Number 16 Series 1925

UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF CHEMISTRY AND SOILS
In Cooperation with the Wisconsin Geological and Natural History Survey
and the University of Wisconsin College of Agriculture

SOIL SURVEY

OF

CALUMET COUNTY, WISCONSIN

BY

W. J. GEIB, U. S. Department of Agriculture, in Charge
and A. H. MEYER, J. A. CHUCKA, and H. H. HULL
Wisconsin Geological and Natural History Survey

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COUNTY SURVEYED

Calumet County is in the east-central part of Wisconsin, in the second tier of counties west of Lake Michigan. Lake Winnebago forms the western boundary. The county is irregular in outline and comprises an area of 320 square miles or 204,800 acres.

By far the greater part of the county is gently rolling and undulating, but considerable areas are level. The most extensive tracts of level land are in the northern and northwestern parts of the county, where much of the region has the appearance of being an old lake bed. The remainder of the county is, for the most part, undulating or gently rolling, with here and there level or nearly level areas.

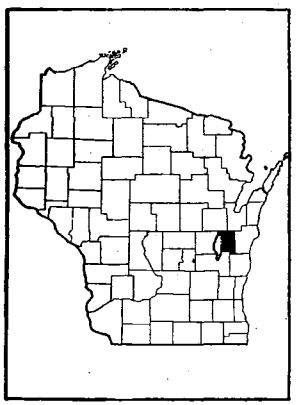

FIGURE 1.—Sketch map showing location of Calumet County, Wis.

One of the most pronounced topographic features in the county is the Niagara escarpment which crosses the county from north to south nearly parallel with the east shore of Lake Winnebago. The level of the lake is 747 feet above sea level, whereas the ledge at Highcliff has an elevation of 970 feet, 223 feet higher than the surface of the lake. The escarpment continues south into Fond du Lac County.

Elevations above sea level at different points in the county are as follows: Chilton, 856 feet[1]; Forest Junction, 833 feet; Hayton, 825 feet; Hilbert, 837 feet; New Holstein, 936 feet; and the surface of Lake Winnebago, 747 feet.[2]

The first settlers in Calumet County were the Stockbridge and Brothertown Indians, who about 1833 were settled in reservations on the eastern shore of Lake Winnebago. Two reservations were laid out, and the land was divided into lots of 50 or 100 acres each. About 1856 the Stockbridge Reservation was shifted to Shawano County, but some of the Indians remained in Calumet County. There are now a number of Indians in the southwestern part of the county, where the reservations previously existed, and some Indians are on small farms. Most of the land, however, is now owned by

[1] GANNETT, H. A DICTIONARY OF ALTITUDES IN THE UNITED STATES. (FOURTH EDITION.) U. S. Geol. Survey Bul. 274. 1,072 pp. 1906.
[2] U. S. Geol. Survey.

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white farmers. In 1840 there were 230 Stockbridge and 300 Brothertown Indians in the county.

The military road running from Green Bay to Fort Winnebago through Stockbridge was opened or completed through this county in 1835. In 1836, the county was set off from Brown County and was partly organized. It was reorganized in 1842 but did not fully function until 1850, when it was fully and completely organized. The real white settlement of the county did not actively begin until about 1846 or 1847.

The population in 1920 was 17,228. Of this total only 1,658 were foreign-born whites, and of these 1,168 were of German birth. The population is well distributed throughout the county. A number of villages, some incorporated and others not, are scattered throughout the county. Chilton, with a population of 1,833 in 1920, is the largest town in the county. Brillion has a population of 1,102, New Holstein has 1,373, Hilbert 614, and Stockbridge 387. Other small places include Potter, Highcliff, Brothertown, Quinney, Dundas, Sherwood, Hayton, Jericho, and Forest Junction.

Rail transportation in Calumet County is furnished by the Minneapolis, St. Paul & Sault Ste. Marie Railway, the Chicago, Milwaukee, St. Paul & Pacific Railroad, and the Chicago & North Western Railway systems. Numerous county and State trunk highways are kept in good repair, and practically all of them are crowned with gravel, crushed rock, or concrete. The town roads and secondary roads are usually kept in good repair, and many of them are also graveled.

The towns within the county afford a market for a small part of the farm produce and provide shipping facilities through which outside markets, such as Milwaukee and Chicago, are readily reached. Telephone service and rural free delivery of mail reach all parts of the county. Schools are good.

CLIMATE

Calumet County lies within and bordering the Fox River basin. The climate is intermediate, being somewhat influenced by Lake Michigan but exhibiting more of the features of a land climate. The average date of the last killing frost, according to records of the Weather Bureau station at Chilton, is May 6 and of the first is October 7. The latest recorded frost was on June 11 and the earliest on September 22. The frost-free season is 154 days.

The mean annual temperature is 44.7° F., the absolute maximum is 100°, and the minimum is −34°. The average annual rainfall of 30.43 inches is well distributed throughout the year. The rainfall is heaviest during the growing season, when it is most needed.

There is a good supply of water for the homes and for livestock, and the climate is healthful. The winters are rather long and somewhat severe, but the summers are delightful. The climatic conditions favor the high development of a prosperous agriculture.

Table 1, compiled from data of the Weather Bureau, gives the normal monthly, seasonal, and annual temperature and precipitation at Chilton.

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at Chilton*

[Elevation, 860 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year, (1895)	Total amount for the wettest year, (1905)	Snow, average depth.
	° *F.*	° *F.*	° *F.*	*Inches*	*Inches*	*Inches*	*Inches*
December	20.7	59	−21	1.62	1.50	1.30	10.9
January	17.2	54	−29	1.62	3.47	2.31	12.5
February	17.3	60	−34	1.30	1.55	1.89	9.5
Winter	18.4	60	−34	4.54	6.52	5.50	32.9
March	30.7	82	−11	2.20	.44	2.28	5.4
April	44.6	85	10	2.60	1.51	1.69	5.8
May	55.9	92	23	4.01	3.52	6.09	.9
Spring	43.7	92	−11	8.81	5.47	10.06	12.1
June	65.6	98	32	4.01	1.13	8.36	.0
July	70.7	100	42	3.26	1.79	4.04	.0
August	68.2	97	39	2.81	2.55	4.87	.0
Summer	68.2	100	32	10.08	5.47	17.27	.0
September	61.8	97	25	3.20	2.11	1.77	.0
October	49.2	85	6	2.21	.60	2.49	.5
November	34.6	70	−5	1.59	1.35	1.28	3.6
Fall	48.5	97	−5	7.00	4.06	5.54	4.1
Year	44.7	100	−34	30.43	21.52	38.37	49.1

AGRICULTURE

When the first settlers came to Calumet County they found it a dense wilderness. At that time the timber did not have much value and much of it was cut and burned by the very early settlers to clear fields for cultivation. Lumbering was developed before agriculture in nearly all sections. The first crops to be grown were subsistence crops, including corn, potatoes, wheat, and oats. The acreage of wheat increased most rapidly, and in 1879 amounted to 39,076 acres. In the same year 8,928 acres were in oats, 4,463 acres were in corn, 6,294 acres were in barley, 239 acres were in rye, and 89 acres were in buckwheat.

In 1875, 55,603,283 pounds of freight were shipped by rail from the towns of Chilton, New Holstein, Hilbert, Brillion, Forest Junction, Sherwood, and Hayton, and 33,456,166 pounds of freight, mostly merchandise, farm machinery, and lumber were shipped into these towns.

The most important general farm crops now grown in Calumet County are hay, corn, oats, wheat, and barley. Such special crops as peas, beans, cabbage, sugar beets, and fruit are grown, and some trucking is carried on near the small towns.

Hay now occupies a larger acreage than any other crop in Calumet County. In 1919, according to the 1920 census, clover and timothy mixed was grown on 37,347 acres. This crop is grown in all parts of the county and on all soils which are sufficiently well drained. It

does especially well on the clay loam and silt loam members of the Superior and Kewaunee series. The acreage of alfalfa is increasing yearly, as the importance of this crop as feed is being appreciated by dairymen. In 1919 the 1,686 acres devoted to this crop gave an average yield of 2.6 tons to the acre. The soils, most of which are rich in lime, are well suited to alfalfa, especially the loam and silt loam members of the Kewaunee and Bellefontaine series. The alfalfa is used almost entirely as feed for dairy cattle. A small acreage of wild hay is cut from the marshes and lowlands which can not be cultivated. In 1919 wild hay was cut from 927 acres. Sweetclover is coming into greater favor as a hay and pasture crop. Some hay is sold each year, but a large quantity is consumed by livestock on the farms.

The crop second in acreage is oats. In 1919 this crop was grown on 23,894 acres. The average yield that year was about 30 bushels to the acre. The crop is grown in all parts of the county and does especially well on the heavy soils. A large quantity of oats is fed to livestock, but some is sold.

Some wheat is still grown in this county, and the soils are well adapted to it. In 1919, 8,843 acres were devoted to this crop. This acreage is much smaller than that of 30 years ago but is somewhat larger than the acreage grown just prior to the World War.

In 1919 corn was grown on 6,872 acres. It is grown throughout the county, but it does best on the loam, silt loam, and fine sandy loam soils. Fully 75 per cent of the corn is cut for silage. The average yield of grain in 1919 was nearly 45 bushels to the acre and of silage was 8 tons. Most of the corn is fed to dairy cattle and hogs.

Barley is not grown so extensively as it was a number of years ago. It is used mostly as feed, and very little is sold. It is grown on most of the well-drained soils.

Rye is grown on only a small acreage, chiefly on light-textured soils. In 1919 it occupied 2,259 acres and gave an average yield of 17 bushels to the acre, which is above the yields usually obtained from the light, sandy soils of the State.

Potatoes are grown mostly for home use. The acreage reported for 1919 was 1,092 acres and the average yield was nearly 66 bushels to the acre.

One of the most important special crops is peas for canning. In 1919, the 7,516 acres of dry peas yielded an average of nearly 16 bushels to the acre. It is common for a farmer to receive at least $100 an acre for his canning peas, and a few farmers have reported considerably higher returns. The soils of this county are rich in lime and are well adapted to this crop.

Dry edible beans were grown on only 84 acres in 1919. This crop is usually grown on more sandy soils than occur in this county. Clover was grown for seed by a few farmers in 1919. With good yields, this proves a profitable crop.

In 1919 sugar beets were grown on 1,047 acres, with an average yield of nearly 12 tons to the acre. This crop does well on the loam, silt loam, and clay loam soils, although the clay loams are heavy and difficult to work. However, as the clay loam soils predominate, the

largest acreage is on the heavy soil. Beet sugar factories are at Green Bay and at Menomonee Falls.

Small acreages are devoted to cabbage, flax, and soybeans. A fine cherry orchard at Chilton gives satisfactory yields of good-quality fruit. Apple orchards are found on many of the farms, but most of these are small, and the fruit is used chiefly at home. The 1920 census reported 27,928 bearing trees in the county. The parts of the county best suited to apples are the rolling areas where there is good air and soil drainage.

The 1920 census reports that there were in that year 2,087 farms in the county, with an average size of 93.3 acres. The total land area of the county is 204,800 acres, and of this 194,623 acres are in farms. There are 145,005 acres of improved land in farms and 19,979 acres of woodland. The percentage of land in farms is 93.9 per cent and the percentage of the farm land in the county that is improved is 74.5. There are, on the average, 69.5 acres of improved land on the farms.

The value of all farm property in the county in 1920 was $37,359,683. The average value of all property to the farm was $17,901. The value of the land averaged $120.28 an acre.

Of the farms in the county, 88.5 per cent are operated by the owners. Only 16 farms are operated by managers. Tenants operate 224 farms. Of the tenants, 88 are share tenants, 4 are share-cash tenants, 109 are cash tenants, and 23 are unspecified.

Table 2 gives the acreage and yield of the principal crops, as reported by the census.

TABLE 2.—*Acreage and yield of principal crops in stated years*

Crop	1879		1889		1899		1909		1919		1924	
	Acres	*Bushels*	*Acres*	*Bushels*	*Acres*	*Bushels*	*Acres*	*Bushels*	*Acres*	*Bushels*	*Acres*	*Bushels*
Corn	4,463	161,781	5,117	164,518	8,073	305,220	9,490	440,965	6,872	306,738	688	21,301
Oats	8,928	315,069	15,580	651,527	24,711	1,062,480	23,484	1,002,531	22,894	700,166	25,718	902,167
Wheat	39,676	483,318	20,374	390,568	15,592	299,210	3,216	78,394	8,843	140,935	5,898	165,726
Barley	6,294	157,021	17,210	567,530	31,245	1,167,570	26,863	786,358	7,927	167,397	5,850	155,823
Potatoes	-------	79,713	1,138	98,173	1,164	116,622	922	119,188	1,092	71,972	543	57,585
		Tons		*Tons*		*Tons*		*Tons*		*Tons*		*Tons*
Hay	16,282	17,169	21,334	35,171	[1]19,745	34,435	[1]31,519	58,497	[1]49,246	166,002	37,984	70,756

[1] Including forage.

Dairying is the most important branch of farming in Calumet County. On January 1, 1925, there were in the county 25,675 dairy cows and 4,424 heifers 1 year old and under 2. In 1924 the total milk production was 15,327,020 gallons, and dairy products had a value of $2,065,832. By far the greatest part of the milk is made into cheese. In 1922 there were, in the county, 49 cheese factories, and in 1916 there were 44. The State department of agriculture reported that during 1921, 5,937,649 pounds of cheese, with a value of more than $1,000,000 was made in Calumet County. Little butter is made now. In 1916 there were 10 creameries, but by 1922 there was only 1. There is 1 milk condensery in the county. By far the greater proportion of the dairy cows are well-bred grade animals of the Holstein and Guernsey breeds, but there are a few grade Jersey,

Ayrshire, Red Polled, and Shorthorn. The raising of beef cattle is not an important industry in this county, but a large number of calves are sold for veal.

Hog raising has not developed to the extent that it has in the southwestern part of Wisconsin, probably because most of the milk produced goes as whole milk to the cheese factories. In 1925 there were 10,329 hogs in the county and 1,150 sheep.

In 1920 there were in the county 7,040 horses and 38 mules. The large number of tractors in use on the farm tends to reduce the number of horses somewhat. As most of the soils of the county are heavy, heavy work animals are required for tillage operations. There are no breeders of purebred horses in the county, but a number of farmers raise a colt or two each year to keep up their supply and have a team to sell occasionally.

The cultural methods common in dairy regions in eastern Wisconsin prevail in Calumet County. Modern farm machinery is in common use. There are more than 2,000 farms in the county, and in 1923, 605 tractors were in use on them. As the soils are heavy and plowing is difficult, the tractor can be used to advantage even on small farms. Hay loaders, tedders, and side-delivery rakes are in common use. Most of the corn crop is put into silos. In 1923 there were 1,590 silos in the county. A few farmers do not have silos, but others have two or three.

Farm buildings are substantial, well built, and usually kept in good repair and well painted. Pumps, feed cutters, and feed grinders are operated by gasoline engines or by electric current. An increasing number of the houses and barns are being lighted by electricity, some from individual plants and others from high-tension lines which traverse the county. Many of the farm homes are as modern in equipment as the homes in the city.

SOILS [3]

The soil map of Calumet County reveals the fact that more than half the total area of the county is occupied by three soil types, and that these three soils occur in large areas of definite though irregular outline. The most extensive of the three soils, Kewaunee silty clay loam, occupies a large area in the central part of the county and smaller areas along the northern part of the east county boundary and just east of Lake Winnebago in the southwestern part of the county. Bellefontaine silt loam, with almost as large a total area as the Kewaunee soil, occupies nearly all the south-central and southeastern parts of the county. Superior clay loam, the third of the major soils, occurs in a large area extending nearly across the northern fourth of the county.

[3] On comparing the soil map of Calumet County with that of Outagamie County it will be noted that the soil boundaries do not join everywhere. The failure of the maps to join is usually owing to indicated slight differences in texture, usually between a loam and silt loam, a loam and clay loam, or a clay loam and silty clay loam. Superior loam of Calumet County joins Kewaunee silt loam in Outagamie County. Again, Kewaunee loam of Calumet County joins Kewaunee loam of Outagamie County. At another place, Kewaunee silty clay loam of Calumet County joins Kewaunee silty clay loam of Outagamie County. It will also be noted that there is more detail shown in the map of Calumet County than in the map of Outagamie County. The difference in detail between the two maps is owing to the fact that when Outagamie County was surveyed the field work was done by traversing at one-half-mile intervals, and the Calumet County work was done by traversing at one-fourth mile intervals.

These three soils are the normally developed soils of the region, that is, they exhibit, in common, the soil-profile characteristics imposed upon them by the dynamic soil-forming agencies or factors, such as temperature, moisture (rainfall and snowfall), and natural vegetation, which was timber. Since these factors are common to these soils and to the well-drained soils of the region in general, it is evident that the differences between the soils have their origin in other and probably local factors. Without here entering further into a discussion of the subject, it may be stated that such is the case; that the recognized differences have resulted largely from local differences in composition of the parent material and, to a less degree, from differences in surface relief.

These three soils are all good farm land, and, because of this and their large total area, the agriculture of the county is largely based upon their productivity.

The well-drained soils of Calumet County are all light colored, as are most soils which developed under a forest cover. The rainfall of about 30 inches has been sufficient to cause the leaching of the surface material to a depth of 2 or 3 feet. Above this depth there is little or no free lime, but below it, in the parent material, there is in most of the soils a high percentage of lime. The winters are cold and the summers mild, and this condition has allowed the preservation of somewhat more organic matter than is possible in a hot climate.

The various factors and conditions at work in this region have developed a soil profile with three distinct major soil layers or horizons, including the parent material. A description of a profile of Kewaunee silty clay loam may be considered representative of this region. The location is 1 mile southeast of Brant; the relief is rolling; and drainage is good. Over the surface there is a 1 or 2 inch layer of leaf litter and mold. The soil consists of the following layers: (1) From 0 to 3 inches, dark-gray, single-grained, slightly acid, friable heavy silt loam; (2) from 3 to 8 inches, light grayish-brown, single-grained, medium acid, friable light clay loam or clay loam, which near the bottom of the layer becomes granular in structure; (3) from 8 to 26 inches, pinkish-red or Indian-red, finely granular, medium acid, stiff clay, which becomes alkaline with depth; and (4) from 26 to 36 inches pinkish-red, rather coarsely granular, alkaline, stiff clay containing a few limestone pebbles. This material becomes light colored with depth. It is sticky and plastic when wet. The timber growth consisted of maple, beech, basswood, elm, and hickory. There was probably some white pine in the primeval forest.

As has been stated, the composition of the parent material has had much to do with the characteristics of the soils of the county. The parent materials of the soils of Calumet County, in common with those of all eastern Wisconsin, owe their accumulation to glacial action, to lacustrine and alluvial deposition, and to the accumulation of organic matter in poorly drained areas. During glacial and interglacial times, Lake Michigan stood at a much higher level than at present. There were then laid down vast deposits of red clay, part of which was later moved about by the ice sheet. Where the ice action was the least pronounced, the surface is now level or nearly level, and where the action was more pronounced the surface is gently rolling

or morainic. Many depressions were left by the ice, and in these there has been an accumulation of organic matter sufficiently deep and pure, in many places, to form peat, and in other places only sufficient to make a high organic-matter content in a mineral soil. All these low areas were or are poorly drained, and this wet condition has favored the accumulation of the organic matter.

The rock floor in Calumet County is almost entirely limestone, and the glacial ice in passing over this ground up some of the rock and mixed it with the clay deposits. In some places the rock material predominates, and in other places the soils are made up largely from the clay deposits. The variations in texture of the parent material, the differences in relief and drainage, and the differences in color have caused a rather wide range in texture, color, and structure of the soils. In Calumet County these materials have been classified into 13 series of mineral soils, 1 organic soil (peat), and 1 miscellaneous classification, rough stony land.

The Superior soils are derived from lacustrine or lake-laid materials, and the surface is level or nearly level. The soils are light colored, and the soil layers are well defined in most places. The subsoil is typically reddish clay, very calcareous below a depth of about 2 feet. The clay loam, silt loam, loam, and fine sandy loam members of this series are mapped.

The characteristics of the Kewaunee soils are indicated by the description of Kewaunee silty clay loam. The parent material is heterogeneous, the surface is undulating or gently rolling, and natural drainage is good. The soil layers are well developed in most places. The surface soils are light colored, and the subsoils are reddish clay. The members of the series mapped are the silty clay loam, with a level phase and a steep phase, silt loam, with a level phase, loam, with a level phase, and fine sandy loam.

The Bellefontaine soils occur in upland timbered regions. They are light colored, and the parent material consists of gravelly glacial till. The surface is in most places gently rolling, and natural drainage is good. In this series the soil layers are all well defined. The substratum is everywhere calcareous and in most places begins at a depth of a little less than 3 feet. Members of this series mapped are the silt loam, with a level phase and a steep phase, loam, and gravelly loam, with a steep phase.

The Fox soils, occurring on terraces or plains, are derived from outwash material composed in part of limestone material. In typical areas the soil layers are well developed. Fox silt loam is mapped.

The Warsaw series includes dark-colored well-drained soils in which sand or gravel material is present in the lower part of the subsoil, commonly at a depth of less than 3 feet. Warsaw loam is mapped.

The Poygan soils occur in depressed areas in the region of the Superior and Kewaunee soils. They are poorly drained, and there is a sufficient accumulation of organic matter to give a dark color to a depth of 10 or 12 inches. The chief characteristics are the dark color and the heavy reddish or mottled subsoil. Where typically developed, the deep subsoil is red clay. Poygan silty clay loam is mapped.

The Clyde soils, which occupy depressed, poorly drained areas, are derived from glacial till. The surface soils are very dark colored, and the subsoils are mostly dull gray or mottled plastic clay or clay loam. Clyde silty clay loam and Clyde silt loam are mapped.

The Conover series includes light-colored soils, with mottled subsoils, derived from calcareous glacial till. The surface is nearly level, and the drainage is somewhat deficient. Conover silt loam is mapped in Calumet County.

The Maumee series includes low-lying, poorly drained, dark-colored soils in which sandy material occurs in the deep subsoil, in most places at a depth of less than 3 feet. Maumee loam and Maumee sandy loam are mapped.

The Wabash series includes very dark-colored first-bottom soils. Wabash silt loam is the only member of this series mapped in Calumet County.

The Ewen series includes reddish-brown first-bottom soils which are subject to overflow. These soils occur chiefly in the region where the upland soils are of the Kewaunee and Superior series. Ewen silty clay loam is mapped.

The Genesee series includes brown and light-brown first-bottom soils subject to annual overflow. Genesee silt loam is mapped.

The Rodman soils include rough, broken, and bumpy areas of gravelly material. There is little development of soil layers. Rodman gravelly loam is mapped.

Peat consists of deposits of organic matter accumulated under very wet conditions. A shallow phase, in addition to the typical peat, is mapped.

Rough stony land and gravel pits and quarries are miscellaneous classifications of nonagricultural land.

In the following pages of this report the soils of Calumet County are described in full and their agricultural importance is discussed; the accompanying soil map shows their distribution, and Table 3 shows their acreage and proportionate extent.

TABLE 3.—*Acreage and proportionate extent of the soils mapped in Calumet County, Wis.*

Type of soil	Acres	Per cent	Type of soil	Acres	Per cent
Kewaunee silty clay loam	46,720	26.2	Fox silt loam	1,280	0.6
Level phase	5,376		Warnaw loam	960	.5
Steep phase	1,472		Peygan silty clay loam	18,368	9.0
Kewaunee silt loam	2,304	1.2	Clyde silty clay loam	11,904	5.8
Level phase	128		Clyde silt loam	192	.1
Kewaunee loam	3,008	1.7	Conover silt loam	2,304	1.1
Level phase	320		Maumee loam	640	.3
Kewaunee fine sandy loam	192	.1	Maumee sandy loam	448	.2
Bellefontaine silt loam	40,512	23.5	Wabash silt loam	2,496	1.2
Level phase	7,872		Ewen silty clay loam	1,152	.6
Steep phase	896		Genesee silt loam	256	.1
Bellefontaine loam	192	.1	Rodman gravelly loam	128	.1
Bellefontaine gravelly loam	384	.8	Rough stony land	1,856	.9
Steep phase	1,088		Peat	15,104	9.4
Superior clay loam	26,496	13.0	Shallow phase	4,032	
Superior silt loam	1,088	.6	Gravel pits and quarries	64	.1
Superior loam	5,440	2.7			
Superior fine sandy loam	128	.1	Total	204,800	

KEWAUNEE SILTY CLAY LOAM

On the surface of virgin Kewaunee silty clay loam, as it occurs in undisturbed wood lots, there is a layer of leaf mold, consisting of decaying leaves and other organic matter. The surface soil itself, to a depth of about 2 inches, is friable dark-brown or nearly black, smooth heavy silt loam. Between depths of 2 and 8 inches is grayish-brown light clay loam, which grades into heavy, stiff, compact red clay continuous to a depth of at least 24 inches. This material is sticky when wet. Below a depth of 24 inches the clay becomes somewhat lighter in color and contains gritty material in the form of small pebbles and fine rock fragments. This gritty material continues to a great depth. The subsoil is granular; that is, it breaks up into small cubes and crumbles when fairly dry. The lower part of the subsoil is somewhat more coarsely granular than the upper part. The surface soil and upper part of the subsoil show a slight or medium degree of acidity. At a depth of 2 feet, however, lime is found, and the material effervesces when acid is applied. The deeper part of the subsoil and the substratum contain large quantities of lime. The pebbles and small rock fragments which make the material gritty consist of limestone. Under cultivation the dark surface layer soon disappears, and as it is mixed with the underlying material the color of the cultivated topsoil is grayish brown.

There are some variations in the soil, but as a whole it is rather uniform. In places the silty surface covering is thicker than typical, and in other places the heavy clay is at or near the surface. In many places this heavy clay is turned up by the plow, and this gives cultivated fields a somewhat spotted appearance. In some small, low included areas of Poygan silty clay loam the organic matter content is higher than typical.

Kewaunee silty clay loam is the most extensive and one of the most important soils in Calumet County. In the triangle between Chilton, Sherwood, and Brillion it is the predominating soil. Other large areas occur in the western and northeastern parts of the county. The areas of Kewaunee silty clay loam vary from undulating to gently rolling. Natural drainage is good, for so heavy a soil. In some of the depressed areas small patches would be benefited by tile drains, but most of the soil can be farmed without artificial drainage.

The few wood lots remaining on this land support a growth of maple, beech, elm, hickory, oak, and basswood trees. By far the greater part of the merchantable timber has been cut, and the land is now in highly improved farms. It is estimated that more than 90 per cent of the land is under the plow.

This is a good, strong soil and is well suited to general farming and dairying. Dairying, the most important farming industry, is highly developed. The farmsteads have a prosperous appearance. The leading crops grown are hay, grass, small grains, and corn. Some peas are grown, and sugar beets are among the special crops which do well on this soil. Alfalfa does well as the subsoil is well supplied with lime.

Kewaunee silty clay loam, level phase.—Scattered through the areas of typical Kewaunee silty clay loam are a few areas where the surface is level or very gently undulating. These are mapped as Kewaunee silty clay loam, level phase. The soil is almost identi-

cal with the typical soil, but the surface soil may be a little thicker on the average. Drainage is not quite so good as on the typical soil.

Kewaunee silty clay loam, steep phase.—Kewaunee silty clay loam, steep phase, is of small total extent in Calumet County. It includes rolling or hilly land and a few slopes sufficiently steep to make the danger of erosion serious. The soil is practically the same as typical Kewaunee silty clay loam, but the surface layers are not quite so thick and in many places the heavy subsoil is exposed where the surface soil has been entirely washed off.

KEWAUNEE SILT LOAM

The surface layer of virgin Kewaunee silt loam consists of dark-brown silt loam 4 or 5 inches thick. The upper part of this layer is in places nearly black, and on the surface of wood-lot areas there is a thin covering of leaf litter and mold. Between depths of 5 and about 14 inches is grayish-brown, smooth, friable silt loam. Between depths of 14 and 36 inches is heavy reddish clay. Below a depth of 2 feet the material is calcareous. The lower part of the subsoil contains a few pebbles, and stones are found in places in borings. Some ston s are on the surface, but these are in no place so plentiful as to interfere with cultivation. In cultivated fields the dark layer has been mixed with the underlying material, so that the color is lighter than that of the virgin surface soil.

This soil is subject to some variations. In places the surface soil varies in thickness from 8 to about 20 inches. In a very few places the clay is near enough to the surface to be turned up by the plow.

This soil comprises an area of 3.6 square miles in Calumet County. It occurs chiefly in the northwestern part of the county, north and east of Sherwood. Most of it occurs in association with Kewaunee silty clay loam.

Areas of this soil are undulating or gently rolling, and the natural surface drainage is good. The subsoil is heavy, and the water moves through the soil slowly. The soil withstands drought well. In a few included depressions the drainage is somewhat deficient, but as a whole the soil is farmed without the need of artificial drains.

Wood lots on this soil support a growth of maple, elm, hickory, basswood, some beech, and a little oak. By far the greater part of the soil is cleared and in cultivated crops. This is a good soil and is well suited to general farming and dairying, the lines of farming to which it is now devoted. It is farmed in about the same way as the silty clay loam of the same series, but it is somewhat easier to cultivate as it is not quite so heavy. Fall plowing is practiced wherever possible.

Kewaunee silt loam, level phase.—A few level or gently undulating areas of Kewaunee silt loam are mapped as the level phase of this soil. The soil is similar to typical Kewaunee silt loam but averages a little thicker. Drainage is not quite so good as on the typical soil.

KEWAUNEE LOAM

The profile of virgin Kewaunee loam shows the following layers: From 0 to 4 inches brown, loose, friable fine loam with a covering, in wooded areas, of dark-colored or nearly black leaf mold and other

organic matter, from one-half to 2 inches thick; from 4 to 10 inches grayish-brown heavy fine sandy loam or loam, a little more compact than the surface layer; from 10 to 30 inches pinkish-red clay loam or clay which in many places in the lower part contains some small, irregular rock fragments and pebbles of limestone. This material is granular and breaks up into small irregular cubes about one-fourth inch in size when fairly dry. Below a depth of 30 inches the clay becomes more gritty, and more pebbles and coarse material are present. The material is granular, though the granules are probably somewhat larger than in overlying layers. In color this layer is lighter than the layer above. Under cultivation, the dark surface layer becomes mixed with the lighter colored second layer, and the cultivated topsoil is lighter in color than that in virgin areas.

The surface layer is slightly acid in most places, and the second layer is somewhat acid. The subsoil below a depth of 30 inches is calcareous and in most places effervesces freely with hydrochloric acid. The parent material from which this soil has been derived is all highly calcareous.

A few small areas of clay loam and some small patches of fine sandy loam were included with this soil in mapping. The soil as a whole is intermediate between Kewaunee clay loam and Kewaunee fine sandy loam.

Kewaunee loam is of rather small extent in Calumet County. It is most extensive in the northern and northeastern parts, where it is associated with other Kewaunee soils. Areas are undulating or gently rolling, and natural drainage is good. The heavy subsoil is retentive of moisture, and crops seldom suffer from drought.

The virgin forest on this soil consisted chiefly of maple, beech, hickory, elm, some poplar, and, doubtless, considerable white pine. Nearly all the original timber has been cut and the land placed under cultivation. Most of the few remaining wood lots have been pastured.

This is a good agricultural soil and is well suited to all the general farm crops of the county. The chief crops are corn, hay, oats, and peas, and some barley and sugar beets are grown. Alfalfa, which does very well on this soil on account of the high lime content of the subsoil, is becoming an important crop.

Probably the greatest need of this soil is phosphorus. It has been found that the Kewaunee and Superior soils usually respond well to the use of a phosphatic fertilizer, and it seems reasonably certain that the rational use of this fertilizer will materially increase the yields and profits from farming on this soil.

Kewaunee loam, level phase.—Kewaunee loam, level phase, occupies a total area of only one-half square mile. It includes a few level or gently undulating areas scattered through the typical soil. This phase differs from the typical soil mainly in that the surface soil is somewhat thicker and the land is not quite so well drained.

KEWAUNEE FINE SANDY LOAM

The profile of virgin Kewaunee fine sandy loam shows the following layers: From 0 to 6 inches, brown fine sandy loam which, under cultivation, works readily into a mellow seed bed; between depths of 6 and 20 inches, loose yellowish-brown fine loamy sand or fine sandy loam, which in the lower depth in places takes on a pinkish hue;

from about 20 to about 36 inches, pinkish-red, calcareous clay which, when dry, breaks up into cubical blocks about one-fourth inch in diameter and in the lower part of which there are some angular fragments and pebbles of limestone; below a depth of 3 feet lighter colored more calcareous material containing more pebbles and angular material. The lower clay subsoil is glacial till or heavy lacustrine material. The upper layers of sandy material are doubtless of somewhat different deposition and may be in part wind blown. The upper layers are commonly somewhat acid, but below a depth of 2 feet the soil is calcareous.

Under cultivation the surface soil is mixed with the material immediately below, and the cultivated fields are a little lighter in color than the surface of the virgin soil. There are some variations, but none worthy of special note.

This soil is of very small total extent and of minor importance. Most of it is south of Brillion, where it is associated with other soils of the Kewaunee series. Areas are undulating or gently rolling, and the natural drainage is good. The heavy subsoil is very retentive of moisture, so crops seldom suffer severely from drought. The native growth on the land was mostly maple, oak, basswood, beech, and some pine. Practically all the timber has been cut and the land placed under cultivation.

This is a very good soil, but it occurs in such small areas that no farms are located entirely on it. It is easy to cultivate and responds well to fertilization. It is well suited to most of the general farm crops. Because of the sandiness of the surface material it is earlier than the heavier soils and therefore is more desirable for corn. Although it is devoted to general farming it is well suited to truck crops and where suitably located could well be devoted to the truck-ing industry. It is a good potato soil.

BELLEFONTAINE SILT LOAM

In its virgin condition Bellefontaine silt loam shows the following profile: From 0 to 2 inches dark-brown silt loam over which there is a thin covering of leaf litter, mold, and other organic matter, which gradually disappears as the wood lots are pastured and subjected to trampling of farm animals or to burning; between depths of 2 and 14 inches, smooth, friable, grayish-yellow silt loam; between depths of 14 and 28 inches yellowish-brown or slightly reddish-brown gritty clay loam, in which the gritty material is mostly fine limestone fragments and pebbles, which when fairly dry breaks up into irregular fragments about one-fourth inch in diameter; between depths of 28 and 36 inches and continuing to about 48 inches grayish or yellowish sandy, gravelly, clayey loam, in which the gravelly material is mostly limestone; below a depth of 48 inches very gravelly parent material consisting largely of unassorted gravelly glacial till identical or similar to the material from which the soil is thought to have been derived.

Under cultivation the dark-colored surface soil becomes mixed with the underlying lighter material, so that the plowed soil is lighter in color than the immediate surface of the virgin soil.

Bellefontaine silt loam is very uniform in the texture of the surface soil, but because of erosion there is some variation as to the

depth to the heavy subsoil. On some of the hilltops and steep slopes, the subsoil is exposed in places where erosion has removed the surface soil. In places the soil is very stony, the stones being mostly limestone and granitic rocks. Stone fences are common, and piles of stones are to be seen in many of the cultivated fields and along the borders of wood lots. Some farmers dump the stones in ravines or washed places. The stones have been largely removed from the cultivated fields. Bedrock of limestone is near the surface in places, and where the rock comes to within 6 or 7 inches of the surface the material has been mapped with rough stony land. Bellefontaine silt loam has been derived by weathering from gravelly, stony glacial till, mostly limestone material, with which has been mixed more or less material from the north, including granitic bowlders. The till material was originally all calcareous, but leaching of the surface has removed much of the lime carbonate, and now the surface soil and the upper part of the subsoil are, in most places, slightly acid, whereas the lower part of the subsoil and the substratum or the parent material are decidedly alkaline in reaction. Associated with Bellefontaine silt loam are numerous low poorly drained areas. These include peat areas and areas of the Clyde and Maumee soils. These soils require artificial drainage before they can be successfully farmed.

This is one of the extensive and important soils of the county. It is the most extensive soil in the southern and west-central parts, and smaller areas occur in the northeast corner. In many places the soil g ades into Kewaunee silt loam, and the boundary line is not everywhere distinct. Bellefontaine silt loam resembles Kewaunee silt loam in the character of the surface soil. It differs from that soil, however, in that the upper part of the subsoili s more brownish and less distinctly red or pinkish red, and the lower part of the subsoil is gray or yellowish-gray gravelly till, rather than reddish heavy till. The Bellefontaine soil is also more stony on the surface than the Kewaunee, and in most places is more broken and irregular. Areas of Bellefontaine silt loam vary from undulating to gently rolling or rolling, but most of them are gently rolling. (Pl. 1, A.) Because of the rolling relief and the gravelly subsoil, natural drainage is good. Internal drainage is better than on Kewaunee silt loam.

The native timber on this soil consisted chiefly of maple, beech, basswood, hickory, and oak, with some pine. A small second growth of white pine is common in the few remaining wood lots. Practically all the best merchantable timber has been cut and the land placed under cultivation.

In general it may be said that Bellefontaine silt loam is the most desirable of the three major soils in the county. The chief type of farming is dairying, and this industry is highly developed. Hog raising is carried on to some extent in conjunction with dairying.

Probably between 85 and 90 per cent of the soil is under cultivation. Corn, oats, barley, alfalfa, clover, timothy, and peas are the principal crops, but some wheat and sugar beets are also grown. Corn does better than on Superior clay loam or Superior silt loam, because the land is better drained, warms up earlier, and is not so difficult to cultivate. This is a first-class alfalfa land, although liming of the surface soil may be advisable in some places. The acreage of alfalfa

is gradually increasing, and many good fields were seen while the soil survey was in progress. Sweetclover is also grown with success, and the acreage of this crop is on the increase. Apples, potatoes, and small fruits are grown, mainly for home use, although a small commercial cherry orchard at Chilton produces cherries of good quality.

Bellefontaine silt loam, level phase.—A number of level or gently undulating areas of Bellfontaine silt loam were mapped as the level phase of this soil. The soil is similar to the typical soil, but the surface layer is a little deeper and may contain somewhat more organic matter. In a few very slightly depressed areas drainage is somewhat deficient. The agriculture is similar to that on typical Bellefontaine silt loam.

Bellefontaine silt loam, steep phase.—The steep phase of Bellefontaine silt loam includes areas which are rolling or hilly and on which slopes are steep enough to be in danger of serious erosion. The soil itself is similar to the typical soil, but the surface soil is not quite so deep, as some material has been eroded. In places the heavy subsoil is exposed, giving cultivated fields a spotted appearance. This soil is of small extent. It occurs in association with the typical soil.

BELLEFONTAINE LOAM

Virgin Bellefontaine loam shows the following succession of layers: To a depth of 4 inches, brown light-textured loam, over the surface of which there is, in wooded areas, a thin covering of leaf litter and mold and other organic matter; between depths of 4 and 12 inches grayish-brown or slightly yellowish-brown light loam; between depths of 12 and 24 inches chocolate-brown gritty clay loam containing some fine rock fragments and small pebbles of limestone, mixed with the soil material; below a depth of 24 inches and extending to a depth of 48 or more inches, yellowish-brown, calcareous gravelly sandy loam. The gravel material is mostly limestone. Under cultivation the surface material is mixed with the lighter-colored material below, and as a result the cultivated fields are somewhat lighter colored than the immediate surface of the virgin soil.

Areas of this soil are for the most part gently rolling, and natural drainage is good. The native timber growth was the same as on Bellefontaine silt loam, and the two soils are utilized in the same way. Because of its very small total area, Bellefontaine loam is of minor importance in the county.

BELLEFONTAINE GRAVELLY LOAM

The surface soil of Bellefontaine gravelly loam, to a depth of 4 or 5 inches, consists of brown loam or silt loam over which, in undisturbed wooded areas, there is a layer an inch or more thick of leaf mold and other organic matter. This organic matter largely disappears on cultivation or is mixed with the underlying soil. The surface layer contains considerable gravel, chiefly limestone, and there is a varying quantity scattered over the surface. Between depths of 6 and 12 inches, the material is in most places grayish-yellow loam or silt loam containing some gravel. Between depths of 23 and 28 inches, there is a layer of yellowish or reddish-brown gritty clay loam carrying considerable gravel. Below this heavy

layer the material becomes more open and is unassorted gravelly, sandy, clayey till, much more gravelly than the overlaying layers. The gravel is more than 90 per cent limestone. The parent material is glacial drift which was ground by ice from the underlying limestone and deposited as morainic material, kames, and eskers. The foreign material, such as granitic rocks and granitic gravel, was transported from the north by the action of the ice and mixed with the local débris.

The entire soil is in many places very similar to Bellefontaine silt loam, but it is more gravelly and in places is somewhat sandy. It is, as a whole, uniform in texture, the sandy spots being of small extent. Stones and bowlders are common on the surface and some areas are very stony. Most of the stones have been removed from cultivated fields. In many places on knolls and steep hillsides the surface soil has been eroded and the underlying subsoil exposed. Such areas are of small extent but, because of their reddish color, are conspicuous in cultivated fields.

Bellefontaine gravelly loam is of small extent and minor importance. Several small areas are in the northeastern part, and small patches are scattered about the county in association with Bellefontaine silt loam. The surface is generally rolling, irregular, and bumpy, and potholes are common. Because of the irregularity of the surface and the gravelly nature of the material, natural drainage is very good and in places is excessive.

The native timber was chiefly oak, maple, and hickory. Most of the merchantable timber has been cut and the best of the land placed under cultivation. Where not too rough or steep this soil is good for general farming. It is especially well suited to alfalfa, as it seldom needs lime and is so well drained.

Bellefontaine gravelly loam, steep phase.—The steep phase of Bellefontaine gravelly loam includes a number of rolling or hilly areas where the slopes are steep enough to be in danger of serious erosion. The soil on such slopes is shallower than in typical areas, and where the surface has been eroded a spotted appearance of the fields results. This soil is steep and should be kept in pasture or timber as much as possible. Except in thickness and relief, this soil is similar to typical Bellefontaine gravelly loam.

SUPERIOR CLAY LOAM

Virgin Superior clay loam is to be found only in a few wood lots. In such places a thin covering of organic matter, consisting of partly decayed leaves, grass roots, and other organic matter, covers the surface. Immediately below the leaf mold is a layer, about 2 inches thick, of dark-brown or nearly black loam. Between depths of 2 and about 8 inches, the material is grayish-brown light clay loam. From 8 to 36 inches the material is red clay with a decided pinkish tinge. Below a depth of 2 feet this clay is calcareous and effervesces with hydrochloric acid. The dark surface layer is commonly slightly acid, and the gray layer immediately below the surface is medium acid. Below a depth of 36 inches the clay is in most places a little lighter or paler in color and in some places was found to contain a few gravelstones, mostly limestones. This material, which is highly calcareous, continues to an undetermined depth and rests on the

A, Typical Bellefontaine silt loam landscape in the southern part of Calumet County; B, farmstead on Superior clay loam

underlying limestone rock. There are fewer pebbles in this subsoil than in the subsoil of Kewaunee silty clay loam.

Although this soil is, in general, uniform, several minor variations are worthy of mention. In places a thin covering of silt loam lies over the clay loam at the surface, whereas in other places the heavy clay is very near the surface. This condition gives cultivated fields a somewhat spotted appearance. In some places, mainly in low areas where the soil is similar to the Poygan soils, the color is darker than typical. Where such areas are large enough, they are mapped as Poygan silty clay loam. Along the east side of Lake Winnebago or west of the area of Bellefontaine soils, this soil is nearly heavy enough to be mapped as a clay soil.

In cultivated fields, the shallow, dark surface layer becomes mixed with the underlying material, and the color is light brown. The grayish-brown layer is not so noticeable as in the virgin soil, and in many places becomes mixed with the underlying clay and can not be detected. The surface soil is in places so shallow that the plow turns up the heavy subsoil.

Superior clay loam is one of the extensive and important soils of Calumet County. It occurs most extensively in the northern and northwestern parts, where it occupies large level stretches which have the appearance of an old lake bed or plain. Smaller areas are also scattered about over the county in association with Kewaunee silty clay loam and, to a smaller extent, with the Bellefontaine soils. The areas of Superior clay loam are broken by low, poorly drained patches of Poygan silty clay loam and by more rolling areas of Kewaunee silty clay loam.

The surface of this soil is level or gently undulating (pl. 1, B), and natural drainage is rather slow. The subsoil is so heavy that water moves through it slowly. In many places tile drains would improve the drainage conditions, and in some places tile lines are necessary to insure the highest production. Although there are some tile drains on this soil, they are not so common as they should be. The most poorly drained areas border areas of the Poygan soils or occur in slight depressions not large enough to map as a separate soil.

The wood lots remaining on this soil at present support a growth of maple, oak, beech, hickory, elm, and poplar. By far the greater part of the timber has been removed, and probably more than 90 per cent of the soil is cleared and cultivated. Agriculture is highly developed. The soil is generally a little "late" in the spring, which makes it less well suited to corn than the higher, better-drained soils of light texture. The chief crops grown are hay, small grains, and corn. Hay does well, and the pastures are excellent. Some alfalfa is grown, peas are an important crop on some farms, and sugar beets do well on the better-drained areas. On account of the heaviness of the soil, cultivation is difficult, and heavy tools and work animals are needed. As a whole, the soil is somewhat deficient in organic matter, and it has been found that it responds well to prosphatic fertilizer. It is desirable to plow this land in the fall, and this practice is followed wherever possible. If plowed in the spring it is very difficult to obtain a good mellow seed bed. Fields plowed in the fall are exposed to freezing and thawing in the winter, and this makes spring cultivation less difficult and insures better tilth.

SUPERIOR SILT LOAM

Virgin Superior silt loam has a surface covering, about 1 inch thick, of dark leaf mold, which is made up largely of organic matter. The surface soil to a depth of about 3 inches, is dark-brown silt loam. Between depths of 3 and 14 inches is decidedly grayish or slightly brown silt loam. Between depths of 14 and more than 36 inches the material is pinkish-red clay which is calcareous below a depth of 2 feet. This bed of heavy red calcareous clay extends to an undetermined depth but is known to rest directly on the bedrock in a number of places. Under cultivation the dark surface layer is mixed with the gray subsurface layer, giving a light-brown color to the cultivated soil.

In one variation mapped with this soil, the silt loam is shallower than typical and the heavy clay comes close to the surface. A few included low spots, had their extent been sufficient to warrant it, would have been included with the Poygan soils in mapping.

This soil is of very small extent. One area is in the vicinity of Forest Junction, and others occur in the northern and northwestern parts of the county in association with Superior clay loam and the Kewaunee soils.

Areas of this soil are level or slightly undulating, and natural drainage is fair. Because of the heaviness of the subsoil, water moves through the soil rather slowly. This is a late soil and rather cold. Tile drains could advantageously be installed in places.

The few wood lots which remain on this soil support a growth of hickory, maple, elm, basswood, and some oak. It is estimated that more than 90 per cent of the soil is in cultivated fields and pasture.

This is a good general-farming soil and is well suited to hay, grasses, and small grains. Corn does better than on Superior clay loam but not so well as on the better-drained members of the Kewaunee series. Because of the siltiness of the soil it is easier to cultivate and more desirable than Superior clay loam. It is of such small extent, however, that but few farms are located entirely on it.

This soil is somewhat deficient in organic matter, and it has been found that it responds readily to the use of phosphatic fertilizers.

SUPERIOR LOAM

The surface layer of virgin Superior loam, to a depth of about 4 inches, consists of light-brown loam which in wood lots is covered with a thin layer of leaf mold. Between depths of 4 and 10 inches the material is heavy grayish-brown loam, and from 10 to 36 inches it is pinkish-red clay. This heavy subsoil is calcareous below a depth of 30 inches. Under cultivation the brown surface layer is mixed with the grayish-brown layer, giving the tilled fields a grayish-brown appearance. The texture of the surface soil may range from loam to light clay loam, and the depth to the clay may vary somewhat. In places the plow will turn up the heavy subsoil, although this is unusual. In some small depressions the soil resembles Poygan clay loam. These places are more poorly drained than typical, and there is more organic matter in the surface soil, giving the darker color.

Superior loam has been derived from a lake-laid or lacustrine deposit. The parent material was rich in lime, but the soil has been leached to such an extent that the lime has been removed from the surface layer, and this and the gray layer are now slightly or medium acid. The deeper subsoil and substratum, however, are well supplied with lime.

This soil is of rather small extent. It occurs chiefly in the northwestern part of the county in the vicinity of Darboy. It is associated with Superior clay loam. The surface is level or gently undulating, and natural drainage is fair. In many places, however, tile drains would be beneficial.

The timber found in wood lots consists chiefly of hickory, elm, maple, basswood, and oak. More than 90 per cent of the soil is under cultivation. It is well suited to small grains, hay, and pasture. Sugar beets, peas, and alfalfa do well, and corn is grown but does not succeed so well as on the Kewaunee or Bellefontaine soils, as Superior loam is not so well drained naturally as these soils.

This soil is deficient in organic matter and responds to the use of phosphatic fertilizers.

SUPERIOR FINE SANDY LOAM

About the only areas of Superior fine sandy loam not under cultivation are along old fence rows. In such places the surface soil is brown fine sandy loam about 8 inches thick. This material is underlain by grayish-brown fine sandy loam, which is underlain, at a depth ranging from 12 to 14 inches, by heavy red clay continuous to a depth greater than 3 feet. The depth to the clay is variable, ranging from 12 to 26 inches. The texture of the surface soil may also vary a little, but it is commonly fine sandy loam or loam. The parent material is largely of lacustrine or lake-laid origin. The surface layers of the soil are slightly or medium acid, and the subsoil below a depth of 2 feet is very calcareous.

This soil is of small extent. An area is southwest of Brillion and another is near Highcliff. No farms are located entirely on it. The surface is level or very gently undulating, and natural drainage is fair or good.

The native timber on this soil was chiefly hickory, maple, basswood, and elm, with some oak. Practically all the soil is under the plow and is well improved. This is one of the most desirable of the Superior soils. Because of the texture of the surface soil it is easier to cultivate than the heavy soils, and a good seed bed can be obtained with but little difficulty. The crops grown are the same as on Superior clay loam and Superior silt loam. This is a soil which, if well located in respect to markets, would be well suited to trucking.

This soil is somewhat deficient in organic matter and responds to phosphatic fertilizers, as do the other Superior soils.

FOX SILT LOAM

In virgin Fox silt loam there is the following succession of layers: Over the surface in undisturbed wooded areas, leaf mold and other organic matter, an inch or more thick, which under cultivation becomes mixed with the underlying material; to a depth of 4 inches brown silt loam which is smooth, friable, and free from gravel and

coarse material; between depths of 4 and 14 inches, grayish-brown friable but slightly compact silt loam; between depths of 14 and 24 inches chocolate-brown or reddish-brown gritty clay loam, which breaks up in cuts into angular fragments when crumbled in the hand; between depths of 24 and 36 or more inches sticky, gravelly sand, which is underlain by stratified sand and gravel. In places gravel beds are present, and in other places the deep layers consist mostly of sand. The gravel and coarse material in the subsoil are composed largely of limestone material and are calcareous, whereas the two upper layers are commonly slightly acid. The material from which this soil is derived was deposited by streams issuing from the ice sheet during glacial times. It contains a high percentage of limestone gravel.

In places the surface soil varies from silt loam to loam, and a few sandy areas too small to separate were also included in mapping.

This soil is of small total extent. An area is about 2 miles east of Harrison, and other areas are scattered along Lake Winnebago and in the vicinity of Brillion. Areas are level or gently undulating, and natural drainage is good or somewhat excessive. Crops are apt to suffer during long dry spells.

The native timber on this soil has practically all been cut, and the land is now devoted to farming. This soil compares well with Bellefontaine silt loam, with which it is in many places associated. The crops grown, the rotations followed, and the methods of farming practiced are the same as on Bellefontaine silt loam.

WARSAW LOAM

The surface soil of Warsaw loam is very dark-brown loam about 10 inches thick. On the surface, in places, there is some gravel, and the soil contains considerable coarse and medium sand. Between depths of 10 and 20 inches the material is reddish-brown gritty loam containing some gravel. Below a depth of about 20 inches there is in most places a gravel bed which extends to an undetermined depth. Warsaw loam, like Fox silt loam, is derived from coarse water-laid deposits which occur as stream terraces or outwash plains. The top layer is acid, but the subsoil is calcareous, being made up largely of limestone material.

This soil is of very small extent. It occurs in the western part of the county close to Lake Winnebago. The surface is level or gently undulating, and natural drainage is good. The soil is apt to suffer somewhat from drought. The surface in places has been made irregular by taking out gravel, and for this reason some of the soil is not now used for farming.

Typical Warsaw loam is a fairly good soil and is capable of being highly improved. Part of the soil is under cultivation. It has about the same agricultural value as Bellefontaine loam.

POYGAN SILTY CLAY LOAM

The surface soil of Poygan silty clay loam, to a depth of 12 inches, consists of dark-brown or black heavy, rather stiff silty clay loam. The content of organic matter is high, and in a few low places a layer of peat, a few inches thick, covers the surface of the mineral

soil. Between depths of 12 and 22 inches, the material is bluish or drab heavy, stiff silty clay loam, which when wet becomes plastic. Between depths of 22 and 36 inches the material is dull-gray, mottled or reddish silty clay. Typically the lower part of the subsoil is reddish, but, owing to variations in oxidation, considerable included material is dull gray or mottled rather than red. All the material is very heavy. Below a depth of 36 inches it is not uncommon to find gritty material in the subsoil. The surface soil is commonly neutral in reaction, and calcareous material is found in most places at a depth of about 3 feet or a little more. The gritty material in the deep subsoil is mostly limestone débris. The parent material of this soil is considered to be lacustrine, having been deposited in quiet waters. It is possible that it has been influenced to some extent by the action of glacial ice since its deposition.

This soil is rather extensive. It occurs chiefly along the east border of Lake Winnebago and scattered over the county in association with the Superior and Kewaunee soils. The surface is level or slightly depressed, and natural drainage is deficient in most places. Only a few areas can be cultivated without artificial drainage. Some areas are very swampy and are covered with water part of the year, whereas other areas have been drained and placed under cultivation.

The original timber on this type of land consisted chiefly of elm, ash, soft maple, and willow. There is still some fair timber on areas of this soil, but most of the best has been cut. Less than 20 per cent of this land has been cleared and placed under cultivation. Where drained it is a good soil and well suited to a number of farm crops. It is well suited to grasses and hay and is good for corn except for the danger from frosts on account of its low position. Small grains make a rank growth, but are apt to lodge. Sugar beets, cabbage, and such crops thrive, and when the soil is well drained and placed under cultivation it will add greatly to the agricultural production of the county.

The first step in the improvement of this soil is drainage. In some instances drainage districts will have to be organized, but in many cases farmers can drain small areas without going into such an organization.

CLYDE SILTY CLAY LOAM

The surface soil of Clyde silty clay loam, to a depth of 12 inches, consists of black or very dark-brown silty clay loam or silt loam which contains a high percentage of organic matter. The material is heavy and is commonly stiff and plastic. When wet it becomes very sticky. Between depths of 12 and 36 inches is mottled dull-gray and yellowish silty clay loam or silty clay. In some places the deep subsoil contains some gritty material, whereas in others it is free from grit. The gritty material is commonly calcareous, but the grit-free subsoil is generally noncalcareous. The surface soil is neutral in most places. The smooth heavy clay may extend to a depth of 4 or 5 feet, but in many places, especially in the till regions, the deep subsoil grades into unassorted till, which is everywhere calcareous.

The parent material of Clyde silty clay loam owes its accumulation to two more or less distinct agencies. Part of the material, occurring in low places where the drainage is poor and where there has been a

large accumulation of organic matter, is glacial till; and part, occurring along streams where it is subject to overflow, is alluvial in origin. The soil in the two locations is very similar, but the till soil is considered typical.

Clyde silty clay loam covers a total area of 18.6 square miles and is widely distributed throughout the county. It occurs chiefly in association with Bellefontaine silt loam and other Bellefontaine soils in the central and south-central parts of the county. The surface is level, and there are few irregularities. Areas are low and depressed, and natural drainage is poor.

The native timber on this soil was mostly elm, ash, soft maple, and willow. Most of the merchantable timber has been cut. Some of the land has been drained by open ditches or tile drains, and about 15 per cent of it is now under cultivation. Where not drained, but cleared sufficiently, the land is utilized for pasture or the production of hay.

This is a good soil, and when properly and thoroughly drained it will be one of the best in the county. Drained land of this kind is well suited to corn, hay, sugar beets, cabbage, and other crops. Small grains can also be grown, but the grain is apt to lodge and not fill so well as on the upland soil.

In the improvement of this soil, drainage is the first and most important step.

CLYDE SILT LOAM

The surface soil of Clyde silt loam, where typically developed, is black smooth silt loam from 12 to 16 inches thick. The subsoil is dull-gray and yellow mottled silty clay loam which extends to a depth varying from 4 to 5 feet. In the lower part of the subsoil there is in many places some gritty material.

This soil is of very small extent. It closely resembles Clyde silty clay loam in all characteristics except the texture of the surface soil. The areas are small and few in number and are scattered through the region where Bellefontaine silt loam occupies the upland.

CONOVER SILT LOAM

The surface soil of Conover silt loam, to a depth of about 6 inches, consists of grayish-brown silt loam. In its virgin state in undisturbed wood lots there is commonly a surface covering, an inch or more thick, of leaf mold and other organic matter. This layer is soon lost or mixed with the underlying material under cu tivation. Between depths of 6 and 16 inches the material is mottled gray and yellowish-brown silt loam, somewhat heavier than the surface soil. Between depths of 16 and 36 inches the material is mottled yellow and dull-gray or bluish silty clay loam. Below a depth of 3 feet, generally between depths of 4 and 5 feet, occurs the unassorted till, which is grayish in color. This till is calcareous, but the material above is in most places somewhat acid in reaction. This soil is intermediate in drainage between Bellefontaine silt loam and Clyde silt loam and is somewhat variable in color though it is uniform in texture. The parent material is largely glacial till, composed in part of limestone débris of local origin. There may have been some wash from adjoining higher lands, which would make the soil in part of colluvial origin.

Where Conover silt loam borders the Bellefontaine soils it is light colored, and where it grades into the Clyde or other low soils it is commonly darker than typical.

Conover silt loam is of small total extent and minor importance. It occurs over the county in association with Bellefontaine silt loam. It occupies long gentle slopes or nearly level areas, and natural drainage is somewhat deficient, especially near low soils.

The native timber on this land was largely elm and soft maple, but there was some oak. Most of the timber has been cut and the land placed under cultivation. It is a fairly good soil, though it is not everywhere sufficiently drained. It is best suited to use as hay and pasture land, but when drained it can be used for small grains, corn, and other crops. It is farmed along with Bellefontaine silt loam, and farming methods are the same as are followed on that soil.

MAUMEE LOAM

The surface soil of Maumee loam, to a depth of 6 inches, consists of very dark-gray or nearly black heavy loam. Between depths of 6 and 28 inches the material is drab or grayish heavy fine sandy loam, and between 28 and 36 inches it is mottled gray or yellowish fine sand, which is rendered somewhat coherent by a small content of clay. Below a depth of 36 inches the material is stratified and consists of layers of fine sand, some gravelly material, and layers of clayey material.

This soil is variable. The surface soil ranges from heavy loam to fine sandy loam, and there are numerous variations in the subsoil. The lower part of the subsoil is everywhere sandy, however.

Maumee loam is of small total extent. The areas along Lake Winnebago are very stony and have a moderate slope to the lake. Two areas are near Chilton, and one is west of Brillion. Most of the small tracts are along the shore of Lake Winnebago. The surface is for the most part level, but many areas have a gentle slope. Natural drainage is deficient, and many areas are affected by seepage from the adjoining higher lands.

Typically this is an outwash or valley-filling soil of alluvial origin. Its position is everywhere low enough so that drainage is deficient.

The native timber growth was largely elm, ash, willows, alder, and other water-loving trees. Part of the soil has been cleared, and a small proportion is partly drained and under cultivation. A rather large part is used for pasture, and in its present condition the soil is best suited to such use. When well drained and placed under cultivation it will be a fairly good soil, but without drainage it can be used only for pasture land.

MAUMEE SANDY LOAM

The surface soil of Maumee sandy loam, to a depth of 14 inches, consists of very dark-gray or black sandy loam of medium texture. Between depths of 14 and 36 inches the material is mottled gray and yellowish-brown medium sand. Where the surface is slightly elevated and better drained than typical, the subsoil is brown. Below a depth of 36 inches the material is generally stratified, and

some gravel is present. A number of sand and gravel pits occur in this soil.

Maumee sandy loam is of small total extent. It occurs chiefly at Waverly Beach, along the shore of Lake Winnebago. The surface is for the most part low and level, and most of the soil is poorly drained, although a small part that is higher lying than typical can be cultivated without artificial drainage. Part of the soil is only a few feet above the level of the lake. Such areas are very marshy.

The native timber on this land consists chiefly of ash, elm, soft maple, and willows, with some alder brush. Part of the soil has been cleared, and the most elevated areas are in cultivation. The soil is rather light textured and can be considered only fairly good. It has a lower value than Maumee loam. When drained and properly fertilized it should produce fair yields of a number of truck crops. At present the uncultivated areas are used in part for pasture, but some are too wet for any purpose.

WABASH SILT LOAM

The surface soil of Wabash silt loam, to a depth of 14 inches, consists of dark grayish-brown or black silty clay loam or silt loam which contains a high percentage of organic matter. Below a depth of 14 inches and extending to a depth of 36 or more inches the material is mottled dark grayish-brown and yellow silty clay loam or silty clay. The surface soil is commonly neutral, and the subsoil is alkaline in reaction below a depth of 2 feet. The soil is variable, especially in regard to the thickness of the dark upper layer, which in places extends to a depth of 2 or 3 feet. The parent material is alluvium derived in part from heavy glacial till and in part from limestone residuum.

This soil comprises a total area of nearly 4 square miles. It occurs chiefly along South Branch Manitowoc River, Pine Creek, and Killsnake Creek, but some areas are along the smaller drainage ways of the county. Areas are nearly level, and natural drainage is poor. This is all first-bottom land and is subject to overflow. The native timber was elm, ash, soft maple, and willow.

Because of poor drainage, very little of this soil is cultivated. Where it is utilized at all, it is pasture land. It produces good pasturage and some hay. If it could be drained, it would be strong, productive farm land well suited to corn, hay, sugar beets, cabbage, and other crops.

Along small streams the land could doubtless be drained readily, but along the larger streams diking or lowering the bed of the streams would be necessary.

EWEN SILTY CLAY LOAM

The surface soil of Ewen silty clay loam, to a depth of 4 inches, consists of brown clay loam having a slightly reddish cast. Between depths of 4 and 36 inches the material is red clay loam, which when dry breaks up into angular cubical blocks similar to the subsoil of Superior clay loam. In some places this layer is laminated and breaks up into shalelike sheets. Below a depth of 36 inches the material

grades abruptly into sand, which generally extends to a considerable depth.

This soil is variable, especially in regard to the depth to the sand layer. In some places it is found at a depth of 18 inches, in other places at 2 feet, and in a few areas it was nearer the surface. The surface soil is in some places silty.

This soil occurs throughout the northern and eastern parts of the county, where the Kewaunee and Superior soils predominate. It occurs as narrow strips along the streams and is very badly cut by stream courses, so that it has little value for cultivated crops. Areas are low and level, where not cut by streams. This is all first-bottom land subject to annual overflow. Many of the slopes bordering the bottom lands are steep and range in height from 5 to 15 feet.

This is a good strong soil and would be very productive if it could be protected from flooding, but the danger from floods and the fact that it is so badly cut up makes most of it unfit for cultivated crops. It is utilized mostly for pasture. A few farmers cultivate small areas with fair results, when the areas are not flooded.

GENESEE SILT LOAM

The surface soil of Genesee silt loam, to a depth of 12 inches, consists of brown silt loam. This is underlain by a lighter colored silt loam subsoil. Sand seams are common in the subsoil, and a bed of sand is present in many places in the deep subsoil.

This soil is of small extent. It is found along the streams which traverse the region of Bellefontaine soils. It is all first-bottom land subject to overflow and is badly cut by streams. Because of this, little attempt is made to cultivate this land, which is utilized largely for pasture. It is a good strong soil, and if it could be protected from flooding would make desirable farming land. Along small drainage ways some of it can be drained and protected readily from flooding, but along the larger streams in which the flow is steady, protection would be more difficult. It would be necessary to put in dikes or lower the bed of the streams, and in most places this would not be justified under present conditions. After diking, tile drains would in places be necessary also.

RODMAN GRAVELLY LOAM

Rodman gravelly loam comprises gravelly material which occurs on areas so rough, broken, and steep that it is of little value. The surface layer, to a depth of a few inches, consists largely of gravelly loam which rests on assorted and unassorted gravel. Natural drainage is excessive, and the soil is droughty. It is all made up of glacial material, largely in kames and eskers or other morainic forms, and the gravel, stones, and bowlders are largely limestone. All of the gravelly material is highly calcareous.

This soil is inextensive. It occurs chiefly in the northeastern and southern parts of the county. The native timber was mostly scrub oak, and part of the soil is still timbered with such a growth. Some of the land has been cleared, and in places some effort has been made to cultivate it, but yields are unsatisfactory. The soil is utilized

mostly for grazing, but the grass usually dries up during the dry summer months. Because of its low value for farming, this soil should be considered, under present conditions, as nonarable.

ROUGH STONY LAND

Rough stony land consists largely of steep, rocky slopes where there is but little soil or where the rocks are so numerous that cultivation would be impossible. In some places the slopes are not so steep, but the rocks are so numerous that the land could not be used for cultivated crops. Many areas are all rock in the form of steep cliffs, but in others there may be smoother areas where there is a little soil between the rock exposures. Where there is some soil present the land can be used to a small extent for grazing, but this is the only agricultural use that can be made of it. The outcrops are all of limestone, and this rock is in places being ground for use on the land as well as being burned to make lime.

This classification occurs chiefly along the Niagara escarpment on the east side of Lake Winnebago. An area is south of Chilton. These areas are nonarable.

PEAT

Peat consists of accumulations of plant remains varying in color from brown to nearly black, in structure from soft finely divided material to fibrous, felty, and woody material, and in thickness from 10 inches to many feet.

The peat in this county is all low-lying, level, and naturally very poorly drained. It occurs along streams, in what appears to be old lake or pond beds, and in small undrained depressions throughout the county. In many of the areas along streams the level of the marsh is no more than 2 feet above the water in the rivers, and in many places some of the peat is flooded during times of high water. All the peat is so situated that it must be drained before cultivated crops can be grown.

Three phases of peat, based on physical characteristics, were recognized in Calumet County but were not separately indicated on the soil map. One phase, to a depth of 12 inches, consists of dark-brown or black well-disintegrated peat. The disintegration has gone so far that no trace of the original fiber can be seen in the material. It is, for the most part, black but as mapped included some brownish material. Between depths of 12 and 36 inches the material is black, well-decayed, finely divided peat. The thickness of the deposit ranges up to 15 feet and probably averages 5 or 6 feet. The underlying material is for the most part heavy but varies somewhat with the character of the surrounding upland soils.

A second phase consists of dark-brown, fairly well disintegrated peat. There is very little change in the material with increased depth. The material is finely divided, and some traces of the original fiber can be seen, though in most places the fibers are rather thoroughly broken up. This material is less extensive than the well-disintegrated peat and is not so desirable agriculturally. Some of this peat occurs southwest of Kiel along the valley of Sheboygan River. Numerous smaller areas are scattered about the county.

A third phase of peat may be termed raw peat. The material is a brown, raw, fibrous mass of partly decayed vegetation in which the fiber and woody structure of the plants can readily be seen. The raw peat extends to a depth ranging from 3 to 8 or more feet, and the underlying material is very similar to that in the adjoining upland soils. If the upland soils are heavy, the subsoil of the marsh is generally heavy. The total area of the raw peat is less than of either the well-disintegrated or intermediate phase. The areas are scattered in various parts of the county, without any regularity or system.

The native vegetation on the well-decomposed peat consists chiefly of ash, some elm, soft maple, willows, tamarack, alder, and other water-loving shrubs. On the less well-decomposed peat there is tamarack, cedar, alder, and willow, but fewer hardwoods. Rather large areas are open and grass covered and appear always to have been treeless.

Only a small proportion of the peat, consisting of small patches which can be readily drained or narrow strips along the border of the larger marshes where the drainage is better than in the marsh proper, has been improved. Cleared and sufficiently firm areas are used for hay and pasture land.

By far the greater part of the peat is uncleared and, in its present condition, unfit for crop production. Before this land can be farmed it will be necessary to install many drainage ditches, and in many places this will mean the establishment of drainage districts.

Peat, shallow phase.—A phase of peat, based on a variation in the thickness of the organic deposit, is indicated on the soil map as peat, shallow phase. In areas so indicated the peat is less than 3 feet thick. In its physical characteristics it is largely of the better-disintegrated, darker-colored phase previously described.

SUMMARY

Calumet County is in the east-central part of Wisconsin. Lake Winnebago forms the western boundary. The county comprises an area of 320 square miles.

The relief of Calumet County ranges from level to gently rolling, and only a few areas are rough and broken. Transportation facilities are excellent.

The average frost-free season at Chilton is 154 days. The average annual rainfall of 30.43 inches is well distributed throughout the year. There is a good supply of water for the home and for livestock, and the climate is healthful.

Dairying is the leading farming industry followed in the county. The chief crops grown are hay, corn, oats, wheat, peas, and sugar beets. Alfalfa is becoming a very important crop. The farms are, as a rule, very well equipped. Silos, tractors, and modern farm machines are common in all parts of the county. The homes are modern and well kept, and agriculture is in a prosperous condition.

Calumet County was originally covered with a dense forest of hardwoods, with a mixture, in places, of some pine. The underlying rock is practically all Niagara limestone. The soils are for the most part heavy, and clay loams and silt loams predominate. These soils

have been derived largely from lacustrine material, which has been modified in varying degrees by glacial action.

The mineral soils of the county are classified in 13 series, with 23 types. Kewaunee silty clay loam, Bellefontaine silt loam, and Superior clay loam are the most important soils, together comprising 62.7 per cent of the area of the county. In low places there has been extensive accumulation of organic matter, and peat soils are rather extensive. In addition, two miscellaneous classifications of nonarable material, rough stony land and gravel pits and quarries, are mapped.

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[PUBLIC RESOLUTION No. 9]

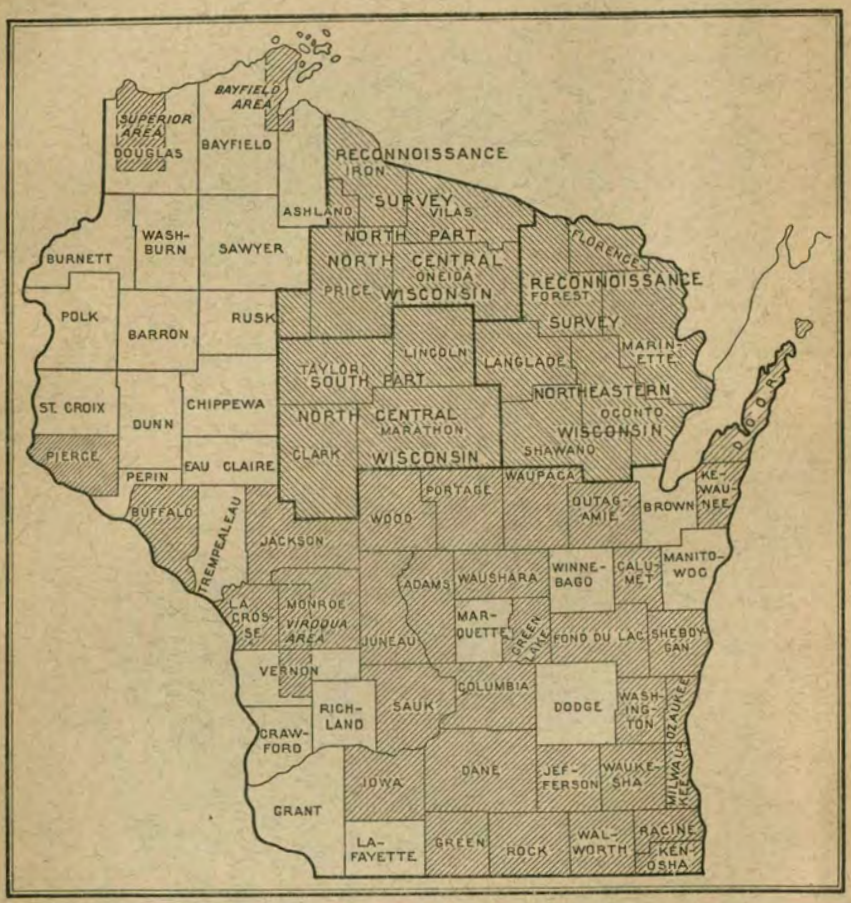
JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

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

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided,* That in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets, bound in paper covers, of which five 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, and on July 1, 1927, the Bureau of Soils became a unit of the Bureau of Chemistry and Soils.]



Areas surveyed in Wisconsin, shown by shading

U. S. GOVERNMENT PRINTING OFFICE: 1930