

SOIL SURVEY OF WAUSHARA COUNTY, WISCONSIN.

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DESCRIPTION OF THE AREA.

Waushara County is located in the south-central part of Wisconsin. It is in form a parallelogram, with its east-and-west dimensions $35\frac{3}{4}$ miles and its north-and-south dimension 18 miles. It is bounded by Portage and Waupaca counties on the north, by Winnebago County on the east, by Green Lake and Marquette counties on the south, and by Adams County on the west. It covers an area of 643 square miles, or 411,520 acres.

The area may be divided into three natural physiographic divisions. The western division embraces nearly all of Plainfield, most of Hancock, and the northwestern two-fifths of Coloma townships. This division lies entirely within the Wisconsin River Valley and has a level to very gently undulating topography. It consists mainly of open country, with many narrow belts of Muck lands entering the western boundary and extending from one-half mile to several miles into the

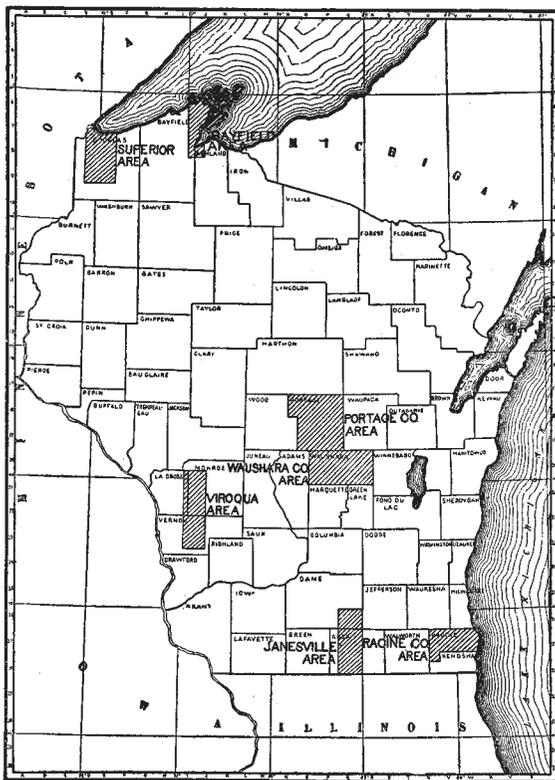


FIG. 39.—Sketch map showing location of the Waushara County area, Wisconsin.

county. These belts of Muck usually follow the courses of streams which flow in a westerly direction and drain this part of the county. Very few boulders occur in this division and the only sandstone outcrop covers a few square rods in section 31 of Hancock Township.

The central division embraces a series of morainic hills crossing the area from north to south and from the Wisconsin River Valley eastward nearly to Bloomfield, Poy Sippi, and Warren townships. It is made up of numerous hills, pothole depressions, and narrow, irregular ridges and valleys. The hills vary in height from 30 to 100 feet or more above the Wisconsin River Valley. This rough rolling topography is most pronounced in the northern part and breaks up into more gentle slopes and more open valleys southward and eastward. The largest of these valleys, lying almost entirely within Oasis Township, was at one time an interglacial lake with its outlet to the southwest. Several small terraces, their slopes southward, cross the valley from east to west. This valley is nearly all under cultivation. It is locally known as the "Great Prairie" and has very fertile soil and is occupied by a very prosperous class of farmers.

The smaller valleys of this division opening to the south and east were old drainage channels for the swollen streams of water issuing from the melting glaciers. The streams flowing through these valleys now drain this division. Many beautiful small fresh-water lakes are scattered through the morainic belt, and areas of Muck are found along most of the streams. Many of the pothole depressions are 100 feet or more in depth, have quite steep slopes, and are usually dry. Most of this division is under cultivation, though considerable areas are still covered with scrubby oak. The soil for the most part is very sandy and numerous crystalline glacial boulders are scattered over its surface.

The eastern division embraces the Lake Poygan and Pine Creek valleys, which are included in Warren and the three eastern townships. Lake Poygan lies in the east-central part of this division and covers an area of about $3\frac{1}{2}$ square miles in Poy Sippi and Bloomfield townships. The topography of this division is level to gently rolling, and most of the land is under cultivation and highly improved. The drainage is eastward into Lake Poygan and the roads are generally good.

Fox River, which cuts off the southeastern corner of the county, is the largest stream in the county. It flows in a northeast direction and no streams enter it within the limits of the county. Pine Creek, which drains the northeastern third of the area into Lake Poygan, is the second largest stream. It affords fair water power at different points along its course. Willow Creek, the third stream in impor-

tance, drains the central and southeastern parts of the area. Its outlet is in Lake Poygan near that of Pine Creek.

White River and smaller streams tributary to the Fox drain the southern part of the area. Most of these streams have sufficient fall to furnish good water power for manufacturing. The lakes in the morainic belt vary in size from one-half acre to more than a section. Prominent among these are Silver, Pine, and Fish lakes.

Two railroads cross the county from north to south—the Chicago and Northwestern at about the center, with a branch extending to Redgranite, and the Minneapolis, St. Paul and Sault Ste. Marie (Wisconsin Central Railway) through the western part of the county. Wautoma, Wild Rose, Glenrock, Springlake, and Lohrville are situated upon the former line, and Coloma, Hancock, and Plainfield upon the latter. These two systems offer good transportation facilities, though the sandy nature of the roads and the many hills make hauling of farm products heavy work. The important markets—Chicago, Milwaukee, Madison, Oshkosh, and Fond du Lac, the first named only 200 miles distant and the others near by—afford advantageous outlets for the products of the county. Many other small towns are found throughout the county. Good schools are found in every township, and rural free delivery of mail and telephone service extend to all parts of the county.

The area is settled by a mixed population of Germans, Welsh, English, Danes, Norwegians, Poles, and Swedes, most of whom came from the adjoining counties to the south and east; a few from the Eastern States and from Europe. Nearly all were homeseekers who began to till the land as soon as they settled upon it. The Germans are now the predominant nationality.

CLIMATE.

The climate of this area is invigorating and healthful. Though the winters are long and severe, the temperature sometimes falling as low as -35° F., the air is usually dry and the cold is not so penetrating as in more humid climates. The soil generally freezes to a depth of 1 to 3 feet and is covered with snow from December 1 until about the 15th of March.

The summers are usually short and very pleasant, the temperature seldom reaching 100° F. The high percentage of sunshiny days causes crops to develop very rapidly, and they mature in a relatively short time. In average years the growing season extends from the middle of May to the latter part of September; from the recorded data of killing frost its length is one hundred and thirty-one days. The average date of the last killing frost in spring is May 16 and of the first killing frost in fall September 24.

The following table, compiled from the records of the Weather Bureau station at Hancock, shows the mean monthly, seasonal, and annual temperature and precipitation. The data here given are computed from records covering a period of ten years:

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

Month.	Temperature.			Precipitation.			
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year.	Total amount for the wettest year.	Snow, average depth.
	° F.	° F.	° F.	Inches.	Inches.	Inches.	Inches.
December.....	20	50	-25	1.2	1.8	1.1	7.5
January.....	16	53	-30	1.1	1.4	1.6	10.1
February.....	16	53	-35	1.2	1.2	1.6	7.9
Winter.....	17			3.5	4.4	4.3	25.5
March.....	30	73	- 8	1.7	0.5	1.2	6.5
April.....	46	85	11	2.4	1.0	2.9	2.8
May.....	58	93	25	3.7	1.8	5.6	.5
Spring.....	45			7.8	3.3	9.7	9.8
June.....	67	99	31	4.2	1.4	7.3	.0
July.....	72	100	44	4.0	1.8	4.0	.0
August.....	69	100	40	2.9	3.4	4.0	.0
Summer.....	69			11.1	6.6	15.3	.0
September.....	61	94	20	2.6	1.4	2.7	.0
October.....	50	84	15	2.1	0.4	1.0	.5
November.....	32	68	10	1.2	1.7	1.1	3.9
Fall.....	48			5.9	3.5	4.8	4.4
Year.....	45	100	-35	28.3	17.8	34.1	39.7

It will be noted from the preceding table that the yearly rainfall is sufficient to mature good crops and that it is well distributed, 11 inches falling during June, July, and August, the time when moisture is most needed by the growing crops.

AGRICULTURE.

A few settlers entered the county as early as 1848, but little or no attempt was made to cultivate the land until 1850. There were no mineral resources in the county and only a few small areas of timber, so the early settlers were forced to depend on agriculture for their living. Wheat, corn, potatoes, and buckwheat were the first crops grown, and excellent yields were obtained for several years, but wheat soon began to decline in yields, and its production was abandoned. It was found that the sandy soils were well suited to

corn, rye, and potatoes, and the growing of these and red clover was extended.

Little attention was given to crop rotation in early times, and it became evident, with the decline in yields, that some changes in the general practices were necessary if the productiveness of the soils were to be maintained. As early as 1875 the settlers began to experiment with a number of new crops to see which were best adapted to the soils and climate. It was soon found that potato culture was well suited to this area, and that industry, with dairying, began to receive considerable attention. These two industries, with the production of red clover seed, hog raising, and the growing of beans, corn, rye, oats, and hay constitute the lines of farming now followed in this area. Potato raising and dairying are the two most prominent specialties at the present time, and they have done much to place the county in its present prosperous condition. The cranberry is the chief fruit exported.

In 1900 the average size of the farms in Waushara County was 136.5 acres, and 79.40 per cent of the farms were operated by the owners. The value of land, fences, and buildings increased \$3,300,000 from 1890 to 1900, of live stock \$465,000. The production of beans was 100 per cent greater in 1899 than in 1889, of red clover seed 100 per cent greater, of hay 33½ per cent greater, and of potatoes nearly 300 per cent greater, though in comparing these figures the possible effects of differences in the seasons must be given consideration. The increase in expenditure for machinery in this time was \$242,000, or 100 per cent. Besides being well suited to the soil types of this area, the crops here mentioned, with others discussed in the chapter on "Special industries," are proving very profitable, and if further developed will furnish employment and substantial incomes to many times the present population.

In whatever type of farming the system of cropping should be arranged so that a good supply of organic matter may be maintained in the soil, because without this crop yields are sure to diminish. The rotation generally followed at the present time is potatoes or corn, rye or oats, and clover and timothy. The sandy types are seldom left in sod for more than one or two years, because of the difficulty of maintaining satisfactory stands of grass for longer periods. The loams and clay loams are frequently left in sod from two to five years, the land during the last year or two being used for pasture. In many of the sandy localities where dairying has not been developed, farmers are having difficulty in obtaining sufficient organic matter to maintain the productivity of their soils. Heretofore they have depended upon a clover and timothy sod to plow down, but in recent years they have had considerable difficulty in securing satis-

factory growths of red clover, and as a result the fertilizing value of the sod is greatly decreased. One or more legumes in the rotation are vitally important for the maintenance of the fertility of the sands and sandy loams, and where clover fails some other legumes, such as soy beans, cowpeas, or vetch should be substituted until the soils are in condition to support the growth of red clover again. Alfalfa can be grown when the necessary conditions are supplied. Where manure is not available it may be advisable to plow down an occasional crop of legumes, in order to supply organic matter and nitrogen. Care should be exercised, however, in the plowing down of green crops, and if the growth is very heavy it is a good plan to give the land an application of lime.

Crop yields are greatly influenced by the methods of tillage used, and this is an especially important matter in Waushara County. The general practice is to plow in the spring for all crops except rye, for which the land is prepared early in the fall. Some farmers break sod land early in the spring, while others wait until just before planting time, claiming this is best as the sod prevents the soil from washing. Some systematic tests in tillage for the various types of soil would undoubtedly prove very beneficial. Spring plowing may be the most advisable for the sands and sandy loams, as their open texture permits free circulation of air, which aids in the rapid decomposition of the organic matter. However, spring plowing is usually more shallow than fall plowing and the organic matter is kept near the surface. This causes the greatest root development to occur near the surface and in times of drought the crop is more likely to suffer for moisture than if the organic matter were worked deeper into the soil. If deeper spring plowing is practiced on the sandy soils, it may be advisable to firm the soil by using a corrugated roller. On the loams and clay loams, where there is little danger from washing, it would seem best to plow the sod land in the fall, as this method will give the organic matter sufficient time to decay, will destroy many worms and other pests, will have a better effect upon the granulation of the soil, and enable it to catch and hold more of the water which falls. A seed bed at least 10 inches deep is advisable for the heavy types, while on the sandy soils more shallow plowing is usually advisable, except under certain conditions. At present most of the plowing is done with single-share plows. With the easily tilled soils of this region and the scarcity and high price of labor, it would seem better to use gang plows.

With an average annual rainfall of only 28.3 inches and the usual occurrence of a period of dry weather during the growing season, it is very necessary to conserve all the moisture possible for the growing of crops, especially in the case of the loose sandy types of soils. The field may be properly plowed and the seed bed well prepared

and yet crops may fail, unless frequent and careful cultivation be given during the growing season. In the sandy soils the aim should be to maintain the largest supply of moisture in the zone of greatest root development, which is from 3 to 24 inches below the surface, with the most effective region between 3 and 12 inches below the surface. Deep cultivation should be avoided when the plants have made considerable growth, as it cuts the surface roots and forces the root development below the richest part of the soil; but an effective mulch should be maintained during the growth of all inter-tilled crops by cultivating frequently about 2 inches deep. This will prevent the growth of weeds and the loss of moisture otherwise drawn off by them. It will also reduce to a minimum evaporation of moisture from the soil itself, and this is by far the most important result of cultivation as affecting moisture conditions. From an examination of various types of soil in this county it was found that in every instance where fields had been well tilled and frequently cultivated the soil, to a depth of 4 feet, contained a moderate supply of moisture even during the driest part of the summer, while adjoining fields of the same types of soils, planted to the same crops, which had not received good cultivation, were in a droughty condition and the crops were suffering badly.

Satisfactory moisture conditions may be promoted, also, by maintaining an ample supply of humus in the soil, every ton of humus added increasing its water-holding capacity 2 or more tons. Suggestions already given in connection with crop rotation cover sufficiently the matter of supplying organic matter. However, by observing the simple rules laid down above the soils will hold sufficient moisture to mature very good crops each year.

Most of the farms are operated by the owners and most of the labor is performed by members of the family. There is a general scarcity of help during potato-digging time, and from \$2 to \$2.50 a day, with board in addition, is paid for good men. Much hand labor is being eliminated by the use of machinery. Many of the potatoes, however, are still dug by hand with forks, though this method is rapidly being displaced by machinery which elevates the potatoes into boxes, one man sorting the potatoes and changing the boxes as the work progresses.

In parts of the county where the soil is very light the tendency is to increase the size of farms, but on the older and better farms, especially those of the heavier types of soil, the land is being divided into smaller tracts, usually among the members of the family.

SPECIAL INDUSTRIES.

The importance of a number of specialized crops for the soils of Waushara County can not be emphasized too strongly. With one special industry developed to the practical exclusion of other crops

there is always the risk of overproduction or failure, whereas by giving attention to several specialized crops the loss of one may not seriously handicap the farmer. Every agricultural community should direct its attention to a few specialized crops suited to the soils and climate and by organization provide a way to dispose of the products in the most direct and profitable manner. The crops discussed in this chapter are very well suited to the soils and climate of the region, some of which are now being more or less extensively grown in this county.

Potatoes.—As early as 1875 it was found that the sands and sandy loams of this area were well adapted to the growing of potatoes, and this industry has steadily increased since that time. In 1900 the yield was 1,905,000 bushels, and it is now the leading crop of the county. From 1890 to 1900 the average yield per acre fell 17 bushels and the yield per acre is still gradually declining. This is mainly due to the increased acreage on less productive soils and a failure to maintain the productiveness of the better soils, either through lack of care in cultivation or to the difficulty of securing good stands of clover, with a consequent depletion of humus and nitrogen in such areas.

The Rural New Yorker, Burbank, Early Ohio, Triumph, Hebron, and Early Rose are the main varieties grown.

In growing this crop on land supporting a heavy sod it is a good plan to plow either in the fall or early in the spring, as this gives the sod a chance to rot well and destroys insect pests. The seed bed should be at least 7 inches deep, so that the roots can develop downward into the moist soil. Disking and harrowing should begin in early spring and continue until time of planting, in order to conserve all the moisture possible. This practice should also be followed in the case of land plowed in the spring. No definite time for planting can be set, as this factor is controlled by weather conditions. Potatoes should be harrowed at least once a week after they are planted until they are large enough to be cultivated. This will keep the weeds down and also keep a good mulch on the surface and prevent loss of moisture. Frequent cultivation should be given this crop—once a week is not too often. Level cultivation, which is generally practiced, is advisable, as it exposes the least surface to evaporation. The first cultivation may be deep, but subsequent cultivations should be shallow, not more than 2 inches of the soil being stirred.

Many potatoes are hauled directly to the station and sold, many are stored in warehouses, and some are pitted in the field to be hauled to market later. A charge of 2 cents per bushel is made for storage in warehouses and 1 per cent deducted for shrinkage in weight for each month.

While Waushara County is not one of the chief fruit sections of the State, fruit of several kinds can be grown at least for home con-

sumption. Strawberries and native plums do well on most of the light soils of the county, and good success with the more hardy apples, such as the Duchess, Wealthy, and Northwestern Greening, and some varieties of crabs can be expected with reasonable care. The bush fruits can also be grown on most of the soil types in the county and do exceptionally well on the heavier types. Cranberries have been grown on some of the marshes in the vicinity of Berlin for a great many years, and conditions in that section are well adapted to this crop.

Trucking crops.—It has been demonstrated that profitable yields of sweet corn, garden peas, and asparagus can be obtained on the sands, sandy loams, and loams. The development of a trucking industry must depend to a considerable degree upon the establishing of local canning factories, but there is apparently nothing to prevent the profitable use of wide areas for the production of these crops whenever enough interest can be aroused to cause concerted action of a number of farmers in their cultivation.

Sorghum.—Considerable sorghum is grown on the lighter soils, the product being used by the local mills to make sirup. The lightest phase of newly broken Coloma sand produces the best quality of sirup. As the soil becomes heavier and the humus content increases the color of the sirup becomes darker and the quality less desirable. As there are extensive areas of this type of soil in the county this industry might be extended sufficiently at least to supply local demands.

Beans.—The Coloma sand, Plainfield sand, Coloma sandy loam, and Superior sandy loam are very well adapted to the production of navy and other kinds of beans. More than 40 varieties have been tested with varying degrees of success. The land should be well prepared and manured preparatory to planting and the crop should be frequently cultivated during its growth to keep the weeds down and conserve soil moisture. It is a splendid crop to use in rotation, matures quickly, and yields good profits.

Dairying.—Dairying has developed into a very profitable industry on the sandy loams, loams, and clay loams of the county. It is followed to a limited extent on the sands, where it gives moderately good results, especially if there are muck areas adjoining the sands to furnish hay and pasturage. The milk is sold to local creameries for butter making, and the skim milk is usually returned to the farmer for hog feed. Some attention has been given to special breeds of dairy cows, but many herds are composed mainly of grade animals. Jerseys, Holsteins, and some Guernseys are the leading dairy breeds. Silos are used quite extensively and much of the corn grown is used for ensilage. The raising of hogs and sheep has developed considerably in the eastern part of the area where the soils are heavier and grass crops are grown more easily.

Dairying and hog raising have been very important factors in the present prosperous conditions in the county and their further development, together with the improvement of the breeds of cattle, will have much to do with the future prosperity of Waushara County farms.

SOILS.

Waushara County lies almost entirely within the glaciated region and its soils are the product mainly of ice and water action upon the Potsdam sandstone formation, which was deposited over the granite floor during Cambrian times, when this region was under water. Several outcrops of granite occur in Marion and Warren townships. These were evidently projecting elevations during the time the Potsdam formation was laid down. The only exposure of the undecomposed Potsdam sandstone is a very small outcrop in Section 31 of Hancock Township.

Over the hilly and rolling division of the county the soils, which have not been reworked by streams, are members of the Coloma series. The soils of the uplands consist of a heterogeneous mass of material in which weakly cemented porphyries and granites are prominent. These rock fragments are slowly disintegrating and forming new soil.

The soils of the Wisconsin River Valley and of the valleys to the east and south were carried down from the uplands and deposited near the close of the ice age when the waters were high and moving rapidly. These soils have been acted upon by water to a great extent and have been laid down in comparatively uniform layers.

The heavy soils of the eastern fourth of the county are lacustrine in origin, having been deposited in the waters of Green Bay when that body of water lay at a higher level and covered this portion of the county. These soils were carried down by the water issuing from the glacial deposits and laid down in quiet water. They have been classified as Poygan and Superior soils.

Fourteen types of soil are mapped in the county. The name of each type and its actual and relative extent are given in the following table:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Coloma sand.....	156,928	38.1	Waukesha sand.....	5,504	1.3
Muck.....	68,480	16.6	Superior loam.....	3,328	.8
Plainfield sand.....	58,048	14.1	Coloma stony sand.....	3,008	.7
Coloma sandy loam.....	50,944	12.4	Coloma gravelly sand.....	2,880	.7
Poygan clay loam.....	23,232	5.6	Coloma loam.....	2,880	.7
Waukesha sandy loam.....	17,600	4.3	Superior clay loam.....	1,152	.3
Poygan clay.....	9,600	2.5			
Superior sandy loam.....	7,936	1.9	Total.....	411,520	.....

COLOMA SAND.

The Coloma sand consists of a loose, incoherent, grayish to yellowish-brown sand, from 8 to 10 inches deep, underlain by a reddish yellow, incoherent, medium sand to 36 inches. The surface usually contains a moderate quantity of organic matter. There are two phases of this type, one heavier and the other lighter than the typical soil. The heavy phase contains a little more silt and clay and the subsoil is slightly heavier than the typical and occasionally a sticky sandy loam is reached at 36 inches. This phase, found mainly in Wautoma and Deerfield townships, ranks next to the light Coloma sandy loam in producing power.

The light phase has a medium brown surface soil containing very little silt or clay, underlain by a loose, incoherent, yellowish medium sand, many feet in depth. It is found in small areas throughout the morainic belt, but is most extensively developed in Richford, Dakota, Springwater, Saxeville, and Leon townships. It occupies gentle slopes to rolling ridges and sometimes rounded hills. The virgin soil of this phase is very light from the surface down and only contains about an inch of brown surface soil. The heavy phase is usually more rolling and frequently has many glacial bowlders scattered over the surface. The largest bowlders in the county are found on this soil.

The sand grains of this type consist mainly of rounded quartz particles. The type is generally deficient in humus and shows high acidity with litmus paper. Its loose incoherent nature makes it naturally droughty, and in years of low rainfall crops suffer considerably for moisture. The lower the heavy subsoil stratum the more droughty the soil.

The native vegetation consists of oak and hazelnut bushes. On the heavy phase the oak is thrifty and tall, but on the light phase it is scrubby and spreading.

The subsoil frequently contains a moderate amount of gravel and sometimes a little occurs in the surface soil. There are a number of granite outcrops along the Redgranite branch railroad. These outcrops are small, occupying only from 30 to 60 acres each, and are extensively quarried. The Coloma sand originated through the grinding up of the Potsdam sandstone by ice.

A larger percentage of this type is under cultivation. It is easily tilled, and in years of normal rainfall moderate to good yields are obtained, except on the light phase, which is still largely in a wild state. Some fields of this character have been abandoned after many attempts to produce satisfactory crops upon them.

Dairying is followed to a limited extent and does fairly well where there are included in the farm areas of muck that can be used for

hay and pasture. In general farming potatoes, corn, rye, and hay is the rotation followed; but little success has been attained in the production of hay, except where especially good methods of soil management have been followed. Potatoes yield from 75 to 125 bushels per acre, and in exceptionally favorable years as high as 250 bushels per acre have been obtained on fields of the heavy phase. Corn yields 20 to 35 bushels, rye about 10 bushels, and hay about one-half to 1 ton per acre.

The Coloma sand is by far the most extensively developed type of the county and future development in agriculture will depend largely upon the improvement of this type. Some farmers are still successful in growing red clover, but many are not. Moisture and organic matter with an occasional dressing of lime are the prime essentials for successful farming on this type, and where clover fails Canada peas or vetch should be grown and turned under for manure. With this treatment followed carefully for a few years it will be possible to secure again a satisfactory growth of red clover. It would seem best to sow red clover alone, so as to give it all the moisture the soil contains and thereby enable it to tide over the dry period in summer without serious injury. Organic matter oxidizes more rapidly in sandy soils than in the heavy soils and it consequently requires heavier applications of manure or green crops plowed under to keep up the humus content of the Coloma sand than it does in most of the other soils of the county.

Potatoes grown on the Coloma sand are of medium size, smooth, and mealy. They are generally superior to those grown on heavier soils or on soils very rich in humus. Sweet corn, beans, and garden peas are crops well suited to this type. From 6 to 10 carloads of beans mainly grown on the Coloma sand are shipped from Wautoma each year. These crops should be grown more extensively, as they yield well and sell for a good price. The sorghum produces a better quality of sirup than that grown on any other type in the county. Early truck crops could be made profitable also if proper arrangements were made for marketing. The soil warms up early and is well suited to cucumbers, strawberries, pumpkins, and all quick-maturing vegetables.

The time and manner of plowing for this type is the same as that practiced on the Coloma sandy loam. The land is generally plowed from 4 to 7 inches deep. If plowed in the spring it may be found advisable to pack the soil with a packer or corrugated roller before planting. The roller should be followed immediately by a light harrow to form a mulch on the surface. The more extensive use of green manure crops, the liberal application of barnyard manure where possible, an occasional dressing of lime, a deep seed bed, and clean and

frequent cultivation will result in satisfactory crops on this type in most years.

Land of this type sells for \$25 to \$60 an acre, depending on its location, buildings, and state of productiveness. The roads are very sandy, which with the usually rolling topography makes hauling heavy.

The following table gives the average results of mechanical analyses of typical samples of the soil and subsoil of a Coloma sand:

Mechanical analyses of Coloma sand.

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.	<i>Per cent.</i>
22242, 22246.....	Soil.....	0.4	12.7	18.1	43.2	4.5	6.2	4.9
22243, 22247.....	Subsoil.....	1.1	13.1	29.7	43.3	4.0	4.9	3.8

COLOMA SANDY LOAM.

The Coloma sandy loam consists of a brown heavy to a moderately loose medium sandy loam, about 8 inches in depth, underlain to about 26 inches by a yellowish brown sticky sandy loam containing enough stones to make boring difficult in many places. From 26 to 36 inches the subsoil is a mixture of sand and gravel, though occasionally it is a continuation of the second foot becoming somewhat heavier and more sticky with depth. In places the surface sandy loam is underlain by a yellowish gravelly sand to about 24 inches and then by a sticky sandy clay to 36 inches. Wherever the moraine is prominently developed, the surface is strewn with granite boulders and the soil contains enough stones to interfere somewhat with tillage. Occasionally very small areas, from one-half acre to 5 acres, may be found in which the surface is covered with large granite boulders and such areas are shown by symbol wherever possible. The extent of land of this character was too limited to justify mapping as a separate type. On the margin of some of the highly rolling areas and on the brows of some of the knolls very small areas of gravelly sand occur, with a shallow layer of heavy material near the surface.

The Coloma sandy loam occurs in irregular-shaped areas in the morainic district. In Marion and Mount Morris townships the surface soil is somewhat lighter and crop yields are not quite equal to those on the typical soil. As the depth to the subsoil increases the producing power of the type is decreased. The type usually occupies ridges and hilltops, with irregular, narrow intervening valleys of Coloma sand. The water table lies from 25 to 80 feet below the surface, which is too deep to have any influence on crop yields.

In topography the Coloma sandy loam is very rolling to hilly, with steep slopes and numerous pothole depressions, some of which are 100 feet or more in depth. These potholes were originally small lakes, but with rare exceptions they are now dry. The soil in these depressions is somewhat heavier and contains more humus than that of the type proper, but these bottoms seldom occupy more than a few square rods. They are, however, tilled regularly with the less broken surrounding areas, and are frequently used for gardens because of the greater amount of moisture in the soil.

The rolling and hilly nature of this type gives it very good though not excessive drainage. Its composition and structure are such that it does not wash readily and there is none of it so steep as to preclude the growing of the ordinary crops. The sand content of the type consists of rounded particles of quartz and some other rocks.

The soil is of glacial origin and is composed of a heterogeneous mass of sand, silt, gravel, and clay, with many boulders, brought from the north and mixed with material derived from the local disintegration of Potsdam sandstone. Moisture and organic matter seem to be the controlling factors of crop yield on this type. With the application of liberal quantities of barnyard manure, or the plowing under of an occasional green crop of Canada field peas or vetch, a moderate application of lime every four or five years, and good cultivation, it is possible to maintain the humus and conserve sufficient moisture for the maturing of good crops every year.

The native vegetation of this type is oak with a heavy undergrowth of hazelnut bushes. From Wautoma eastward scattered hickory is found. The oak is much more thrifty, with longer and more slender trunks, than that found on the Coloma sand.

Where not too stony the soil is easily tilled, and nearly all of it is under cultivation. Potatoes, corn, oats, rye, and hay are the main crops. Potatoes yield from 80 to 150 bushels per acre and under very favorable conditions 300 bushels per acre have been obtained. Corn yields 25 to 40 bushels, oats 30 to 40 bushels, rye 12 to 15 bushels, and hay an average of about $1\frac{1}{2}$ tons per acre. Dairying and potatoes are the two leading specialties on this type. Corn or potatoes, oats or rye, clover, and timothy is the rotation usually practiced. The soil shows a moderate degree of acidity and on account of this some difficulty has been encountered in growing red clover. An application of about 20 bushels of lime per acre every four or five years would improve the soil for this crop. Fall plowing for rye and spring plowing for all other crops are the usual practice. The seed bed should be prepared to a depth of at least 8 inches and organic matter should be worked in deeply as well as near the surface to increase the water-holding capacity and to induce a deeper development of the roots.

Apple culture and the growing of beans, peas, sorghum, and small fruits should receive more attention, as this soil, if properly handled, is well suited to these crops. At present the summer and fall varieties of apples seem to do best, but there are several varieties of winter apples now being developed in the State which give great promise on soils of this character. Many of the early truck crops do well.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of this type:

Mechanical analyses of Coloma sandy 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.	<i>Per cent.</i>
22248.....	Soil.....	0.6	12.8	20.0	33.0	10.6	17.3	5.9
22249.....	Subsoil.....	.6	9.8	18.5	40.2	7.2	10.4	12.8

COLOMA LOAM.

The Coloma loam, to a depth of 10 inches, consists of a dark-brown friable loam. Beneath this occurs a yellowish-brown loam which becomes somewhat heavier with depth to 18 inches, where the material is a yellowish sticky sandy clay containing some gravel. At 28 inches there is another change, the material being a yellowish gravelly sand containing some stones and a little clay.

The largest body of Coloma loam extends south from the north-central part of Rose Township a short distance into Wautoma Township. A small area is also found in the northwestern part of Springwater Township, occupying an elevated gently undulating plateau. The topography of the area in Rose Township is slightly rolling to moderately rolling. While the position of this type gives it good natural drainage, the texture is such that it is capable of retaining sufficient moisture to mature good crops.

This type of soil is found entirely within the glaciated belt. It originates from the grinding up and disintegrating of crystalline rock and the assorting of glacial till. It is the best type of the upland soils for farming and is well suited to general farm crops and dairying. Potatoes yield from 100 to 150 bushels per acre, corn 35 to 60 bushels, oats 40 to 60 bushels, rye 15 to 20 bushels, and hay from 1½ to 2 tons per acre. Dairying is highly developed, and the large quantity of manure available under this system of farming renders it easy to maintain the productiveness of the soil. Red clover usually does well, though the soil shows some acidity. An occasional application of lime would undoubtedly be beneficial.

The Coloma loam is well adapted to apple growing. The varieties already recommended for the sandy loams and loams are well

suiting to this type. It is also well adapted to bush fruits and heavy truck crops. The same rotation is practiced on this type as on the Coloma sandy loam. Most of this type is under cultivation. Its present value ranges from \$50 to \$75 an acre, depending upon its location with reference to markets.

The following table gives the results of mechanical analyses of typical samples of the soil and subsoil of the Coloma loam:

Mechanical analyses of Coloma 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.	<i>Per cent.</i>
22252.....	Soil.....	0.8	7.8	14.9	19.5	12.1	30.8	14.3
22253.....	Subsoil.....	.5	6.6	17.3	24.9	19.2	19.7	11.7

COLOMA GRAVELLY SAND.

The Coloma gravelly sand is a loose gravelly sand of practically the same texture from the surface to a depth of 36 inches. The surface 2 or 3 inches contains a little light-brown organic matter, otherwise the surface and subsoil are alike. Gravel occurs upon the surface in most places, though very few boulders are found, the fragments varying in size from a pea to that of a hen's egg. The sand grains are nearly all quartz and rounded. This deposit of gravel and sand extends to a depth of many feet. Frequently thin strata of medium sand occur through it at varying depths.

This type occurs as narrow ridges and rounded knolls along valleys and stream courses between the uplands and lowlands. It was deposited during the melting of the ice sheet when the streams were greatly swollen.

The Coloma gravelly sand is not tilled to any extent because of its droughty nature and stony character. Rye is about the only crop suited to it. Awnless brome grass would undoubtedly increase its value for pasture. The type is of little importance, as it only occurs in very small areas.

The results of mechanical analysis of a fine-earth sample of the soil are given in the following table:

Mechanical analysis of Coloma gravelly sand.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
22254.....	Soil.....	10.9	47.3	20.5	12.4	5.0	2.4	1.5

COLOMA STONY SAND.

The Coloma stony sand consists of a brown medium-textured sand, about 8 inches deep, underlain by a light-yellowish sand of texture similar to the soil and extending to 36 inches. Both surface soil and subsoil contain varying quantities of gravel and stone, which interfere with tillage to some extent.

An area of the Coloma stony sand occupies a roughly rolling section in Rose Township, with an extent of about $5\frac{1}{2}$ square miles. It is the roughest type in the county, and the surface is strewn with numerous large granite boulders. Many deep pothole depressions lie between the high ridges. Its greatest length is north and south and it represents a projection of the rough morainic belt extending south from Portage County. The topography, position, and sandy nature give the soil rather excessive drainage, and in years of moderate to low rainfall it is inclined to be droughty. The materials forming this soil come from the grinding of the Potsdam formation by ice and the mixing of the fine particles with other rock débris brought from the north.

Only a very small part of this type is tilled. The crop yields are very similar to those of the Coloma sand. The type has been neglected because of the more easily tilled soils near by. It produces fair crops of grass and is used mainly for pasture. It needs organic matter, and will respond to the same treatment as the Coloma sand.

This land sells for \$20 to \$35 an acre, according to its location with reference to markets. It supports a native growth of scrubby oak and hazelnut bushes.

WAUKESHA SAND.

The Waukesha sand to a depth of 8 to 10 inches consists of a dark brown to black medium sand containing a small amount of silt and clay and a high percentage of organic matter. Beneath this is found a loose, incoherent yellowish-brown sand of medium texture, becoming lighter in color and texture with depth to 36 inches. Below 3 feet the material is a yellowish gravelly sand. Varying quantities of fine to medium gravel are found at different depths in the subsoil. Very few boulders occur upon the surface.

Excepting some very small areas found in Oasis Township, all this type lies west of the morainic belt. It has a level to very gently undulating topography. The native forest growth is scrubby and consists mainly of oak.

The materials forming this type were deposited during the decline of the Glacial period. The high organic content is the result

of the decomposition of rank water-loving vegetation. At present the drainage is very good.

The Waukesha sand is an easily tilled soil. Its water-holding capacity is not high—about the same as that of the Plainfield sand. In seasons of light rainfall crops suffer considerably for lack of moisture, and in wet years it produces medium to good crops. In order of their importance the crops grown are potatoes, corn, oats, rye, and hay. Potatoes yield from 60 to 125 bushels per acre, corn from 15 to 35 bushels, oats 15 to 30 bushels, rye 8 to 10 bushels, and hay from one-half to 1 ton per acre. Litmus tests apparently indicate a very acid condition of the soil, and the abundance of sorrel points to the same condition. The type is not suited to hay, but early-maturing truck crops thrive. It will respond to the same methods of treatment and cropping as the Plainfield sand.

The following table gives the results of mechanical analyses of typical samples of soil and subsoil of this type:

Mechanical analyses of Waukesha sand.

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.	<i>Per cent.</i>
22236.....	Soil.....	0.7	31.7	29.5	21.9	3.4	5.6	6.9
22237.....	Subsoil.....	1.0	23.3	29.3	28.5	3.0	7.9	7.1

WAUKESHA SANDY LOAM.

The Waukesha sandy loam consists of 8 to 15 inches of dark-brown to black sandy loam of medium texture, very rich in organic matter, underlain by a yellowish-brown heavy medium sand to 20 inches and then by a yellowish sticky sandy clay extending in places to 36 inches. In some areas the subsoil below 15 inches is a yellowish gravelly sand, containing a considerable quantity of stone fragments from 1 inch to several inches in diameter. The topography is level to gently undulating. The above description applies to the type in the Wisconsin River Valley. The type also occupies a large area, covering nearly all of Oasis and a small part of Deerfield Township, representing here an old glacial lake basin and locally known as the "Great Prairie." The surface soil in this valley, from 8 to 15 inches deep, is a dark-brown to black sandy loam of medium texture and very rich in humus. It is underlain to 24 inches by a brownish-yellow gravelly sandy loam, becoming lighter in color to 36 inches. From 36 to 48 inches the subsoil is a yellowish gravelly heavy sandy loam. In places the subsoil to 24 inches is a yellowish sandy clay, and this is underlain by a yellowish sandy gravelly loam. Along the margin of the areas the surface becomes somewhat lighter in

color, owing to admixing of the lighter colored materials from surrounding soils. In this valley the type occupies nearly level areas, with occasional slight depressions and slightly elevated terraces.

All the type appears to have been formed from material washed down from the higher glaciated areas near by. The sand consists of rounded quartz grains. In places where there is a slight change in elevation small gravelly sandy ridges or knolls occur.

The Waukesha sandy loam is very productive, and most of the farmers living upon it are prosperous. The natural drainage is very good. Where well cultivated the soil is very retentive of moisture and capable of high yields. It is apparently in an acid condition and would be benefited by occasional applications of lime. About 20 bushels per acre every four or five years would greatly improve it for the production of corn and clover.

This type is given the same treatment and tillage as the other soils. It responds to the addition of organic matter, notwithstanding its already high humus content. The type is easily tilled. Potatoes, corn, oats, rye, and hay are important crops, in the order named, and dairying is a leading specialty. Potatoes yield from 100 to 150 bushels per acre, corn from 50 to 60 bushels, oats 25 to 40 bushels, rye 15 bushels, and hay from 1½ to 2 tons per acre. Where improved methods are used, yields considerably higher than these are secured.

This is an excellent truck soil. It is especially well suited to onion culture. Small plots of onions are now grown and heavy yields of high quality are obtained. Small fruits also do well if given proper care.

Potatoes or corn, rye or oats, clover and timothy is the rotation followed. Clover has done very well so far, but it will decline unless the soil is limed. Sorrel is often seen growing in the fields of this type. Hog raising has developed quite extensively along with dairying and is paying the farmer well. The roads on this type are very good at all times. Land sells for \$75 to \$150 an acre.

The following table gives the results of mechanical analyses of samples of soil and subsoil of this type:

Mechanical analyses of Waukesha sandy 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.	<i>Per cent.</i>
22240.....	Soil.....	0.3	10.0	22.7	35.4	7.1	12.6	11.9
22241.....	Subsoil.....	.7	6.8	15.5	39.8	13.1	11.9	12.2

PLAINFIELD SAND.

The Plainfield sand, to a depth of 8 to 10 inches, is a loose incoherent sand of medium texture and brownish color. The subsoil is

a yellowish, loose, porous sand, extending to 36 inches. The surface when exposed soon bleaches to a light-gray color. The subsoil of the areas of this type in the Wisconsin River Valley frequently contains varying quantities of gravel, making boring somewhat difficult in places, while in the eastern part of the area little gravel is encountered in the first 3 feet.

This type has a level to gently rolling surface in the Wisconsin River Valley and a level surface in the valleys of the southeastern and eastern parts of the county. It is droughty in most places, but where the water table is near the surface, or in years of considerable rainfall, fair crops are produced. In the western part of the county, this soil was deposited during the time when the waters of the Wisconsin River flowed at a much higher level and overspread the valley. This type has the same origin as the Coloma sand, except that the material has been reworked to a greater degree by swollen streams issuing from the melting glaciers.

The type supports a scrubby growth of oak on the higher portions and poplar, birch, willow, and some elms on the lower levels. It is usually very deficient in humus, is apparently acid, judged by the litmus test, and holds water very poorly. However, with careful plowing and preparation of the seed bed, frequent cultivation, the application of liberal quantities of organic matter, and an occasional dressing of lime, fair to moderately good crops can be grown.

Potatoes yield from 75 to 125 bushels per acre, corn from 20 to 35 bushels, rye about 10 bushels, buckwheat at 10 to 15 bushels, oats 20 to 35 bushels, and hay from one-half to 1 ton per acre. Potatoes or corn, rye, oats or buckwheat, and hay is the rotation practiced and the tillage is similar to that followed on the Coloma sand. The type is well suited to the production of early truck crops, of which the quantity and yields are about the same as on the Coloma sand. Hay is not suited to this type and considerable difficulty is encountered in securing satisfactory yields. The growing of legumes and the application of organic matter to the soil are necessary for successful farming. This soil has a value of \$30 to \$50 an acre, depending on its location and productiveness.

The following table gives the average results of mechanical analyses of samples of the soil and subsoil of this type:

Mechanical analyses of Plainfield sand.

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.	<i>Per cent.</i>
22255, 22259.....	Soil.....	0.4	11.7	19.6	42.3	12.4	8.4	5.4
22256, 22260.....	Subsoil.....	.7	10.4	21.5	46.0	14.9	3.3	2.9

SUPERIOR LOAM.

The Superior loam consists of 6 to 8 inches of medium brown heavy sandy loam to loam, underlain by a heavy tenacious red clay extending to 36 inches or more. On the higher elevations and ridges the heavy red clay comes near the surface and is 20 feet or more in depth. A thin layer of a grayish yellow soil, about $1\frac{1}{2}$ to 2 inches thick is usually found between the surface soil and subsoil. This layer is similar to the subsoil, but has been acted upon and changed by the organic matter in the soil above. There are scattered over this type occasional small areas, a few square rods in extent, covered with several inches of sand which appears to have drifted from near-by sandy areas or from local deep sandy knolls. A little fine gravel is sometimes found between the surface soil and subsoil. The small quantity of sand in the surface soil prevents it from cracking when dry except where the soil is very shallow.

Tillage of this type is more difficult than on the Coloma soils because of its heavier texture. The usual depth of plowing is from 4 to 7 inches. Plowing is generally done in the spring, though fall plowing would seem to be best, as it would give the heavy soil an opportunity to weather during winter, would enable it to catch more of the rainfall, and would give the sod a good chance to decay before spring planting. Plowing should be done when the soil is not too wet or puddling will result.

This type is found in irregular bodies in the eastern third of the county. It occupies gently undulating to moderately rolling areas and is high enough to have good drainage. It is found from 10 to 40 feet above Lake Poygan and occupies rolling ridges in the Fox River Valley and a belt between the Coloma soils and the Lake Poygan Basin.

This type is lacustrine in origin, having been deposited in Green Bay by the inflowing glacial streams when its waters were at a much higher level than at present. These soils were exposed later by the decline of the bay waters. The red color of the subsoil is due to the presence of ferric oxide.

Oak, elm, and considerable hickory are found on this type, and the trees are prolific and longer lived than those on the sandy soils.

The Superior loam is one of the best agricultural soils in the county and is well suited to dairying and hog raising, the main industries of the farmers. Some sheep are also raised. Corn, oats, and hay are the main crops. Corn yields from 50 to 80 bushels, oats from 40 to 60 bushels, and hay about 2 tons per acre. Potatoes are not suited to this type, but red clover and timothy thrive. Corn, oats, grass for hay is the rotation followed, and the land is left in sod from two to five years. The soil in some cases is apparently slightly

acid and in such cases would be improved by applying lime. From 10 to 15 bushels per acre every four or five years should be sufficient. After cutting hay for two or three years the sod is pastured as much longer before it is plowed.

This is an excellent type for apple culture and this industry is being successfully developed. The trees are vigorous and healthy, and the fruit ripens well, all of it maturing before winter sets in. Small fruits also do very well. It is thought alfalfa might succeed on this type if the soil and crop were handled properly.

This type is nearly all under cultivation and the farmers living upon it are prosperous. The roads are excellent and markets are near. The present selling price of the land, including buildings, ranges from \$75 to \$150 an acre.

The following table gives the results of mechanical analyses of typical samples of soil and subsoil of the Superior loam:

Mechanical analyses of Superior 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.	<i>Per cent.</i>
22282.....	Soil.....	1.2	10.3	23.2	24.7	4.4	17.6	18.6
22283.....	Subsoil.....	.4	3.0	5.3	9.5	8.4	38.9	34.4

The following sample contained more than one-half of 1 per cent of calcium carbonate (CaCO_3): No. 22283, 7.09 per cent.

SUPERIOR SANDY LOAM.

The Superior sandy loam consists of 12 inches of grayish to medium brown loamy sand, underlain to 36 inches by a yellowish reddish sandy clay, sometimes becoming quite heavy, in places a reddish clayey sand. The surface soil is of medium texture and contains considerable organic matter. Occasionally a few small rocks and boulders are found scattered upon the surface.

This type occupies small irregular areas in the eastern part of the county, frequently adjoining areas of Superior loam. The surface is nearly level to gently rolling and the drainage is good. The red clay subsoil resembles that of the Superior loam, and was laid down in the waters of Green Bay when they were much higher than now. The surface covering of sandy soil, which is in some places quite deep, was washed down from the lighter sandy areas near by.

The Superior sandy loam is easily tilled and where given good cultivation holds moisture very well. It is well adapted to small fruits, corn, potatoes, oats, rye, beans, and the grasses. Red clover and timothy do well and dairying and hog raising are followed largely by the farmers. Corn yields 30 to 50 bushels per acre, potatoes 90 to 150 bushels, oats 30 to 40 bushels, rye 12 to 15 bushels, and

hay 1½ to 2 tons per acre. No commercial fertilizer is used, but the soil responds well to manure. It seems to have some acidity and would be improved considerably for corn and clover by an application of about 15 bushels of lime per acre every four or five years.

The roads on this type are usually quite sandy. The value of the land is about the same as that of the Coloma sandy loam.

The following table gives the results of mechanical analyses of samples of soil, subsoil, and lower subsoil of this type:

Mechanical analyses of Superior sandy 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.	<i>Per cent.</i>
22276.....	Soil.....	0.0	8.5	17.0	36.0	10.7	12.2	15.7
22277.....	Subsoil.....	.0	7.2	12.7	44.3	13.9	9.4	12.1
22278.....	Lower subsoil...	.0	1.8	2.3	13.8	7.5	53.8	20.7

SUPERIOR CLAY LOAM.

The Superior clay loam, to a depth of 6 inches, consists of a light chocolate-brown to red heavy clay loam of close texture and containing a small quantity of organic matter. This is underlain by a pinkish-red, compact, heavy tenacious clay, containing very little grit, which extends to 24 inches, or perhaps to 30 inches, below the surface, where it rests upon a reddish incoherent sand sometimes containing pockets of white sand. The red coloring of the sand is apparently due to iron salts leached in from the surface soil.

This type is found in the low, flat valley surrounding Lake Poygan, where it occupies slightly higher elevations than the Poygan clay which surrounds it. It is somewhat better drained than the Poygan clay loam, but needs ditching for the best results.

There are many artesian wells of excellent water on this type. The wells vary in depth from 35 to 150 feet.

The soil of this type was laid down in a manner similar to that of the Superior loam. It supports a native growth of oak, elm, hickory, and some poplar. It is mostly under cultivation and dairying and hog raising are highly developed specialties. In dry years it produces very good crops of corn, oats, and hay. Corn yields 35 to 50 bushels, oats 35 to 50 bushels, and hay about 2 tons per acre. Grass does well, but not so well as on the loams. If left in sod for two or three years wild grasses begin to crowd out the cultivated varieties.

According to litmus-paper tests the soil is apparently slightly acid and would be benefited by applications of lime, say, 5 to 20 bushels to the acre every four or five years. It is too low lying for successful

alfalfa growing, but is well suited to clover. Alsike does especially well. Drainage, deeper plowing, liming, and the use of manure will keep this type in a very productive state. The roads are very good in summer and fall, but heavy and sticky in winter and spring. This land, including buildings, sells for \$40 to \$75 an acre.

The following table gives the results of mechanical analyses of samples of soil, subsoil, and lower subsoil of this type:

Mechanical analyses of Superior 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.	<i>Per cent.</i>
22279.....	Soil.....	0.0	2.5	8.6	25.4	1.9	36.8	24.4
22280.....	Subsoil.....	.0	1.1	5.3	16.1	2.6	25.7	49.2
22281.....	Lower subsoil...	.0	1.2	16.2	68.6	2.3	.7	11.2

POYGAN CLAY LOAM.

The soil of the Poygan clay loam consists of 10 inches of dark-brown to black medium textured loam, very rich in organic matter. This is underlain to 36 inches by a heavy, tenacious, compact pinkish-red clay.

This type bears the same physiographic relation to the Superior loam as the Poygan clay bears to the Superior clay loam. The Poygan clay loam surrounds the Superior loam and usually extends down to areas of Muck. It occupies low, gently undulating or rolling areas and depressions. In the more rolling portions the drainage is good, but in the lower-lying portions artificial drainage is generally desirable.

In general the soil of this type has the same origin as the Superior loam. It has, however, been influenced by local drainage conditions. The darker-colored surface is due to its low-lying position and to the decomposition of its organic matter in the presence of considerable moisture. This has improved its granulation and texture for cultivation.

Some oak, elm, hickory, and poplar are found on this type, though most of the timber has been cut off. Nearly all of this type is farmed, as it is of high agricultural value. Corn, oats, potatoes, and grass form the rotation practiced. Corn yields 40 to 80 bushels per acre, oats 40 to 50 bushels, potatoes 75 to 150 bushels, and hay 1½ to 2 tons per acre. This is an excellent type for dairying and hog raising, and these industries are highly developed. Red clover and timothy thrive, and where the soil is well drained it is probably adapted to alfalfa. The same quantity of lime recommended for the Superior loam should be applied to this type every three or four

years. Large quantities of manure are added to this soil, with excellent results.

The roads are usually good and the location of the type with reference to markets gives it a relatively high value. Good farms bring from \$75 to \$150 an acre. There are on the lower margins of the areas many good artesian wells, some of which supply enough water to run cream separators.

The following table gives the average results of mechanical analyses of samples of the soil and subsoil of this type:

Mechanical analyses of Poygan 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.	<i>Per cent.</i>
22263, 22265.....	Soil.....	0.7	3.9	5.7	11.3	8.3	45.5	24.2
22264, 22266.....	Subsoil.....	.2	1.4	2.3	9.2	12.4	44.7	29.6

The following sample contained more than one-half of 1 per cent of calcium carbonate (CaCO_3): No. 22266, 5.5 per cent.

POYGAN CLAY.

The Poygan clay consists of 8 to 10 inches of dark-brown heavy clay, underlain, to a depth of 30 inches, by mottled drab, red, and white clay. From 30 to 36 inches the subsoil is a drab incoherent sand, usually saturated with water. When wet, the surface soil is plastic and very sticky and when dry it checks and cracks quite badly. The presence of a great deal of organic matter considerably improves the texture for cultivation, but great care should be exercised in choosing the time for plowing as its physical condition is easily impaired if the soil is worked while wet.

This type occupies level areas in the Lake Poygan Valley, usually lying along and slightly above areas of Muck. It is a lacustrine type laid down by inflowing glacial streams when the region was covered by the waters of Green Bay. The water table is only 3 or 4 feet below the surface and this, together with the low-lying position of the type and its heavy texture, causes crops to suffer considerably from excess of moisture in years of normal to high rainfall. Crops consequently do best in dry years when very good yields are obtained.

Oak, elm, poplar, and birch are the more prominent varieties of native trees. When not tilled for several years, the soil becomes covered with a heavy growth of native grasses.

Dairying is a highly specialized industry, and corn, oats, and hay are the leading crops grown. Corn yields from 40 to 60 bushels, oats 40 to 60 bushels, and hay about 2 tons per acre. Apparently the soil is moderately acid and it should respond well to applications of lime.

About 20 bushels of unslaked lime every four or five years would be about the proper quantity to use. No systematic order of cropping is followed and the land when used for hay production is left in grass for several years.

Most of this type is under cultivation and with moderate applications of manure an intensive system of cropping could be practiced. Drainage would improve the land. The open-ditch method would likely have to be used, because, owing to the slight fall, if tile were used, it would have to be laid at a shallow depth and the drains would be likely thrown out of alignment by freezing and thawing of the soil.

The Poygan clay is too heavy and the water table too near the surface for successful potato growing. The roads are hard and good in summer, but heavy and sticky in winter. The type is favorably located with reference to markets. Its present value ranges from \$50 to \$75 an acre.

The following table gives the results of mechanical analyses of samples of soil and subsoil of this type:

Mechanical analyses of Poygan clay.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
22271.....	Soil.....	0.3	2.2	5.5	9.2	3.1	33.4	46.2
22272.....	Subsoil.....	.0	.9	2.0	11.2	10.5	30.5	44.7

The following sample contained more than one-half of 1 per cent of calcium carbonate (CaCO_3): No. 22272, 26.11 per cent.

MUCK.

Occupying numerous low-lying irregular areas and narrow belts along stream courses throughout the county are accumulations of organic matter in various stages of decomposition locally called "Marsh land." The materials vary in depth from 10 inches to 10 feet or more, being shallower near the margins of the areas, and in color from a brown in the peaty areas to a black in the areas of Muck. The proportion of mineral matter is higher along the contact of the Muck areas with the higher lying soils. The more completely decomposed material is properly Muck, only the less decomposed and very fibrous bodies are in reality Peat, and the areas where water constantly stands at or above the surface, and where grass and other water-loving plants are found, but the ground is too soft to bear the weight of animals, are swamp. It was not thought advisable, however, to attempt separation of the several variations in the conditions in which these organic soils exist. Only two small areas of true peat were seen. These occur in sections 13, 23, and 24, Warren Township, and sections 14, 22, and 23, Dakota Township. The Swamp

area is also small. It is distinguished in the map by symbol. These areas were once lakes or channels for the water of melting glaciers. When the water receded shallow lakes were formed in the depressions and fibrous plants and water-loving grasses soon filled the depressions with their roots and their decaying tissues. The first stage in this process gives Swamp, the second Peat, and the third Muck.

Most of these areas occur in the western, southern, and eastern parts of the county, the most extensive bodies being found in the eastern fourth of the county. In the western part these areas occur as narrow fingerlike belts, extending from one-half mile to several miles into Waushara County from Adams County. In the western and southern parts the Muck is underlain with a drab-colored, incoherent sand, usually saturated with water, while in the eastern part it is underlain by a heavy drab to bluish gray sticky clay. The only swampy areas are found in a narrow belt along Lake Poygan.

Owing to the low position of the areas the water table is within 1 to 3 feet of the surface. The native vegetation is mainly tamarack, poplar, birch, willow, and a heavy growth of coarse wild grass. In dry periods when the water table is low and the surface becomes dry fires frequently burn over large areas, leaving the underlying sand and rough projections exposed. This usually leaves the land unfit for anything but grazing, though sometimes small areas of the exposed underlying soil are cleared and tilled with excellent results.

In some instances farmers think it advisable to burn off the covering of peat soil, as it appears to be cheaper than clearing the land. This, however, is in most cases very bad practice and should be discouraged, as it destroys the most productive constituents of the soil, and the exposed sand soon becomes exhausted and worthless. All areas should be protected from fires because they will, in time, become very valuable for farming purposes. When well drained and put in good physical condition they will produce large yields of celery, onions, corn, carrots, cabbage, potatoes, and peppermint. The tame grasses, such as redtop, timothy, and alsike clover, will do well if the land be properly drained. The cranberry industry has been followed with success for many years on the Muck areas in the southeastern part of the county, but there is only a small portion of this land devoted to this industry as yet. The bogs are situated on typical Muck, and need no drainage for cranberry culture. With good care a bog will continue to bear profitable crops for many years.

At present this land is used almost exclusively for the growing of wild grasses for hay and for pasturage. The yield of hay is from 1 ton to 1½ tons per acre, and it is usually of poor to medium quality. The land sells at \$10 to \$40 an acre, depending on location and drainage conditions. The formation of drainage districts and the reclaiming of this type of Muck, Peat, and Swamp lands would greatly

increase the agricultural output of the county and materially diversify its products.

SUMMARY.

Waushara County is located in the south central part of Wisconsin. It has an area of 643 square miles, or 411,520 acres. It comprises three physiographic divisions, namely, the Wisconsin River Valley, the morainic belt, and the Lake Poygan and Fox River valleys. The valleys have a level to gently rolling topography; the morainic belt is quite broken and hilly.

The summers are short and pleasant and the winters long and cold. The average yearly rainfall for a period of ten years is 28.3 inches. The drainage is to the south and east into Lake Poygan and Fox River.

Wautoma, the county seat, is centrally located. The rural population is well distributed throughout the county.

Agriculture is in a prosperous condition. Potatoes, corn, oats, rye, cranberries, and hay are the chief crops, and dairying and hog raising are the two leading industries. The milk is made into butter in local creameries.

Most of the labor is done by the owners of the farms and their families, but some hired help is used during the digging of potatoes and harvesting of other crops.

Fourteen soil types are shown in the map. These soils range from Muck to heavy clay. The heavy soils are used mostly for dairying, hog raising, and the growing of general farm crops, but are adapted also to apples, small fruits, and alfalfa. The sandy soils are devoted to potatoes and bean culture and are well suited to sweet corn, garden peas, and other truck crops. The great diversity of soils in this county offers excellent opportunities for the growing of many profitable crops.

The Coloma sand is by far the most extensive type. It is well suited to potatoes, beans, corn, rye, small fruits, and quickly maturing truck crops. This type is usually low in organic matter and responds well to manure.

The Coloma sandy loam is found entirely within the morainic belt and is well adapted to general farm crops, alfalfa, fruit, potatoes, and the crops recommended for the Coloma sand.

The Coloma loam has a very small extent. It is well suited to general farm crops, dairying, hog raising, and fruit.

Only a small area of the Coloma stony sand is found. Because of its stony nature it is not well suited to farm crops. It is used for pasture. When well tilled it produces moderate yields of corn, rye, potatoes, and beans.

The Coloma gravelly sand occurs as small irregular ridges along stream courses and is only suited for pasture.

The Waukesha sandy loam is rich in organic matter and a very productive type. Dairying and hog raising are the main industries. Potatoes, corn, rye, oats, and hay are the chief crops. This type is also well suited to the growing of onions and truck crops.

The Waukesha sand has about the same producing power as the Coloma sand. If well tilled and manured it will yield moderately good crops. It is a good early truck soil, but needs organic matter and lime.

The Plainfield sand occupies the level areas in the western, southern, and eastern parts of the county. It is a light to medium brown sand, low in humus, and inclined to be droughty. When well manured and cultivated it produces moderately good crops of potatoes, beans, corn, oats, buckwheat, and hay. This type needs lime and organic matter to grow red clover successfully. It is well adapted to small fruits, quickly maturing truck crops, Canada peas, and beans.

The Superior loam occupies small areas on ridges and uplands in the eastern part of the area. Dairying and hog raising are highly developed industries. It is well drained, has good roads, and produces good crops of clover and timothy, corn, and oats, but is usually too heavy for potatoes and truck crops. It is well adapted to apples and small fruits.

The Poygan clay loam is a dark-colored soil rich in organic matter and very productive. Dairying and hog raising and the growing of general farm crops are the main industries on this type.

The Poygan clay occupies low-lying level areas in the Lake Poygan Valley. Good crops of corn, oats, and hay are produced and dairying is a thriving industry. It is generally in need of drainage.

The Superior clay loam is closely associated with the Poygan clay, being usually surrounded by the latter type. It lies a little higher than the Poygan clay and produces the same general farm crops. Many good artesian wells are found on this type as on the preceding type.

The Superior sandy loam is a well-drained type and produces good crops of potatoes, corn, oats, rye, and hay. It differs from the Coloma sandy loam in having a heavy red clay subsoil.

Muck occurs to a large extent in the county, being usually found in irregular shaped, low-lying bodies and in narrow belts along stream courses. Cranberry growing has developed quite extensively in Aurora Township on this type. Very few areas have been drained. When well drained it is very well suited to the growing of celery, onions, peppermint, and cabbage. The extension of the cranberry industry would prove very profitable on this type.

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