase in the production of cream and butter. Porter and Lake Counties lead the State in the number of silos. Porter County now has an average of one to every 2.7 farms, and is building silos at the rate of about 100 per year.

An active cow-testing association is maintained, in which the average production per cow per year in 1915 was 7,366 pounds of milk, containing 283 pounds of butter fat. These figures show an increase over the results of the first year's work of the association and equal the best records made by any such association in Indiana. Dairies belonging to the Porter County association are located almost entirely north and west of Valparaiso. Other dairy herds are found southwest of Valparaiso, but few are located in the southeastern part of the county.

Porter County ranked fifth in the State with a total of 18,577 cattle of all kinds in 1914. There are a few breeding herds of the beef type, which, like the dairy herds, are headed by purebred bulls. Feeders are obtained from these herds, from the steer calves of the dairy herds, and from the feeder market in Chicago. The fattening stock is grazed largely on marshy pasture lands and finished with hay, ensilage, and corn. The 1910 census reports an expenditure of $84,599 for feed on 809 farms in 1909, but it is probable that more of this was used for stimulating milk production than for fattening stock.

The hog-raising industry is well distributed over the county, but is most important where corn is plentiful and beef cattle are kept. The hogs are a source of meat on the farms, and in some cases the chief source of income.

Several thousand sheep are handled each year in Porter County, but relatively few of them are raised here. Feeders are brought in to fatten on stubble land and other pastures. They are given little additional grain feed and are returned to the Chicago market.

Although a source of some income, poultry production usually is only incidental to other farm operations. Most of the feed is gleaned from the waste in grain fields and around the granaries. There are very few poultry fanciers or egg producers in the county.

There is an average of two teams of horses or mules of the ordinary work type per farm in Porter County.

The relative value of farm products, as reported in the 1910 census, is given in the following table:

Value of farm products, arranged by classes.

Cereals	$1,491,867	Live stock and products:	
Other grains and seeds	1,523	Animals sold and slaughtered	$576,935
Hay and forage	473,420	Dairy products, excluding home use	527,133
Vegetables	116,019	Poultry and eggs	190,196
Fruits and nuts	56,065	Wool, mohair, and goat hair	7,209
All other crops	56,361		
		Total value	$3,496,728

The topographic variations in Porter County influence the distribution of crops to some extent. The broad level lands are usually devoted to large fields of the cereals. Rougher land where the use of improved farm machinery is difficult is generally used as pasture.

Although the principal crops are all grown on most of the soil types of Porter County, their proportionate acreage and yield per acre vary with the different types. Generally the dark-colored soils are used more for corn, oats, and hay, and less for wheat than the lighter colored soils. The great need of the light-colored land for organic matter and nitrogen is often an important factor in influencing the farmers to undertake dairying or stock raising.

The crop adaptation of different classes of land is usually well recognized by the better farmers, although other considerations, such as the benefits of crop rotation and the demands of the market often cause similar crops to be grown on various soils. It is generally recognized that wheat is more likely to winterkill on "clay" lands than on sandier soils, and that this crop does well on the Maumee fine sandy loam, but not so well on heavy, dark-colored soils. The light-colored upland soils with heavy clay subsoils are considered too cold and wet for corn in rainy seasons. On the other hand the corn crop may suffer from drought in dry seasons on the soils underlain by loose, sandy substrata. The soils which support a natural growth of plants indicating acidity are not seeded to clover without special preparation.

On the grain-producing farms an effort usually is made to fall plow all stubble land which has not been seeded to grass. On farms without stock the winter is a relatively idle period. Early in the spring all the land which was not fall plowed is broken, disked, and harrowed. Oats are nearly always drilled late in March or early in April. The rate of seeding is about 10 or 12 pecks per acre.

The fall-plowed land usually is disked, harrowed, and perhaps rolled to make a good seed bed for corn. This crop is put in after danger of frost has passed. It is planted in check rows so that it may be cultivated both ways. In this latitude most of the corn is of rather small early-maturing yellow varieties, such as the Wabash Yellow Dent and Early Yellow Dent. Usually the corn is given from three to five cultivations, and is kept quite free from weeds. However, while the hay is being cut and the oats harvested the corn is likely to receive insufficient attention, especially in more poorly drained fields and in wet seasons.

The hay crop consists chiefly of timothy, although considerable timothy and clover, wild hay, and clover alone are produced. Where storage space is available it is filled and the remainder of the hay is stacked in the higher part of the fields, or near the barn. Later in the year a part of it may be baled for market.

Wheat is harvested soon after the hay-making season. Self binders are used, and the bundles are shocked in the field; very few farmers stack them. The harvesting of oats follows, the same methods being used as in case of wheat. Thrashing usually has begun by the end of the harvest season. A number of farmers join in a thrashing "ring" to use one machine and exchange labor.

Timothy is sometimes thrashed for seed. The second crop of red clover is also cut for seed.

Ensilage corn is cut shortly before the first heavy frosts. After that some corn, especially that on low land, is cut by hand or with corn binders, and shocked, to be husked or shredded later in the season. A part of the corn is left standing in the field and husked from the row in November or December.

Stock farming involves many of the methods used on the grain farms, with the additional labor of handling more rough feed, such as straw, corn stover, shredded corn, and ensilage, and of spreading manure from the feed lots over the fields. It also necessitates the use of more land for pasture and hay production. Most of the feed is home grown. On dairy farms there is the labor of feeding and milking from 20 to 50 cows all the year, and the milk is hauled to market or to a shipping point daily. In some cases the milk cans are collected by auto truck, but most farmers live near one or another of the numerous railroads and attend to delivery of milk and return of the empty cans. The growing of corn for ensilage is important on the dairy farms, most of the farmers filling two or three silos each year.

The 1910 census states that 72 per cent of the farm valuation was in the land, 16.3 per cent in buildings, 2.3 per cent in implements, and 9.3 per cent in domestic animals. The average value of all property per farm is given as $10,079.

The farm dwellings usually are well constructed, and many are thoroughly modern and fitted with most of the conveniences of urban dwellings. Even where the farmhouse is poor the barns and sheds usually are adequate for the needs of the farm. The dairy barns especially are large and well equipped for housing and feeding the cows and handling milk and manure. Improved farm machinery, including drills, corn planters, binders, manure spreaders, etc., is in general use. Automobiles for business and pleasure are fairly common in the county. A large number of steam engines and gasoline tractors are used in the county for thrashing, cutting ensilage, shredding corn, plowing, sawing wood, and grinding feed.

Some of the more common rotations used in Porter County are corn, oats, and timothy; corn, wheat, and timothy; corn, oats, wheat, and clover. On dairy and stock farms the rotations may be varied by using the land as pasture for several years.

As Porter County has long been a dairy district, the farmers have more manure available than is usual in Indiana counties. This supplies in the best and cheapest form organic matter and nitrogen, the elements most needed on the light-colored soils. No extensive use of commercial fertilizer has ever been made. In 1909 only 160 farms reported its use, and the average expenditure per farm was $36. There was a slight but growing demand for potash on the black or mucky lands before the price of this material became prohibitive. Complete fertilizers are sometimes drilled in with the corn or wheat at the rate of 75 to 200 pounds per acre, with fair average results. There is an increasing tendency to use phosphatic fertilizers, such as bone meal and acid phosphate, for corn, wheat, and oats, particularly on lands which also need lime.

In recent years much of the "sour" land east of Kouts has been improved by liming. Lime usually is applied in the form of finely ground limestone, at the rate of 1 ton to 4 tons per acre. This may be obtained at a cost of about $1.25 per ton, including the freight. In some cases air-slaked lime has been used with good results.

Farm labor is an important item in Porter County. In 1909 a total of 1,013 farms reported a total expenditure of $234,189 for labor. Good farm hands are difficult to obtain; they receive $30 to $35 and board per month. Extra help is paid about $1.25 to $2 per day. In harvesting seasons the practice of exchanging labor is general. Most of the laborers are Americans and are efficient.

The average size of farms in Porter County has remained about the same for the last 40 years. In the 1910 census it is reported as 125 acres. About 90 per cent of the area of the county is reported in farms, and of the farm land 77.8 per cent is classed as improved. The farms range in size from a few acres to over 5,000 acres. Farms of a section or more are not uncommon.

The 1910 census reports 69.6 per cent of the farms operated by the owners, which is a larger proportion than that in many counties in the corn belt. However, the number of tenant farms has gradually increased during the last 30 years. Farms usually are rented under the share system, the owner receiving two-fifths to one-half the crops. In some cases he pays for a part of the seed and fertilizer, but he seldom has an interest in the implements and farm stock. The tenant owns the work stock and tools, produces the crops, hauls them to market, and usually furnishes the labor for repairs about the farm. The owner usually reserves the right to decide what crops shall be grown, and it is generally specified that no roughage shall be removed from the farm. Sometimes the tenant is required to pay cash rent for pasture land.

The average assessed value of farm land in Porter County is reported in the 1910 census as $58.09 an acre. Some of the rougher

and marshy, undeveloped land is valued at less than $50 an acre, but the majority of the farmers value their land, with improvements, at $100 to $150 an acre, and some farm land is held for more than $200 an acre.

SOILS.

The soil materials of the Porter County, Ind., area were accumulated by various glacial processes. As shown in the opening chapter, the northwestern part of the county is underlain by materials accumulated by deposition in lakes, the southeastern part by deposition from running water and incidental standing water and the central part by deposition from glacial ice. In the northwestern and southeastern parts, therefore, the material consists usually of sandy clays, silts, clays and sands, while across the central part of the county it consists predominantly of bowlder clays. The bedrock consists of limestone, but it is so deeply buried by the various deposits just mentioned that it is not a factor in the determination of the character of the soils of the county. The material from which they are derived consists of a mixture of clay, silt, and sand presumably derived from the same or similar sources as the gravel and bowlders occurring with them, which consist of granite and other crystalline rock fragments, shale, sandstone, and limestone. It is therefore heterogeneous in its mineralogical composition as well as in its physical constitution. It is from this material that the soils of the county have been developed by weathering and by local redeposition.

The soils have developed in a humid region where in part of the area the natural surface drainage is good and in part it is deficient, the former condition being characteristic of a large part of the central belt of ice-laid material, the latter of a considerable part of the smooth areas in the northwestern and southeastern parts of the county. The soils of the whole county, therefore, because of the humid conditions under which they have developed, are leached of their readily soluble salts, and the carbonates, consisting of the limestone fragments in the parent material, have been eliminated to a depth of several feet; only in a few cases is any left within the 3-foot profile to which examination is extended. The soils on the rolling lands have been oxidized and aerated to a depth of several feet as a rule. Those with light texture or underlain at relatively shallow depths by gravel or sand, occurring within the area of flat or very smooth topography, have in most cases reached the same stage in their development.

The rest of the soils on the flat land areas have developed under conditions of excessive moisture. They are, as a rule, somewhat less thoroughly leached of their lime carbonates and are imperfectly oxidized and aerated in their subsoils, the extent of these changes varying in the various types.

The soils on the rolling land and certain areas of smooth land were well enough drained and well enough protected from annual fires to permit the development of a forest vegetation. This in turn promoted the formation of light-colored soils. They are usually brown to light brown or gray in color and their content of organic matter is low.

The soils developed under conditions of excessive moisture or insufficient subsoil drainage did not favor the development of a forest vegetation. Their native vegetation therefore consisted of grasses.

Well-drained soils on areas of flat or smooth land lying adjacent to or surrounded by areas of wet lands were influenced in the native vegetation they produced by the latter, possibly because of the frequent fires on them, so that as a rule they produced a grass vegetation also. The greater part of the flat or smooth land area, therefore, were prairies in their native state and because of their grass vegetation they are dark in color and contain a high percentage of organic matter.

These soils are *prairie* soils, however, and not *steppe* soils. They are treeless because of excessive moisture, or were controlled by neighboring areas of that kind, and not because of deficient moisture as in the case of steppe soils. They lack the high content of soluble constituents or readily decomposable minerals usually present in steppe soils, their loose powdery structure, their thick humus horizon, and their black color.

The soils of the county have been identified as members of 23 series differing from each other in source of material and character and composition of the soil and subsoil.

The Miami series embraces the well-drained timbered lands, having light grayish brown surface soils and yellow or yellowish-brown subsoils with little or no mottling and resting upon unweathered calcareous material at a depth of 2½ to 3 feet. The series is represented in this county by three types, the fine sandy loam, loam, and silt loam.

The Crosby series differs from the Miami chiefly in having a grayer surface soil and a white or mottled light-gray and yellowish-brown, compact clay subsoil. The surface is flat to very gently undulating, and the natural drainage is deficient. Only the silt loam member is recognized in Porter County.

The surface soils of the Carrington series are dark brown, and the subsoils are brown to yellowish brown, resting upon unweathered, moderately calcareous till at 2½ to 3 feet. These soils have a nearly level to rolling topography and are naturally well drained. They are derived from ice-laid deposits, and the areas have existed under prairie conditions, where large quantities of organic matter accumulated in the soil. The Carrington silt loam is mapped and is one of the important types of the county.

The Clyde series is represented in the poorly drained depressions within areas of the Carrington, Miami, and Crosby soils, where there has been an accumulation of organic matter in the surface soil. The soil is black to very dark gray to a depth of 8 to 12 inches. The subsoil is mottled gray, drab, brown, and yellow, with gray as the dominant color. The substratum is calcareous till, and the lower subsoil may be moderately calcareous. Only one type, the silty clay loam, is mapped in Porter County.

The Waukesha soils are dark brown to black to a depth of 10 or 15 inches, with brown or yellowish-brown subsoils, which rest at a depth of 2 to 3 feet upon a porous substratum consisting of stratified beds of sand and gravel. The fine sandy loam, loam, and silt loam types of this series are encountered in Porter County.

The Plainfield series includes light grayish brown soils with light yellowish brown subsoils and a sandy substratum which affords good to excessive underdrainage. The Plainfield fine sand, fine sandy loam, and loam are recognized in this county.

The Lucas series resembles the Plainfield somewhat in color of soil and subsoil. It differs from that series in having a heavy clay substratum, so that the soil is not droughty. Faint gray mottlings occur in the subsoil. The loam and silt loam members of this series are mapped in Porter County.

The Maumee series is characterized by black soils and a gray subsoil which, with depth, becomes slightly mottled with brown and yellow, or stained with bog iron ore. The substratum consists of stratified material which may be moderately calcareous. The Maumee loamy fine sand, fine sandy loam, loam, and silty clay loam are found in Porter County.

The Homer series includes forested soils similar to the Crosby soils in appearance, but differing from them in being derived from lake deposits and in having less lime in the subsoil. The soil is light gray, the subsurface is almost white, and the subsoil consists of mottled light-gray and yellow or brown, heavy, plastic clay. This series is represented by a single type, the silt loam.

The Newton soils are dark brown. The subsoils are yellowish brown, more or less mottled with gray, and are underlain by grayish stratified sand, silts, and clays which carry some limestone material. The Newton fine sandy loam, loam, and silt loam are mapped.

The recent alluvium of the overflowed stream bottoms is classed with the Griffin series. The surface soil is brown, and the subsoil brown mottled with drab and gray. The silt loam is the only member of this series encountered in Porter County.

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

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Miami silt loam	40,704	16.4	Maumee loamy fine sand	7,360	2.8
Hilly phase	2,624		Griffin silt loam	5,632	2.4
Miami loam	19,904	7.5	Light phase	832	
Muck	18,112	6.8	Crosby silt loam	5,824	2.2
Carrington silt loam	16,064	6.4	Newton silt loam	5,632	2.1
Light phase	896		Dunesand	5,376	2.0
Plainfield fine sand	9,792	6.1	Newton loam	5,312	2.0
Rolling phase	6,400		Newton fine sandy loam	5,120	1.9
Maumee silty clay loam	14,208	5.4	Swamp	4,736	1.8
Maumee loam	13,184	5.0	Waukesha loam	4,480	1.7
Maumee fine sandy loam	11,328	4.3	Plainfield loam	4,288	1.6
Miami fine sandy loam	10,688	4.0	Lucas loam	4,224	1.6
Clyde silty clay loam	9,664	3.6	Lucas silt loam	3,008	1.1
Waukesha silt loam	9,408	3.5	Waukesha fine sandy loam	2,432	.9
Plainfield fine sandy loam	9,344	3.5			
Homer silt loam	9,024	3.4	Total	265,600	

MIAMI FINE SANDY LOAM.

The soil of Miami fine sandy loam, to a depth of about 7 inches, consists of light grayish brown loamy fine sand to fine sandy loam, and from 7 to 12 inches a light yellowish brown fine sandy loam. Below the average depth of 12 inches the material is a compact fine sandy loam to loam or sandy clay loam, and the lower subsoil or substratum may grade into moderately heavy till or into sandy strata. Gravel and bowlders are scattered over the surface and embedded in the soil. There is some reason to believe that much of this type represents the remains of an ancient beach line of Lake Michigan. There are local areas, as south of Sedley, where the sandy surface material extends to a depth of 3 feet or more, and is practically stone free. However, it has been so modified by erosion and mixed with till, which often appears at the surface on knolls and hillsides, that it is classed as a glacial soil.

This type occupies a more or less continuous belt across the county through Burdick and Sedley, and extends up Salt Creek valley to Valparaiso and along the Baltimore & Ohio Railroad to Coburg.

The topography ranges from steep gullied as on hillsides to fairly level areas as on the lower slopes of the moraine. A few kamelike and eskerlike bodies are included with the type.

Both surface drainage and underdrainage are good. Some steep areas are subject to erosion.

This type is not important in the general agriculture of Porter County, and has not been largely cultivated, because of its unfav-

orable topography and rather low natural productiveness. A part of it is forested, mainly with oak and hickory. The type has a large use as pasture for dairy cattle, especially in the rougher areas. Corn, oats, wheat, and hay are grown on the smoother land. Some farmers consider this land better for corn in wet seasons than the Miami silt loam, and wheat on this sandy land will survive a winter season that would greatly injure, if not destroy, the crop on the "clay lands." The type stands drought well where carefully tilled. The average yields on the portion of the type suitable for cultivation are about 30 bushels of corn, 30 bushels of oats, 1 ton of hay, and 18 bushels of wheat per acre.

Under the system of farming usually followed on the Miami fine sandy loam corn, corn ensilage, and hay are grown to feed dairy cows, which graze the hill pastures, while oats and wheat afford some cash returns. The crops usually are planned to protect the land from washing as much as possible. Practically the only fertilizer used is manure.

Well-improved land of this type is held for about $100 an acre.

In some cases greater profits might be had from this soil by growing truck crops. It is considered almost necessary to keep dairy cattle for the manure so greatly needed on this soil, but its productiveness may be maintained by growing cowpeas or soy beans, which not only add nitrogen and organic matter to the soil but make good hay and profitable seed crops. By liming and inoculation it is possible to grow alfalfa on the type.

MIAMI LOAM.

The soil of the Miami loam consists of a light-brown or brownish-gray fine-textured loam about 10 inches deep. The subsoil is a light-yellow or yellowish-brown loam to silt loam, becoming heavier and more compact with depth. The lower part of the soil section is sometimes lighter textured, and more open. Bowlders and gravel may occur on the surface and throughout the soil section and substratum. To a depth of 3 feet or more there is not sufficient lime in the soil to cause it to effervesce with acid. In Porter County the Miami loam is made to include that land intermediate between the silt loam and fine sandy loam, and shows textural variations in both the soil and subsoil.

This type occurs chiefly along the borders of the central moraine occupied by the Miami silt loam. Little of it is found southwest of Valparaiso, though several areas are mapped along Wolf Creek Ditch. There are several areas in the vicinity of Burdick.

In topography the Miami loam resembles the silt loam, but it is probably more rolling, is dissected by draws, and is less favorable for farming. It often occupies the slopes of valleys and knolls or ridges.

The surface drainage is good, and underdrainage is better than in most of the silt loam type. Some fields are subject to erosion.

This type is not nearly so extensive as the Miami silt loam. About 75 per cent of it is under cultivation and the remainder is in pasture or woodlots. As on the silt loam type, the farming consists of dairying and growing corn, oats, hay, and wheat. Crop yields almost equal those on the silt loam.

The Miami loam is handled in much the same way as the Miami silt loam. Probably more of it is in pasture. It is somewhat easier to cultivate and keep in good tilth, owing to the more loamy character of the surface soil, but the topography often necessitates small or irregular fields, and care to prevent erosion. Excepting barnyard manure, little fertilizer is used.

The average value of this type is about $100 an acre.

Like the other light-colored soils, this type is in need of organic matter and nitrogen, which are best supplied by adding manure and growing the legumes.

MIAMI SILT LOAM.

The Miami silt loam typically is a light grayish-yellow or brownish-gray, smooth, friable silt loam to an average depth of 10 or 12 inches. This is underlain by light yellowish brown or buff silt loam to silty clay loam, which is slightly friable, but becomes somewhat plastic at about 22 inches. The lower subsoil is a somewhat plastic, moderately compact silty clay loam, becoming heavier and more brittle with depth. It is yellowish brown in color, and sometimes faintly mottled with yellow and gray. Lime can not be detected by tests with acid within 2½ or 3 feet of the surface, but is usually found in the lower lying material and throughout the substratum, which usually is a heavy till extending to a considerable depth. Some bowlders and small stones are found on the surface and in the soil section.

Some variations from the typical occur within the areas of this type. On the morainic ridge northeast of Chesterton there is a tendency toward the mottlings and the heavy compact subsoil of the adjoining Crosby silt loam. Where the Miami silt loam is intricately associated with the loam and fine sandy loam types, some slight textural variations occur in the soil and subsoil. In the large areas along the Valparaiso-Hebron road, the soil is comparatively uniform in texture. In a virgin state the type has a dark-gray surface layer 1 to 3 inches thick, representing the zone of leaf mold accumulation. The surface of plowed fields when wet appears dark and when dry is very light.

The Miami silt loam comprises most of the top of the main dividing moraine of the county. One large area extends from Valparaiso to Woodville Junction, and another from near Hays School

to the Hurlburt Ditch, which represents the natural drainage way that doubtless was the fire guard for the timber against the prairie fires. Isolated areas occur near Hebron, Boone Grove, and Sedley, and south of Burdick.

In general the topography of the Miami silt loam is gently undulating to gently rolling, and is well suited to farming. Some of the type is quite flat. The rougher areas of this soil are mapped as a hilly phase.

The natural surface drainage is fair to good; underdrainage is poor, owing to the compact nature of the substratum. In many places the drainage has been improved by ditching. Tile drains are not in common use, as they do not seem effective in withdrawing the soil moisture from the dense subsoil.

The Miami silt loam is one of the most extensive and important types of the county. Probably 90 per cent is now under cultivation, and some of the land has been used more than 80 years. It originally supported a heavy growth of white, black, and red oak, hickory, walnut, and other trees. The principal crops are corn, oats, hay, and wheat, and nearly every farm maintains a dairy herd. Usually the whole milk is shipped to Chicago markets. Some hogs and a few beef cattle are kept. Rye, buckwheat, and potatoes are crops of minor importance. Corn yields 30 to 40 bushels, oats 25 to 35 bushels, hay 1¼ tons, and wheat about 18 bushels per acre. On well-improved land in good seasons these yields are greatly exceeded. Corn is likely to suffer in wet seasons, and wheat may winterkill in severe winters.

Farming on this type usually is designed to build up the productiveness of the soil and to keep it in good physical condition. The rotations generally include corn, oats, wheat, and clover and timothy. Either the wheat or oats may be omitted, and if a good stand of clover is not obtained the land may be put in some other crop. A part of the corn crop is used for ensilage, which constitutes an important part of the feed for dairy cows and other stock.

Relatively small quantities of commercial fertilizer are used on this land, largely because there is so much manure available. It is recognized that the soil is primarily in need of organic matter and nitrogen. Bone meal and acid phosphate are the chief fertilizers bought.

The average value of farms consisting largely of the Miami silt loam is about $140 an acre. Well-improved farms are held for higher prices, and some land of the type can be bought for less.

As this soil is slightly acid, the use of lime is beneficial, especially where clover is grown. Surface and tile drainage should be extended

Miami silt loam, hilly phase.—The hilly phase of the Miami silt loam is almost identical with the main type in the soil section and

substratum. There are bowlders or gravel on the surface in places. The principal areas are mapped near Beatrice, Oster School, Hays School, and 2 miles east of Flint Lake.

The topography is quite steeply rolling to rough and hilly, so that only small areas are suitable for cultivated crops. The surface drainage is good to excessive, but washing is only slight because of the coherent nature of the soil and the protection afforded by grasses and timber. The phase is inextensive in Porter County. In a few small fields in the smoother parts corn, wheat, and oats are grown. Possibly 20 per cent of the type is forested. A part of it is utilized for hay production but most of it is in pasture. Crop yields are low.

This phase is valued at about $75 an acre. Its best use is for hay production or permanent pasture.

CROSBY SILT LOAM.

The Crosby silt loam consists of a light grayish brown, friable silt loam, underlain at about 8 inches by a friable silt loam subsurface layer, which is usually light gray to almost white in color. The subsoil is a mottled light-gray, yellow, and brown, heavy, plastic clay. The surface of this type when dry is very light colored. Sometimes a distinct subsurface layer is lacking, but the subsoil is always mottled light gray, and is more compact and impervious than the corresponding material in the typical Miami silt loam. Some local spots are included where the texture of the surface soil is lighter than a silt loam.

The largest and most typical areas of the Crosby silt loam are found in the moraine north and northeast of Chesterton. Other areas occur in slight depressions in the gently undulating land east and south of Flint Lake, where there are also areas too small and indefinite to map.

In general the topography is gently undulating to flat, and the areas are lower than the surrounding soils. The surface drainage is not well developed; in a few cases artificial drainage has been provided. The heavy, impervious subsoil prevents underdrainage, and the mottling of the subsoil is present even on slopes.

This type has a small total area. The greater part of it is utilized for crop production and pasture. Possibly 10 or 15 per cent of the type is forested, the principal trees being oak and hickory, with some elm, ash, and pin oak in more poorly drained situations.

Oats, wheat, and hay are more important crops than corn on the Crosby silt loam, and dairying is the most important live-stock industry. Under average conditions oats yield about 30 bushels, wheat 15 bushels, and rye 12 bushels per acre. Timothy yields over 1 ton of hay per acre. This soil is cold and late, and corn planting frequently is so delayed that the crop can hardly mature

before frosts. In wet seasons the crop is likely to be a failure, but under favorable conditions yields of 25 bushels or more per acre are obtained.

The Crosby silt loam is used largely for dairying, a large part being in pasture and hay land, with corn grown for ensilage and small grains as cash crops. Practically the only fertilizer used is barnyard manure.

This type sells for about $100 an acre, though the price varies according to location and improvements.

The principal needs of the Crosby silt loam are more thorough drainage and the incorporation of organic matter to improve its physical condition and increase the nitrogen content. Although the substratum is calcareous, the surface material is deficient in lime. The use of finely-ground limestone improves the structure of the soil, and renders it more favorable for the production of clover and other legumes.

CARRINGTON SILT LOAM.

The Carrington silt loam consists of a dark-brown to black, friable silt loam about 12 inches deep, underlain by brown to yellowish-brown silty clay loam to silty clay. The substratum usually consists of a heavy, slightly calcareous till. Bowlders, stones, and gravel occur on the surface and in the soil. In flat areas and where the subsoil is dense, mottlings occur in the subsoil.

The greater part of this type occurs in the prairie belt around Hebron, Hurlburt, and Boone Grove. A large area lies about Wheeler, and is characterized by a somewhat heavier and more mottled subsoil than the typical Carrington silt loam, being more nearly like the Brookston silt loam.[1]

In general the topography of the Carrington silt loam is gently undulating to gently rolling, with long, smooth slopes and irregular knolls. Where it borders on the marsh lands south and east of Hebron and east of Boone Grove, the type is quite flat and has many of the characteristics of the Waukesha silt loam. The drainage is good. It is effected by depressions and small stream ways, which have been extended by open ditches and tile drains. The structure of the subsoil and substratum usually is open enough to permit underdrainage and oxidation of the material to a depth of several feet.

The Carrington silt loam is one of the most important soils, agriculturally, in Porter County, and includes practically no waste land. It originally was prairie, although a scattered growth of bur oak and hazel brush occurred near the forested lands. It is a good general-farming soil, and corn, oats, and hay are the principal crops. Beef cattle, dairy cattle, and hogs are raised. Thirty-five or forty bushels of corn or oats per acre is considered a fair yield, but this may be

[1] The Brookston soils differ from those of the Carrington series in having mottled subsoils and flatter surface features with less well developed drainage.

almost doubled. Yields of about 1¼ tons per acre of timothy or mixed timothy and clover hay are obtained.

This type is handled largely under the system of farming prevailing in the corn belt. Corn, the principal crop, is sold or fed to hogs, cattle, and horses. The shredded corn stalks are used for winter roughage, and a part of the crop usually is put in the silo. With the exception of barnyard manure very little fertilizer is used.

The greater part of this type is valued at $125 to $200 an acre.

Carrington silt loam, light phase.—The Carrington silt loam, light phase, is not sufficiently extensive to warrant mapping as a separate soil type. The soil to a depth of about 10 inches is a dark-brown loam. This is underlain by a brown loam which grades into yellowish-brown or buff silty clay loam to silty clay at depths of 12 to 18 inches. The areas mapped occur near Hebron and southeast of Valparaiso along the edge of the moraine and outwash plain. The phase usually occupies slopes or smoothly rounded knolls; the topography is suitable for farming.

Both the surface and underdrainage are naturally well established.

Corn, oats, and hay are the principal crops. Some fields are used for pasture. Crop yields approximately equal those obtained on the typical Carrington silt loam.

The Carrington silt loam, light phase, is considered slightly easier to cultivate than the typical soil, but the methods of handling and farm values are about the same as on the main type.

CLYDE SILTY CLAY LOAM.

The soil of the Clyde silty clay loam is black, and ranges from a silt loam to a silty clay loam in texture. The subsoil is a light-gray or drab, heavy, plastic silty clay, mottled with yellow and brown below about 24 inches. In places the gray color predominates in the lower subsoil, and the yellow color in the upper part. The substratum consists of moderately calcareous till. Some stones are found on this type. The soil is derived from till occurring in depressed, wet areas. The surface may consist partially of wash from the adjoining land, and it is difficult in some areas to decide whether the soil should be classed with the Clyde series or with the Maumee series, the soils of which are derived from lake sediments.

The Clyde silty clay loam generally occurs in relatively small areas surrounded by Carrington, Miami, and Crosby soils. Originally it supported a growth of marsh grasses, though areas associated with forested soils sometimes were covered with water maple, elm, ash, willow, and other trees. Areas of this type are scattered throughout the morainic belt in the central part of Porter County.

The surface is flat and low, though not always distinctly depressed below the adjoining types. The natural drainage is naturally very

poor, so that ponds form in wet seasons, but surface ditches are being extended through most of the areas.

This type, although mapped in a number of areas, has a small total acreage. As the drainage is improved, these areas, formerly used only for hay production or pasture, are used more extensively for cultivated crops, chiefly corn, oats, and timothy. Clover is sometimes grown, and some areas still support a growth of native grasses.

Timothy yields about 1½ tons per acre. Where the land is well drained and in favorable seasons corn and oats yield 35 or 40 bushels per acre. Corn is sometimes injured by early frosts, but good yields of ensilage corn are obtained.

This land is new and naturally productive, and little use is made of fertilizers or manure.

The selling price of the Clyde silty clay loam depends largely upon the value of surrounding soils. Well-improved and well-located farms sell for $125 to $175 an acre.

The chief need of this land is drainage.

WAUKESHA FINE SANDY LOAM.

The soil of the Waukesha fine sandy loam is a dark-brown, mellow, fine sandy loam, averaging 10 or 12 inches in depth. The subsoil is a brown or yellowish-brown fine sandy loam or loam, which usually grades into loose fine sand at about 30 inches. The substratum consists of the same loose material.

Practically all this type occurs in several areas south and southeast of Valparaiso. It usually lies near the old glacial channels, and may in some cases be derived from the sandier layers which underlie other Waukesha types. The topography is level to slightly undulating near the glacial channels. Both the surface drainage and underdrainage are good. The latter may be excessive, making the soil somewhat droughty.

The relatively small acreage of this type in Porter County is all under cultivation. Corn, oats, hay, and wheat are the most important crops. In average seasons the yields equal those on the Waukesha loam, but they may be decreased in times of drought. The productiveness of this type is maintained by growing clover and applying barnyard manure.

The value of this land ranges from about $100 to $150 an acre.

WAUKESHA LOAM.

The Waukesha loam is dark brown to a depth of 10 or 12 inches, where it becomes buff brown, the loam grading into yellowish-brown sandy loam within 3 feet of the surface. The substratum consists of porous gravelly material similar to that underlying the Waukesha silt

loam. Boundaries between this type and surrounding soils necessarily are largely arbitrary, as it merges very gradually with the Waukesha silt loam and fine sandy loam on the one hand, and has some of the mottled and acid characteristics of the Newton soils on the other.

The Waukesha loam occurs in close association with the Waukesha silt loam, but usually farther south from the moraine. It is practically identical with the silt loam in topography, drainage conditions, and extent of use. It may be slightly more subject to drought.

Corn, oats, and hay are the main crops. Yields of 35 to 40 bushels or more of the grains and 1 ton of hay per acre are obtained. The Waukesha loam is devoted largely to grain farming, though some cattle and hogs are raised. No important use is made of commercial fertilizers.

This type has a somewhat lower average value than the Waukesha silt loam, because of its distance from towns and association with poorer soils.

The Waukesha loam would be benefited by artificial drainage in some of the lower places, and liming would be helpful where a growth of dewberries and red sorrel indicate an acid condition.

WAUKESHA SILT LOAM.

The Waukesha silt loam is a dark-brown silt loam about 10 inches deep, underlain by a brown to yellowish-brown silt loam to silty clay loam, which in turn passes into lighter brown sandy loam or even loose sand at depths of 2½ to 3 feet. The substratum consists of sandy and gravelly material containing a considerable percentage of shale and some limestone fragments. This outwash material usually rests on till at 30 to 50 feet below the surface. The soil tends to become lighter textured along the contact with the Waukesha loam, and includes slight depressions in which the subsoil is mottled.

This type occurs along the border of the moraine in the highest part of the outwash plain. The largest areas lie 3 miles east of Valparaiso, near Malden and Tassinong School and northeast of Aylesworth School. It occupies plainlike bodies which are not always distinctly separated from ice-laid deposits.

The topography is in general flat, with slight relief where traversed by old drainage channels. The surface slopes gently to the south, with a gradient of 5 to 10 feet to the mile. The natural drainage is fair, and the slope of the land and the presence of the old channels favor the construction of ditches. The porous subsoil and substratum afford good underdrainage, although the land is not considered droughty.

The Waukesha silt loam is almost entirely under cultivation. Corn, oats, and hay, with some wheat, are the principal crops. The

dairy and live-stock industries are not so important as on the "clay" lands. Corn and oats average about 40 bushels per acre and are less subject to injury in wet seasons than on types with dense clay subsoils. Timothy, or timothy and clover mixed, yields about 1½ tons of hay per acre.

Farms on this type are handled under the usual grain-farming system. The farmers depend on the use of barnyard manure and the growing of clover for maintaining the productiveness of the land.

Most of this type is well located and well improved. The average value is somewhat over $150 an acre.

PLAINFIELD FINE SAND.

The Plainfield fine sand consists of a light grayish brown, loamy fine sand 6 or 8 inches deep, underlain by light yellowish brown loamy fine sand to loose fine sand, which usually extends to considerable depths without change.

This type occurs most extensively near Kouts and Baums Bridge, and from McCool westward to Lake County. A few areas are found near Montdale and Clanricarde and in other parts of the county.

The topography is flat and smooth to slightly ridged and billowy where the wind has shifted the surface material to some extent. On account of its comparatively elevated position above the water table in the Kankakee Basin and the loose character of the soil material, the type is somewhat droughty. This tendency has been increased by the extensive drainage operations of recent years.

The importance of this type has been decreased since the black marsh lands have been drained and prepared for cultivation. Possibly 15 or 20 per cent of the type is forested, chiefly with red, black, and pin oak and some hickory. In general the trees are larger and more thrifty than those on the extensive areas of this type in Starke County.

Corn, oats, wheat, and hay are the most important crops. Dairying and other stock industries are relatively unimportant. The better part of the type produces yields approximately equal to those obtained on the Plainfield fine sandy loam, but crops on the loose, droughty, and slightly drifted areas do not do so well. Usually all the available manure is applied to the fields, and some commercial fertilizer is used for corn and wheat.

The value of this land ranges from about $40 to over $100 an acre, according to the productiveness of the soil and its location.

This type requires the same treatment as the Plainfield fine sandy loam. The production of cowpeas, both for the seed and for soil improvement, has been found profitable, and much of the land would be benefited by light applications of lime.

Plainfield fine sand, rolling phase.—In uncultivated areas the rolling phase of the Plainfield fine sand consists of 2 or 3 inches of brown loamy fine sand, overlying yellowish-brown, loose fine sand. In plowed fields the dark surface color usually disappears.

This soil is mapped in a more or less continuous strip across the northern part of the county and in several irregular areas south of Kouts and near the Kankakee River.

The topography is ridged and dunelike, and this is the distinguishing characteristic of the phase. It ranges from slightly billowy to almost as rough as the dunes along the lake front. The phase is very droughty.

It is estimated that nearly one-half the phase is covered with a rather scrubby growth of oak. There is a scattering of pine north of Furnessville. Some areas are underlain by heavier material, which holds the water comparatively near the surface, and the trees on such areas have a more sturdy appearance.

The principal crops grown are corn, oats, wheat, and hay. Many farmers are experimenting with special crops, such as cowpeas, cucumbers, tomatoes, and even alfalfa. Some dairy cows and other stock are pastured.

Although only the better parts of this phase are farmed, the average crop yields are hardly profitable. Some manure is applied, and weeds, stubbles, etc., are commonly plowed under.

For farming, little of this phase is valued at more than $50 an acre, although much of it is held at higher prices because of its speculative value as sites for manufacturing plants along the lake front.

This soil is in need of the same treatment as the Plainfield fine sand, but probably can not be converted into a strong soil. There is a possibility that this and other light sandy soils of the county could successfully be used for the production of huckleberries. These berries grow wild and bear well even on the dunelike hills.

PLAINFIELD FINE SANDY LOAM.

The Plainfield fine sandy loam consists of a fine sandy loam to loamy fine sand. It is grayish brown to a depth of 8 to 10 inches, below which it becomes light yellowish brown. At about 20 inches there is a relatively compact stratum of fine sandy loam to clay loam, and this grades into loose, yellowish-brown sand at about 3 feet. The loose material also makes up the substratum. This type may grade into the Plainfield fine sand on the one hand, and the Plainfield loam on the other. In some places the surface soil is dark to a depth of several inches. A few low-lying areas have unusually heavy subsoils, slightly mottled with gray and somewhat acid.

This type is found in a number of areas on the Kankakee Plain, the most typical of which occur in the vicinity of Kouts. Areas are mapped at Chesterton and 2 miles northeast of Burdick, where sandy delta deposits were laid down in the bay of glacial Lake Chicago.

The topography is level, though slightly ridged and elevated where the type occupies the natural levees of glacial outwash channels. The type is well drained and sometimes droughty, because of the loose sandy nature of both soil and subsoil.

The Plainfield fine sandy loam has a relatively small total area in Porter County, but was one of the first soils brought under cultivation in the Kankakee Basin. Only a small part of it is forested, the timber consisting of good-sized oak and some hickory.

Like the Plainfield loam, this type is used for general farming, which includes the production of corn, oats, hay, and wheat, the raising of some hogs, and fattening steers. Crop yields depend largely upon the way the soil is handled. Where it has been carefully cultivated, manured, and used for growing clover, yields of 25 to 30 bushels of corn per acre and about the same yield of oats are obtained, with much better yields in particularly favorable seasons. Timothy and clover produce about 1 ton of hay per acre.

The selling price of this soil is about equal to that of the Plainfield loam.

The productiveness of the Plainfield fine sandy loam could be increased on many farms by adding organic matter to the soil. Where other conditions are favorable, dairying and feeding operations are beneficial, owing to the manure produced. Where it is difficult to grow clover, cowpeas may be grown. This crop may be sown broadcast and cut for hay or pastured and turned under, or it may be planted in rows and harvested for the seed or for hay. Where acid-indicating plants, such as dewberries, cinquefoil, and sorrel, are plentiful, liming should prove beneficial.

PLAINFIELD LOAM.

The Plainfield loam consists of 8 or 10 inches of light grayish brown loam to heavy fine sandy loam, underlain by a light yellowish brown loam or fine sandy loam which passes into loose sand at about 30 inches. In some spots the subsoil is a clay loam, slightly mottled with gray and brown. The substratum consists of a deep deposit of loose sand and gravel.

Most of this type is included in several areas in the northern and higher part of the outwash plain. Some of the largest areas are near Malden and north of Liberty View.

The surface is flat and level except for the general southward slope of the outwash plain and the irregular slopes along old glacial channels.

The type occupies a part of the low natural levees along the old channels and therefore lies slightly higher than land farther back. The drainage is naturally good, owing to its elevated position and porous subsoil. Since the extensive drainage system of the Kankakee Basin has lowered the water table several feet, all the Plainfield soils are more subject to drought than formerly.

While the Plainfield loam is not extensive in Porter County, it includes some of the better land of the outwash plain, and is largely cultivated. A small part of the type still supports a thrifty growth of oak and hickory. The principal crops are corn, oats, hay, and wheat. Cattle and hogs are fed or raised in small numbers on most farms.

Most of this type is carefully handled. Corn yields 20 to 50 bushels, averaging about 30 bushels per acre. About 30 bushels of oats per acre are obtained. A ton of timothy hay per acre is considered a fair yield. Considerable use is made of manure for improving the type, and clover is grown where a good stand can be obtained.

The Plainfield loam is held for $75 to $140 an acre, according to improvements, location, and condition of the soil.

This type is in need of organic matter, which can be supplied by adding manure and growing legumes. Cowpeas and soy beans would be valuable crops. Liming facilitates the growing of the legumes, especially clover. Thorough cultivation renders the soil more drought resistant.

LUCAS LOAM.

The Lucas loam, as mapped in Porter County, is rather variable, and much of it might properly be classed with the Homer series if the bodies of such character were of sufficient extent to warrant separation. In the most typical areas the surface 8 inches is a brownish-gray heavy loam. This is underlain by light yellowish-brown loam, which quickly passes into yellowish-brown, heavy, plastic clay, more or less mottled with gray. Sometimes the light-gray color in the subsoil is very pronounced. Local variations occur, where the texture of the surface soil approaches a fine sandy loam. The type is derived from lake-bed deposits which may have a slight overwash of lighter material where the areas lie near streams issuing from the moraine.

This type is mapped in scattered areas in the lake plain north of the Valparaiso Moraine, the largest area lying southeast of McCool. The topography is level except where small draws and streams occur.

The Lucas loam type was originally forested, and the natural drainage was good because of its proximity to streams. In some areas where the surface drainage was imperfect, the subsoil has the characteristics of that of the Homer series.

The Lucas loam is too inextensive to be of any importance in the agriculture of Porter County. Most of it is cultivated, however, and the remainder is used for pasture or woodlots.

Corn, oats, wheat, and hay are the chief crops, and some stock is kept. Wheat is less subject to winterkilling than on the heavier lands, and the soil is somewhat better for corn in wet seasons than the Lucas silt loam.

The greater part of this type is valued at $125 to $175 an acre.

LUCAS SILT LOAM.

The Lucas silt loam is a grayish to yellowish, friable silt loam, underlain by light-yellow or yellow, friable silt loam to silty clay loam, slightly mottled with gray. This passes at about 18 inches into light yellowish brown, dense, plastic silty clay. The substratum consists of the same heavy clay, which contains an abundance of lime concretions at depths of 4 to 7 feet. Occasionally light-gray mottlings occur in the subsoil, but these are not typical.

This soil is derived from the weathering of heavy water-laid clays. It is encountered in the northern part of the county near Chesterton and McCool.

The topography is typically flat, but as mapped in this county the type includes narrow belts of sloping land, along the Calumet River and Salt Creek. It usually occupies slightly higher elevations than adjacent land, and because of its elevated position and the dissection by small streams, the natural drainage is good.

The Lucas silt loam is inextensive, but where it is not too broken it is devoted to farming. The rougher areas are forested with oak and hickory.

On most of this type general farming includes the production of grain, stock raising, and dairying. The ordinary yield of corn is about 35 bushels per acre, of oats about 35 bushels, and of wheat about 20 bushels. This is a good hay soil, producing over 1½ tons of timothy per acre. The type is usually well fertilized with barnyard manure, and clover is included in the rotation for its beneficial effect on the soil.

The Lucas silt loam occurs in such irregular and small areas that its value depends largely on special conditions and on the value of adjoining soils. Most of it is valued at more than $125 an acre.

The principal need of this type is organic matter.

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

Mechanical analyses of Lucas silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
282591	Soil	0.1	1.0	1.3	12.0	6.8	68.1	10.6
282592	Subsurface	.0	.4	.5	5.7	4.3	75.0	14.0
282593	Subsoil	.0	.3	.4	4.0	3.9	66.0	25.3
282594	Lower subsoil	.0	.9	1.3	10.0	6.5	48.1	32.9

MAUMEE LOAMY FINE SAND.

The Maumee loamy fine sand consists of a black or dark-gray loamy fine sand, ranging from 8 to 16 inches in depth, and underlain by light-gray, loose, incoherent fine sand. The deeper areas may have a slightly heavier subsoil than the typical. In places the subsoil is mottled with yellowish brown and rusty brown. Near Dunnes Bridge a variation of this type is forested with pin oak and blackjack oak, the typical soil being marshy prairie.

The Maumee loamy fine sand is largely confined to a strip of land within 2 miles of Lake Michigan, with a large area along the Kankakee River in the southeastern part of the county. A few small areas are found in other parts of the Kankakee Basin.

The type has a smooth, level surface. It was originally marshy and covered with water a part of the year The areas occurring in the northern part of the county are difficult to drain and are wet in rainy seasons. The part of the type around Finns is so near the level of the Kankakee River that dredged ditches do not give sufficient outlet, although they greatly improve the drainage conditions.

This soil is unimportant in Porter County because of its small extent, rather low natural productiveness, and undeveloped condition. It is estimated that over one-half the type is in forest or marshes, but more is being reclaimed each year.

Corn and oats are the principal crops, and considerable marsh hay is cut. Some buckwheat is grown on land that is too wet in the spring to put in corn. Cattle are grazed on parts of the type. The average crop yields are somewhat lower than on the Maumee fine sandy loam, although only the best part of the type is farmed. Liming has been found beneficial in some areas, and phosphatic fertilizers usually are profitable on such land.

The value of undeveloped areas of this type is very low, but improved, cultivated land is held for $75 to $100 an acre.

The Maumee loamy fine sand is primarily in need of improved drainage, and where drained liming is beneficial.

MAUMEE FINE SANDY LOAM.

The soil of the Maumee fine sandy loam is a black, mellow fine sandy loam to loamy fine sand, ranging in depth from 12 to 20 inches. This is underlain by a dark-gray, slightly mottled with yellow, fine sandy loam, grading within a few inches into a light-gray fine sandy loam. In places rusty-brown mottlings are present in the subsoil. The substratum usually consists of light-gray, loose sand, more or less mottled with yellow. The principal variations of this type are areas having a slightly mucky surface or areas approaching the Maumee loamy fine sand in texture.

Most of the Maumee fine sandy loam is comprised in one area lying south of Clanricarde and Kouts. Other small areas occur along Crooked Creek and Sandy Hook Ditch.

This type has the characteristic level topography of the other Maumee soils. Fifteen to twenty-five years ago this land was in the midst of the Kankakee marshes; to-day it is good farm land, having been reclaimed by dredged ditches. All the type is used for agriculture, and corn, oats, hay, and wheat have displaced marsh hay, which was formerly the only crop produced.

This soil is practically virgin, and the yields are still good. Corn and oats produce from 25 to 55 bushels per acre. Wheat averages nearly 20 bushels per acre, with yields as high as 40 bushels in exceptionally favorable years. Yields of timothy and clover hay range from 1 to 2 tons per acre.

Farmers on this soil make little use of fertilizer, except potash, applications of which are made on slightly mucky land and in fields where corn is damaged by insects.

The Maumee fine sandy loam usually is valued at $100 to $150 an acre.

The large dredged ditches traversing this type afford good outlets, but some parts of it would be benefited by tile drainage.

MAUMEE LOAM.

The Maumee loam consists of a black loam to a depth of about 10 inches, underlain by a dark-drab, mottled with brown, heavy loam to clay loam, passing at about 20 inches into light-gray, more or less mottled with yellow and brown, plastic clay. Textural variations occur where the surface consists of fine sandy loam to a depth of 2 or 3 inches, and also where the surface is slightly mucky. The substratum usually consists of water-laid sand and gravel interstratified with layers of heavier material.

Most of the Maumee loam is mapped near Crooked Creek and other shallow drainage channels of the Kankakee basin. A few small areas occur within or north of the morainic belt. Although originally marshy, this type has been reclaimed by dredged ditches, and is now fairly well drained.

The Maumee loam is fairly extensive and one of the important glacial-lake soils. It comprises no waste land.

Fifteen or twenty years ago marsh hay was practically the only crop, but this is now of minor importance. Corn and oats, with some hay and wheat, are the principal crops grown. Most farmers raise a few hogs and beef cattle. This land is quite productive where properly drained. Yields of 35 to 40 bushels of oats and corn, about 20 bushels of wheat, and about 1¼ tons of hay per acre are obtained. Fertilizers have never been used to any great extent.

The selling price of this land is about the same as that of the Maumee silty clay loam.

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

Mechanical analyses of Maumee loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
282517	Soil	2.1	7.0	8.0	20.7	14.6	34.4	13.1
282518	Subsurface	2.9	7.4	9.7	22.5	11.1	27.9	18.2
282519	Subsoil	1.2	7.7	11.4	27.8	10.6	23.8	17.4
282520	Lower subsoil.	4.0	17.9	14.2	22.2	8.5	19.9	13.3

MAUMEE SILTY CLAY LOAM.

The Maumee silty clay loam consists of a black silty clay loam grading at 8 to 12 inches into a dark-drab silty clay, slightly mottled with brown, and this passes at about 20 inches into light-gray or drab, plastic clay, mottled with rusty brown. Considerable variation occurs in the color because of the occurrence of local spots of bog iron ore or spots where a mucky surface soil has burned off. In local areas the surface material may consist of muck to a depth of several inches.

The Maumee silty clay loam is mapped in the old drainage channels cut in the outwash plain south of the Valparaiso Moraine. None, however, occurs southeast of Kouts, where the Kankakee Basin soils become sandier. Other areas occur in the northern part of the county, especially several miles north of Burdick. A few areas along existing streams are partly alluvial in origin. The surface of the type is flat and level except for a gentle slope toward the stream ways and the presence of very slight ridges and depressions.

This type originally was marsh land, and covered with water at least a part of the year. Ditches have lowered the water table, and the type is no longer inundated. Much of this soil has a more or less sandy substratum, and dredged ditches are unusually effective.

Nearly all this land is under cultivation. Corn and oats are the principal crops. Marsh hay, formerly the chief crop, is still cut from a few fields. Timothy and clover are grown, and cattle, usually the beef type, are pastured. Corn and oats yield about 40 bushels per acre in well-drained fields, but the yields depend largely on the season. The yield of timothy or clover hay is about 1½ tons per acre.

This land is new and strong and the farmers have given little attention to fertilizing it or maintaining its productiveness. In the slightly mucky areas some potash has been used in growing corn.

Most of the Maumee silty clay loam is held for $100 to $150 an acre.

More thorough drainage is the main need of this land. Although outlets are now provided, many fields need tiling to hasten the removal of water, so that crops may be seeded early and cultivated regularly. The rotation of crops, including the legumes, is beneficial on this soil.

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

Mechanical analyses of Maumee silty clay loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
282557	Soil	0.4	1.5	2.0	20.3	16.3	41.6	17.9
282558	Subsoil	.5	1.8	2.7	15.9	14.0	42.9	22.3
282559	Lower subsoil.	.2	1.3	2.3	15.3	14.0	42.2	24.8

HOMER SILT LOAM.

The Homer silt loam consists of a light-gray to brownish-gray, rather compact silt loam to a depth of about 8 inches, where a light-gray to white silt loam subsurface layer is encountered. The subsoil, which begins at 12 to 16 inches, consists of light-gray or drab, more or less mottled with yellow and brown, heavy, plastic clay. Some color variations occur. Accumulations of organic matter in places make the surface soil somewhat darker, while in other places the entire soil section is a very light-gray. More yellow occurs in the subsoil, in the zone of transition between the Homer silt loam and the Lucas soils.

The soil materials giving rise to this type consist of heavy lake-bed deposits, entirely free from stone. The substratum is a heavy compact clay, calcareous at a depth of 5 or 6 feet, where lime concretions are found.

The Homer silt loam is mapped in the lake plain north of the moraine, mainly south of the Calumet River, the largest area occurring between Chesterton and Crocker. Other areas are mapped northeast of Chesterton and northwest and northeast of Wheeler.

The topography is flat, with only a few slight irregularities. This soil is not reached by natural drainage ways, but ditches afford an outlet for surface waters. The heavy clay subsoil and substratum greatly retard underdrainage.

This is one of the more extensive and important types in the lake plain along the northern boundary of the county. Originally it was covered with a forest of red, black, and pin oak and elm, but with the exception of a few woodlots, it has all been cleared and placed under cultivation.

The Homer silt loam is a good grass and small-grain soil, and a fair corn soil. The average yields per acre are nearly 1½ tons of timothy hay, 35 to 40 bushels of oats, 20 to 25 bushels of wheat where the crop escapes winterkilling, and about 35 bushels of corn when the season is not too wet. Most of the farmers keep a few cows and ship milk to Chicago.

The value of this land depends largely upon the manner in which it has been handled and improved. It is held at prices ranging from $100 to $200 an acre.

The principal needs of the Homer silt loam are improved drainage, which would insure better corn crops in wet seasons and make it easier to keep the land in good tilth, and an increase in the organic-matter supply.

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

Mechanical analyses of Homer silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
282532	Soil	0.5	1.6	2.1	9.5	6.0	59.2	21.2
282533	Subsurface	1.5	1.9	1.9	10.2	5.8	56.5	22.0
282534	Subsoil	.2	1.1	1.2	6.8	2.6	49.7	38.1
282535	Lower subsoil.	1.4	4.7	11.7	62.5	3.9	11.4	4.2

NEWTON FINE SANDY LOAM.

The Newton fine sandy loam consists of about 6 inches of mellow loamy fine sand to fine sandy loam grading into light grayish brown or yellowish-brown loamy fine sand to fine sandy loam more or less mottled with yellow and brown. The deep subsoil and substratum usually consist of yellowish-brown loose sand and gravel.

The boundaries of this type are often difficult to establish, as the soil grades by imperceptible changes in elevation or color into surrounding Maumee, Plainfield, and Waukesha types.

This type is mapped in a large area near Grassmere and in several smaller bodies in this part of the county.

The surface is level except for a general southward slope of about 5 feet per mile. The type occupies a position intermediate in elevation between the lower lying Maumee types and the higher Plainfield soils. The natural drainage of the Newton fine sandy loam was imperfect, notwithstanding the porous substratum, because of the high level of the water table throughout the Kankakee Basin, but the soil is now well drained by a system of ditches.

Typically the Newton fine sandy loam is a desirable soil, comparing favorably with the heavier soils in crop yields, but in Porter County crops on this type do not do so well as elsewhere. The soil seems to be in an extremely acid condition. Where it is still in prairie sod the grasses make a very irregular, patchy growth, while on the lands that have been cultivated there may be a dense growth of dewberries, cinquefoil, briers, white violets, and sorrel. The corn crop is frequently a failure, and oats and wheat make a very patchy growth. Efforts to grow clover have generally proved unsuccessful.

Investigations of this class of land[1] indicate that its unproductiveness is due largely to acidity, and can be corrected by heavy applications of lime. It appears that nitrates with aluminum as the base, are formed rapidly, and these salts in very dilute solutions so inhibit the development of plant roots and root hairs that the crops fail or make only a stunted growth.

Formerly this soil was used chiefly for pasture and the production of wild hay, but within the last 10 years most of it has been improved and devoted to the production of corn, oats, wheat, and hay. While total crop failures formerly were common, crop yields have generally been increased and are about equal to those obtained on the Maumee fine sandy loam.

The greater part of the Newton fine sandy loam has been improved by drainage, followed by heavy applications of lime or finely ground limestone. In most cases it has been found necessary and profitable to apply phosphatic fertilizers.

This land is held for $100 to $150 an acre.

NEWTON LOAM.

The surface soil of the Newton loam is a dark-brown, mellow loam to heavy fine sandy loam, ranging from 8 to 12 inches in depth. The subsoil to a depth of about 2½ feet is a mottled yellowish-brown

[1] Bul. No. 170, Ind. Agr. Expt. Sta. See also Bul No 157, of the same station.

and gray loam changing below to a grayish sandy loam or gravelly sandy loam, which usually extends to a depth of several feet. In most of the type the soil is acid, and the upper subsoil may be slightly acid to neutral, but the lower subsoil and the substratum, where very little weathering has taken place, may carry some calcareous material.

This type occurs in a large body around Liberty View and in several smaller areas scattered through the southern part of the county. It is flat and naturally poorly drained. The position of the type is intermediate between that of the Plainfield soils, which have good drainage, and the Maumee soils which in their original condition were under water a large part of the time.

The Newton loam is not extensive, and is not important in the agriculture of the county.

It is derived from water-laid sediments, in association with the Plainfield, Waukesha, and Maumee soils. Just why the soil is so strongly acid or toxic to plant growth has not been fully explained, but it seems to be a condition brought about by a high-water table and excessive evaporation from the surface. Better drainage is needed and when this is provided it is probable that the type will give more satisfactory results with all the crops now grown. It has been demonstrated that the acid or toxic condition of the soil can be overcome, in a large measure at least, by heavy applications of lime, and it is said that applications of phosphatic fertilizers are beneficial.

Most of the attempts at farming the Newton loam have proved unsatisfactory, except where lime has been applied. It is formed in the same way as the Newton fine sandy loam and the yields on the two types are about the same.

The value of the Newton loam ranges from about $100 to $150 an acre.

NEWTON SILT LOAM.[1]

The Newton silt loam consists of a dark brownish gray heavy silt loam, with an average depth of 10 inches, underlain by a grayish-brown, slightly mottled with brown and gray, silty clay loam, which grades at a depth of 12 to 16 inches into a mottled yellow, brown, and gray plastic silty clay. The substratum consists of lake-deposited clays, which are somewhat calcareous.

This type occurs almost entirely in the northwestern part of the county, as the lake-bed part of "Twenty-mile Prairie."

The surface of the type is quite flat, except for slight swales and irregularities. The drainage originally was imperfect, although this

[1] This soil is the same as one mapped in Lake County, Ind., the report of which will soon be published, as the Newton silt loam, heavy subsoil phase, and both differ from the typical silt loam in this subsoil feature.

land was not marshy like the Clyde soils. Artificial drainage has been provided by ditching and laying tile drains.

The Newton silt loam is inextensive, but all the type is well suited to crop production. Corn, oats, and hay are the most important crops. Some cattle are pastured.

Corn is a profitable crop, averaging 35 to 40 bushels per acre, with occasional yields of over 60 bushels. Oats usually give about the same yields, but in some years 50 to 70 bushels per acre is not an uncommon yield. Practically no fertilizers are used in growing these crops.

Land of this type has an average value of about $150 an acre.

The principal needs of this soil are more thorough drainage and crop rotation to maintain its natural productiveness.

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

Mechanical analyses of Newton silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
282569	Soil	0.6	1.8	1.5	6.6	7.3	64.7	17.4
282570	Subsurface	.8	2.0	1.4	4.2	5.1	60.1	26.4
282571	Subsoil	.4	1.2	1.0	6.0	5.2	47.8	38.6
282572	Lower subsoil.	.4	.6	.6	3.5	1.2	63.0	30.9

GRIFFIN SILT LOAM.

The Griffin silt loam is a dark-brown or chocolate-brown, friable silt loam from 8 to 12 inches deep, underlain by lighter brown silt loam mottled more or less with rusty brown and drab. In places the mottlings are very pronounced, and textural variations, such as fine, sandy strata, occur in the subsoil. In the narrow bottoms of small branches both the color and texture vary widely. In the Calumet Valley, where the stream enters Lake County, the soil is much darker and heavier than the typical Griffin silt loam. The type is derived from recent alluvium, washed largely from glacial soils, though partly from lake soils.

The greater part of the Griffin silt loam occurs in the bottoms of the Calumet River, Salt, and Coffee Creeks, and small streams flowing north from the county divide. The few areas found south of the divide are inextensive and are not typical.

The surface is flat and level except for the general slope of the stream valley and local irregularities representing abandoned stream channels. The drainage is fair near the streams but poor near the uplands. In rainy seasons most of the small streams overflow their bottoms.

This soil is inextensive, and only a small part of it has been cultivated. There are a few fields of corn and small garden patches on the type, and wild hay is cut in places, but weed seed carried by the streams lessens the value of the hay land. The best use for this type is pasture.

The price of the land ranges from $50 to $150 an acre, according to location and the nature of adjoining land. The wider bottoms of this type would make good corn and oats land if the streams were deepened and straightened, so as to prevent overflow.

Griffin silt loam, light phase.—The light phase of the Griffin silt loam, if of sufficient extent and importance to warrant separation, might properly be classed as the Griffin fine sandy loam. The surface soil consists of dark chocolate brown fine sandy loam, with an average depth of about 12 inches. The subsoil is a brown or grayish-brown fine sandy loam, more or less mottled with drab and shades of brown. Near the stream channels the texture is lighter and the color more uniform, while in lower parts of the stream bottom the subsoil is heavier and more mottled, as in the typical silt loam areas.

The phase is encountered in only a few areas, the largest of which is in the Salt Creek Valley west of Valparaiso. The area mapped in the Calumet Valley north of Burdick is hardly typical. Small areas are found east of Suman and northwest of Lake Hollister.

The topography is practically level and smooth except for the slight irregularities caused by old stream channels. The phase is naturally well drained, but is subject to overflow after very heavy rains.

A small part of this phase is forested with elm, maple, sycamore, and other lowland trees. A few small fields are cultivated to corn and truck crops. Most of the phase is used for pasture. In crop yields and general agricultural value the phase is probably equal to the typical soil, but it is somewhat better drained, warmer, and earlier.

MUCK.

Muck consists largely of decayed remains of marsh grasses and mosses. Usually it is very mellow, black vegetable mold to a depth of 3 feet or more. Sometimes decomposition has been retarded and brown, peaty, fibrous layers occur in the subsoil. Usually the deposits are from 3 to 10 feet deep. Variations occur in which the muck contains a relatively large admixture of sand and clay. In some areas the layer of muck is shallow and sand or clay is encountered within 18 to 36 inches of the surface.

The Muck is scattered through various parts of Porter County. The areas occur within bodies of glacial, glacial-lake, and outwash deposits. Some of the largest areas lie northeast of Furnessville, in the Calumet valley north of Crisman, south of Chesterton, around Canada Lake, and in the glacial outwash channels south of Valparaiso and Coburg.

The topography of much of the Muck is flat, but frequently it occupies a rather high position along the sides of depressions and stream channels. Such areas are due to the springs that issue from sandy strata and keep the hillsides in a saturated condition favorable to a luxuriant growth of vegetation.

In its natural condition the Muck was water-logged most of the time, and many areas are still very wet. However, ditching has reclaimed the greater part of the areas, and more of this land is brought under cultivation each year.

Corn is practically the only crop grown regularly on the Muck. In the shallower areas oats are sometimes grown. A few small fields are devoted to potatoes and millet. Marsh hay is cut from some Muck land, but a part of it is too hummocky and wet for any use except pasture. Corn on well-drained Muck yields 30 to 60 bushels per acre, but the quality is not so good as on the upland soils, and the crop is sometimes injured by early frosts. Oats do well, but are likely to lodge.

Little use has been made of any kind of fertilizer on this land, as it is new and very productive. Potash has a beneficial effect in increasing yields and improving the quality of the grain.

Although Muck lands were worth very little before drainage operations began, they are now held for $100 or more an acre.

Most fields of Muck need thorough drainage. Straw and ashes from wood or corncobs may be used to advantage for the potash they contain. The production of special crops, such as onions, potatoes, peppermint, sunflowers, etc., has been found profitable on such land in other localities.[1]

SWAMP.

Swamp comprises a continuous belt along the Kankakee River, varying in width from a few rods to about 2 miles along the Lake County line. The northern boundary follows the edge of the lowland timber and is usually marked by a small but rather sharp rise to areas of Plainfield and other soils, although in some places the adjoining land is low and marshy.

While this area has the position of a first bottom of the Kankakee River and has always been subject to overflow by that stream, little of the soil material is recent alluvium. A strip averaging only a few rods wide occurs as a slight natural levee along the main river channels, and in this strip the soil has the characteristics of the Griffin series.

The greater part of this forested area mapped as Swamp has a dark soil 1 to 3 feet deep, underlain by grayish, loose waterworn sand which is permanently saturated. Wide textural variations

[1] Farmers' Bul. 761, U. S. Department of Agriculture.

occur in this soil, but it is mainly a complex, mucky mass of material derived from the limbs, roots, and trunks of trees, rather than grass and moss. Where marshy Maumee soils adjoin the timbered belt, it is probable that their soil characteristics continue for some distance into the area mapped as Swamp.

The timber consists largely of water maple, ash, elm, and swamp oak, with some birch near the stream ways. In a few open glades rushes and cat-tails grow luxuriantly.

The capacity of the old river together with that of the dredged channels is far too small to carry off water from the extensive ditching in the upper part of the Kankakee Basin. As a consequence this low land is often inundated to a depth of several feet for weeks at a time. This condition may eventually be relieved by enlarging and deepening the outlet to the lower Kankakee Valley.

Farmers on the adjoining prairie land usually own woodlots in this Swamp area. During the winter they go into the woods on the ice to cut and haul out their annual supply of fire wood.

In one instance in Porter County an attempt was made to prepare this land for farming. It cost $35 per acre to clear it, in addition to the cost of drainage, and the land was not sufficiently productive to make the venture profitable.

DUNESAND.

Dunesand includes the strip of sand hills along the lake front. The soil is similar to that of the rolling phase of the Plainfield fine sand, but the topography is somewhat rougher. Most of this land supports a growth of scrubby oak. A number of "blow-outs" occur where the wind sweeps up sand from the beach through long, smooth troughs cut in the hills, forming bare dunes which gradually are built up over the trees. East of Waverly Beach the dunes are high, and occupy a narrow belt broken in only a few places by marshy depressions. West of Waverly Beach numerous depressions are inclosed by the dunes, which flatten out to some extent west of Dune Park. At Dune Park the sand from an area extending to the lake front has been hauled away by the railroads, and this area is mapped as the rolling phase of the Plainfield fine sand. A movement is projected to make a national park of the dune belt, to preserve the natural scenery. A number of cottages are located among the dunes, and many camps are maintained along the beach during the summer. The land is valueless for agriculture.

SUMMARY.

Porter County, Ind., is in the northwestern corner of the State on Lake Michigan. It is about 40 miles from Chicago. The county has an area of 415 square miles, or 256,600 acres.

The glacial Lake Chicago Plain in the northern part of the county, the Valparaiso morainic system across the center, and the Kankakee Basin in the southern and southeastern section are the main physiographic divisions. The topography of the northern and southern parts of the county is generally level to gently sloping, except for the narrow belt of sand dunes along the Lake Michigan beach. The moraine belt includes considerable rough land, especially along its northern slope, but the top and the southern part are generally well suited to farming.

Elevations range from 585 feet at Lake Michigan to 667 feet at Dunnes Bridge and 888 feet at the highest point of the moraine. The surface drainage is well established over most of the morainic area. The Kankakee Basin was naturally poorly drained, but has been reclaimed by dredged ditches.

Porter County was first settled about 1822. The population is reported in the 1910 census as 20,540, 66 per cent of which is classed as rural. The population of Valparaiso, the county seat and principal town, is given as 6,987.

The county was first reached by railroads about 1850, and it is now well supplied with transportation facilities, both steam and electric. The county has a large mileage of improved roads.

Local towns, chiefly Valparaiso, constitute good markets for farm products. Chicago is the chief outside market.

The climate is temperate, but extreme seasonal and monthly variations in temperature and rainfall occur. The mean annual temperature is about 49° F. and the mean annual precipitation about 31 inches. The growing season averages about 173 days, and usually is sufficiently long to mature all the staple crops.

At present cereals constitute the most important agricultural products. Animal products and hay and forage crops rank next. Corn occupies the largest acreage, and hay, oats, and wheat are important crops. Porter County ranks third among Indiana counties in the production of milk. Most of this is shipped to Chicago as whole milk, and little cream or butter is sold. A part of the grain and rough feed is used for hog raising and the fattening of cattle.

Most farms are well equipped and well managed. Crops are rotated and barnyard manure is used extensively. Little commercial fertilizer is applied. Farm labor is scarce and high priced, but is efficient.

The average size of the farms is given in the 1910 census as 125 acres. About 70 per cent of the farms are operated by the owners, and practically all the remainder by tenants, mainly on the share basis. The 1910 census reports a total of 1,915 farms, about 90 per cent of the area of the county being farm land. Of the farm land about 78 per cent, or an average of about 97 acres per farm, is reported

improved. The average assessed value of farm land is given as $58.09 an acre. Improved farms are held for $100 to $150 an acre.

The soils of Porter County are composed of glacial, glacial-lake, and alluvial materials. They are classed on the basis of origin, color, topography and drainage, and other features, into soil series, the series being separated into types on the basis of texture. Exclusive of three miscellaneous classifications, 23 soil types, representing 11 series, are mapped in Porter County.

The Miami series includes light-colored, forested, glacial soils with yellow or yellowish-brown subsoils. They occupy level to rough areas, and are used for corn, oats, wheat, hay, and dairying.

The Crosby series, represented only by the silt loam type, differs from the Miami chiefly in having a light-gray subsurface layer, and a mottled gray subsoil.

The Carrington is a dark-colored, glacial, prairie soil. This series is represented by the silt loam and a light phase of this type. Grain production and general farming are practiced on the land of this type.

The Clyde series occupies dark-colored, poorly drained depressions within areas of the Miami, Crosby, and Carrington soils. Only one type, the Clyde silty clay loam, is mapped.

The fine sandy loam, loam, and silt loam of the Waukesha series are recognized in Porter County. These are well-drained, dark-colored, glacial-outwash soils, with brown subsoils and a sandy substratum.

The Plainfield series comprises the light-colored, timbered, better drained part of the outwash and lake plain, where the soil is underlain by sandy strata. The fine sand, fine sandy loam, and loam types are mapped.

The Lucas series resembles the Miami, but the topography is flat and the material is derived from lacustrine deposits. It includes two types, the loam and silt loam.

Soils of the glacial-lake beds and drainage channels which have rather deep, black to dark-drab soils and subsoils in which gray predominates, are classed in the Maumee series. The substratum usually consists of water-bearing sand. The Maumee loamy fine sand, fine sandy loam, loam, and silty clay loam, are encountered in Porter County. These usually are good, productive soils.

The Homer series includes lake-bed soils which resemble the Crosby soils in appearance. It is represented by a single type, the Homer silt loam.

The Newton series includes dark-brown, shallow soils with mottled yellow, gray, and brown subsoils and a sandy substratum. It is represented by three types, the fine sandy loam, loam, and silt loam, which are naturally of low productiveness on account of their acidity.

With heavy applications of lime they become good soils for corn and the other general crops.

All the recent alluvium along the small streams of the county is mapped as the silt loam of the Griffin series. The type includes a light phase. The soil is brown, and the subsoil mottled brown, drab, and gray.

The material mapped as Muck consists of black, well-decayed remains of water-loving plants.

Swamp includes the timbered belt along the Kankakee River. The soil consists largely of dark-colored material of complex textures, overlying a grayish, water-bearing sandy substratum.

Dunesand comprises the belt of sand dunes along the shore of Lake Michigan. It is nonagricultural.

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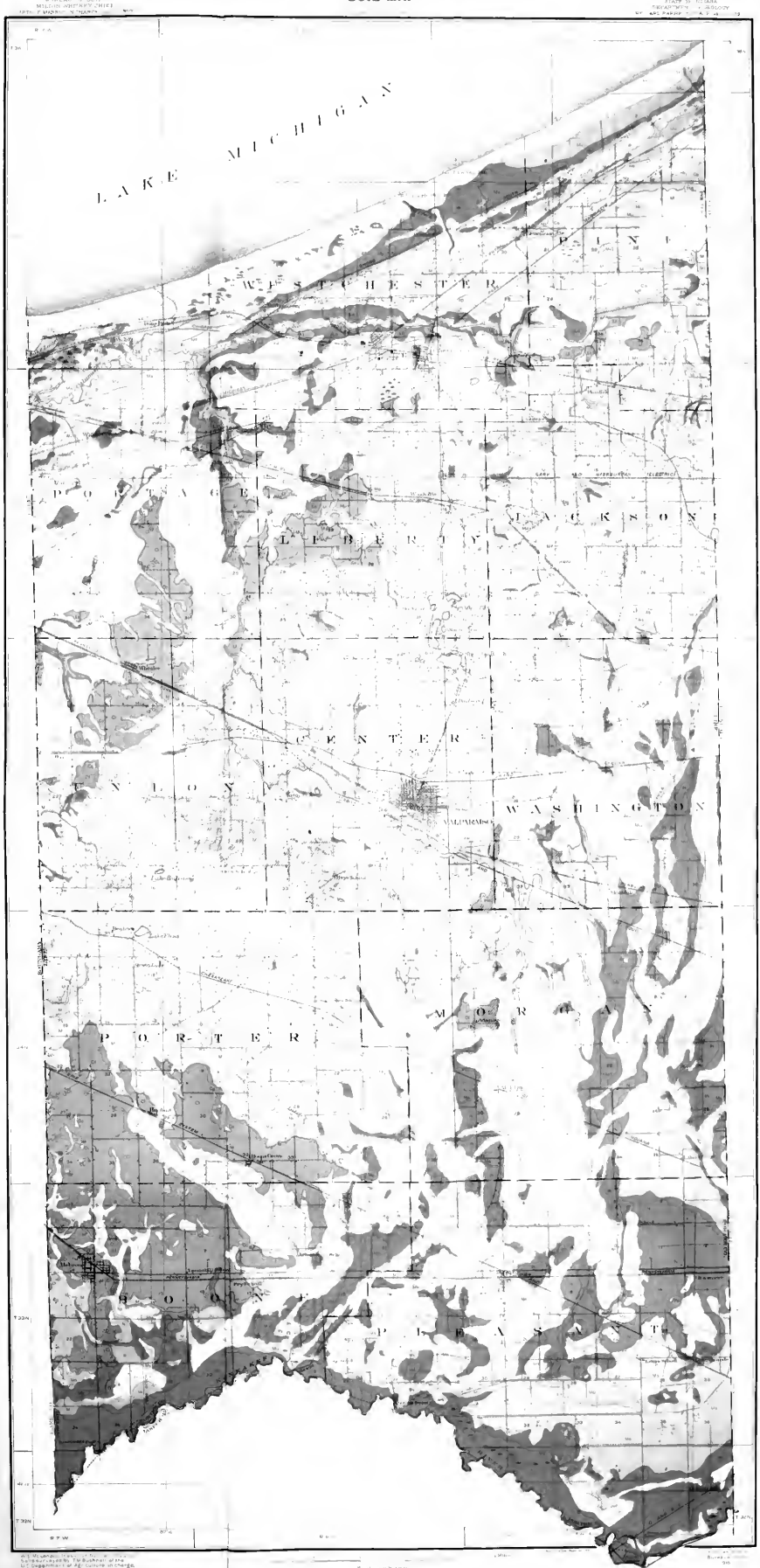
SOIL MAP


LAKE MICHIGAN
WESTCHESTER
PINE
PORTAGE
LIBERTY
JACKSON
CENTER
UNION
WASHINGTON
VALPARAISO
MORGAN
PORTER
BOONE
PLEASANT
LEGEND
CONVENTIONAL SIGNS

[PUBLIC RESOLUTION—No. 9.]

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

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

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

Approved, March 14, 1904.

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

Areas surveyed in Indiana.