

SOIL SURVEY OF THE ALMA AREA, MICHIGAN.

By W. EDWARD HEARN and A. M. GRIFFEN.

LOCATION AND BOUNDARIES OF THE AREA.

The Alma area lies within Gratiot County, which is situated in the south-central part of the State of Michigan, about midway between Lake Michigan and Lake Huron and about 40 miles north of Lan-

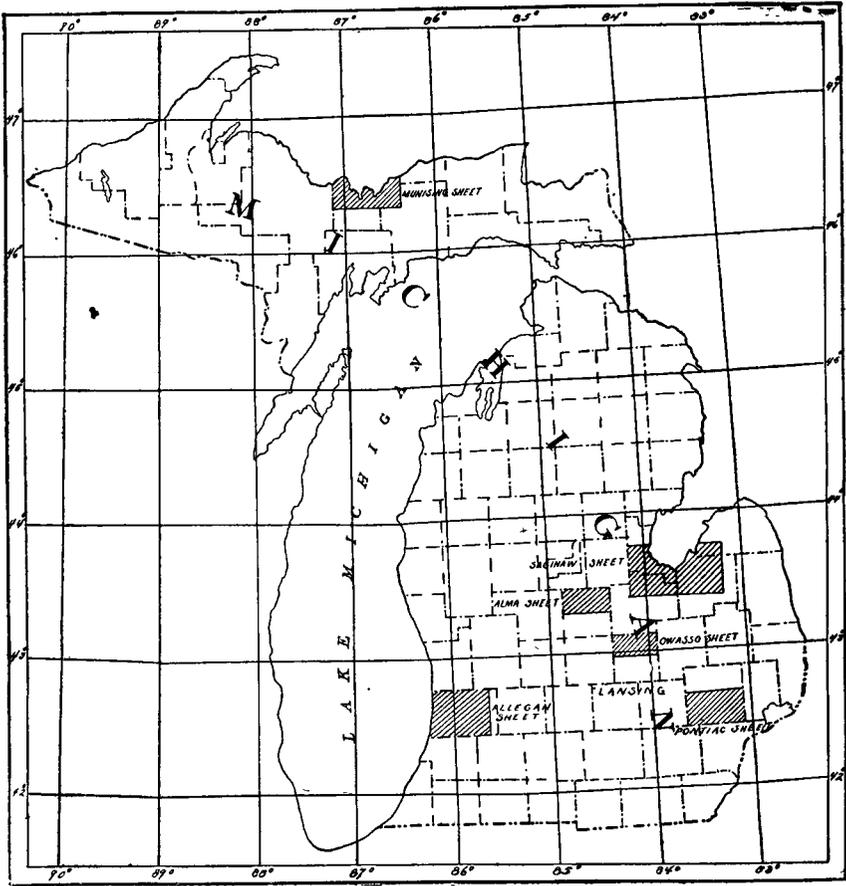


FIG. 26.—Sketch map showing location of the Alma area, Michigan.

sing. The present survey includes the northern half of the county, comprising the townships of Wheeler, Bethany, Pine River, Seville, Sumner, Arcada, Emerson, and Lafayette. The area is rectangular in form, having a length of 24 miles east and west and a width of 12

miles north and south, and contains 180,800 acres, or approximately 282 square miles.

Gratiot County is bounded on the north by Midland and Isabella counties, on the east by Saginaw County, on the south by Clinton County, and on the west by Montcalm County. It is traversed by the Pere Marquette and Ann Arbor railroads. Ithaca, the county seat, has a population of about 2,000, while Alma and St. Louis are somewhat larger.

HISTORY OF SETTLEMENT AND AGRICULTURAL DEVELOPMENT.

Gratiot County was formed about 1855. Seven townships were organized at that time by act of the State legislature, and several other townships formerly attached to the counties of Clinton and Saginaw have since been made a part of Gratiot County.

William McOmber, probably the first white man to settle permanently in what is now Gratiot County, came in 1832. He was an agent for the Northwestern Fur Company, and carried on a considerable trade with the Indians. These were nearly all of the Chipewewa tribe, and being of a peaceable nature no serious trouble arose between them and the white settlers. They soon moved to a reservation in Isabella County, which was ceded to them by the Government in 1856. The first locations of land were made in 1836, but no permanent settlements were effected until 1846. The first sawmill to begin operations in the county was built in 1855, and was followed by the erection of frame houses and substantial buildings of every character. For a long time the only road of any description through the county was known as the "old Indian trail," which extended from Maple Rapids to the Lutheran mission above St. Louis. Saginaw and Maple Rapids were the chief trading points for the Gratiot County people. Pine River furnished a means of transportation both for supplies and lumber.

The early inhabitants came largely from New York State, although there were a number from New England, New Jersey, Pennsylvania, and Ohio, and some from Canada. In the early days this region was known as "Starving Gratiot," and many settlers became discouraged with their venture, but the county soon proved itself one of the best in the State. Upon their arrival the settlers found the whole county densely covered with a magnificent growth of pine, maple, beech, oak, ash, basswood, and elm, with some butternut, hickory, and hemlock. Some of the swamps, especially those around Riverdale, supported forests of white cedar, while most of the Muck areas were covered with tamarack. The pine timber abounded chiefly in the northern part of the county, and was confined to the more sandy soils; the beech and maple forests were usually characteristic of the

sandy loams, while the white elm, black ash, oak, hickory, and maple were indicative of heavier soils, and were found most abundantly on the heavy loam soil in the eastern and central parts of the county.

The first settlements were made on ridges and knolls, as all of the area mapped as Clyde loam was at that time a veritable swamp, though since the natural drainage ways have been opened up and new ditches cut through the area it has become one of the most productive soils in this section of the State. During the summer and fall of 1855 and the spring of 1856 the population rapidly increased, large fields had been cleared, and improvements were seen on every hand. The timber, however, was of little value until the advent of railroads. The Saginaw Valley and St. Louis Railroad was first built from Saginaw to St. Louis, and later extended to Grand Rapids and the name changed to the Pere Marquette. The Toledo, Ann Arbor and North Michigan Railroad was built about 1883, and is now known as the Ann Arbor. The railroads have acted as a great stimulus in advancing the industries of this section.

Since the settlement of the area corn, wheat, oats, and grass have been the principal products. Until recently wheat was one of the most important crops, large yields being obtained, but the acreage devoted to this crop has decreased within the last few years, owing to the ravages of the Hessian fly, to dry seasons, and to extreme cold winters. Sheep and cattle raising have been rather important factors in the development of the county's wealth. In the early days when crops were light the farmers had a fair income from their timber land. The lumber industry was of great importance for a few years during the settlement of the area.

The growing of sugar beets on a commercial scale began in 1899. Some few patches had been grown previously as an experiment, and the success of these aroused confidence and enthusiasm in this new branch of agriculture. The summer of 1899 was unfavorable for beets, but the second year the beets made a good growth, and the sugar content was high. This crop proved to the growers that the soil and climate were suitable for the production of sugar beets and to-day they are one of the money crops of the area.

CLIMATE.

The following table, compiled from Weather Bureau records, shows the average monthly and annual temperature and precipitation at Alma for a period of about seventeen years. The coldest months are December, January, and February, and the minimum temperature recorded within five years was -24° F. The warmest months are July and August, and the maximum temperature has not exceeded 98° F. The winters, as the records show, are very cold. The sum-

mers are cool and pleasant, with a high percentage of sunny days. The last two summers have been somewhat colder and wetter than the three just preceding.

Normal monthly and annual temperature and precipitation.

Month.	Alma.		Month.	Alma.	
	Temper- ature.	Precipi- tation.		Temper- ature.	Precipi- tation.
	° F.	Inches.		° F.	Inches.
January	21.6	2.43	August	67.2	2.44
February	20.3	1.62	September	60.3	3.14
March	29.2	2.44	October	48.6	2.58
April	44.9	2.25	November	37.7	2.94
May	54.9	3.19	December	27.0	2.35
June	66.6	3.13	Year	45.7	31.52
July	70.1	3.01			

In the accompanying table are given the dates of the last killing frost in spring and the first in fall. The average dates are May 9 and September 25. This gives a growing season of about 149 days for the tenderest crops.

Dates of first and last killing frosts.

Year.	Alma.		Year.	Alma.	
	First in fall.	Last in spring.		First in fall.	Last in spring.
1898	Sept. 11	May 12	1902	Oct. 10	May 14
1899	Sept. 14	Apr. 16	1903	Oct. 18	May 4
1900	Oct. 20	May 22	Average	Sept. 25	May 9
1901	Sept. 18	May 15			

PHYSIOGRAPHY AND GEOLOGY.

The topography of the Gratiot County area is that of a region where glacial action has completely effaced preglacial features. The area comprises two main physiographic divisions. The larger of these, which occupies a little more than one-half of the area, consists of a series of glacial moraines extending in a general north and south direction. The continuous ridge extending from Ithaca through St. Louis is the most easterly of these. To the westward are found others, usually separated by ancient drainage channels, which, consisting of glacial material reworked by streams, give rise to more sandy soils than are found in the uplands.

The surface of the morainic country is usually rolling. In some localities a "kame and kettle" topography is typically developed, and the surface is so very rough and broken that tillage is almost impossible. Gravel deposits occur under many of these hills, but

they are usually buried so deeply beneath the till that they do not affect the soil. In many parts of the rolling country sand deposits are found, and in the western part of the area a higher moraine extends almost across Seville and Sumner townships. This contains more sand and gravel than the other moraines, and in places develops into quite extensive sand plains. There are numerous small depressions and sags upon the moraines which have no drainage outlets, and it is in these small depressions that the muck areas occur.

East of the ridge running north from Ithaca the surface consists entirely of lacustrine sediments deposited in the ancient Lake Saginaw, the first of a succession of glacial lakes formed between the ice front and the moraine. These sediments give rise to the Clyde loam, and, as might be expected, are very uniform, the only variation of note consisting of sandy deposits representing the shoals and shore lines of the old lake, which have formed small areas of sand and sandy loam. With the exception of these low ridges there are no marked topographic features in this part of the area surveyed.

Excepting the southeastern portion of Arcada Township, and other local areas lying principally in the old drainage channels, the western part of the Gratiot County area is well drained. The general rolling character of the country gives rise to many small streams tributary to the Pine River. This river enters the area near the northwest corner and flowing south near the western boundary leaves the area below Riverdale. About 2 miles south of this point it reenters the area, runs southeast to a point near the southern boundary, then curves northeast around the end of the western moraine, skirting its base for several miles, then pierces the eastern moraines by a narrow valley, and continues its northeast course out of the area. Although it is not a swift stream it has sufficient fall to furnish power to several flour mills along its course. In the flat eastern portion of the area the drainage problem is a more serious one. Goose and Beaver creeks and the Bad River furnish outlets, but the streams are sluggish, with few tributaries, and an extensive system of ditching is necessary to drain the land between them.

The last ice advance which covered Gratiot County is known as the Wisconsin, and the present moraines are a part of those left by this glaciation. It is likely that a portion of the entire drift mass was formed by earlier advances of the ice, but how much is not known. Many large and small bowlders of granitic rock and some limestone are found scattered over the entire area.

The thickness of the glacial drift varies considerably in different parts of the area. At Alma it is 500 feet, at Ithaca 350 feet, and at St. Louis about 300 feet thick, and a well boring made about 3 miles northeast of St. Louis is reported to have struck rock at 80 feet. In

the vicinity of Alma and St. Louis there are many small flowing wells and a few of considerable size. Water is usually obtained from these at a depth of about 60 feet. Well water is easily found in all parts of the area. In the upland portion the wells vary from 20 to 80 feet in depth and in the lowland from 6 to 15 feet.

Gratiot County lies nearly in the center of the great Michigan coal basin. It is not likely, however, that any extensive coal deposits will be found. The rock underlying the drift is a carboniferous sandstone, but does not outcrop within the area. Small deposits of shell marl are found in some of the muck areas, but none of commercial importance. The glacial clays furnish a suitable material for the manufacture of tile, and there are three factories within the area.^a

SOILS.

Eight distinct types of soil, exclusive of Meadow, were recognized and mapped in the Alma area. The area and proportionate extent of each of these types are shown in the following table:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Clyde loam	59,776	33.1	Meadow	6,592	3.6
Miami fine sandy loam	34,432	19.0	Miami clay loam	6,144	3.4
Miami sand	33,472	18.5	Miami gravelly sand	5,504	3.0
Clyde sandy loam	13,696	7.6	Total	180,800
Muck	10,816	5.9			
Clyde sand	10,368	5.7			

CLYDE LOAM.

The surface soil of the Clyde loam consists of a black or drab-colored loam to a depth of 6 to 10 inches. It is locally spoken of as the "clay land." This type contains quite a large amount of organic matter, and this, together with the relatively high percentage of fine and very fine sand, makes of the greater part a mellow, loamy soil. Some slight variations in texture occur; in a few places the surface soil may be a clay loam, while in other areas spots with a sandy covering are sometimes encountered, but the agricultural value seems to be about the same for all areas. In the wetter and lower-lying areas the soil cracks open when dry and has the appearance of a stiff clay soil.

^a The authors wish to acknowledge their indebtedness to Prof. Charles A. Davis, of Ann Arbor, Mich., for information given in this chapter on the geology of the Alma area.

The subsoil, to a depth of 36 inches, is either a blue, yellowish, or mottled clay or clay loam, stiff and rather tenacious. Strata of sandy material are usually found in the subsoil between 18 and 24 inches, or again the clay may grade into a sticky, sandy clay at 30 inches. The clay is plastic when wet, but hard and crumbly when dry, cracking open in road cuts and ditch banks, as well as on the surface. Underlying the larger areas of Clyde loam a hardpan, composed chiefly of consolidated clay, is found at from 4 to 10 feet beneath the surface. This is usually quite impervious to water, and interferes to some extent with the drainage of this soil.

The Clyde loam is the most extensive soil type in the area. It occurs most typically developed in broad, extended areas in the eastern half of the survey, covering the greater part of Emerson and Lafayette townships and large areas in Wheeler and Bethany townships. Many smaller areas and isolated spots of this soil are scattered over the entire area. Large areas of soil in the adjoining counties to the north, east, and south are similar to this type.

The surface features are generally level throughout, with scarcely any great difference in elevation even in the larger areas. In the vicinity of some of the natural drains the surface is slightly undulating. Some areas of this soil are found occupying depressions and swales interspersed through the other types.

Owing to its flat surface and the rather impervious subsoil, the Clyde loam possesses poor natural drainage. The best results are obtained from this soil where it has been artificially drained. When the county was first settled all the larger areas were in a swampy condition, but by opening up the natural drainage outlets and digging large open ditches these productive areas have been reclaimed. Large open ditches, with smaller laterals and tile drains leading into these, are essential for the thorough drainage of this soil, and many tile drains are now being laid.

Sometimes in the spring these level low-lying areas are covered with water for several days at a time, and the planting of crops is often considerably retarded on account of the wet condition of the soil.

Several tile factories are in operation in the area, and tiling can be secured at reasonable prices. Factories for its manufacture are located at Ithaca, northwest of Ithaca, and west of St. Louis. Most of the tile drains are laid 8 rods apart, and this makes the cost about \$15 an acre. The proper drainage of the Clyde loam areas insures a more uniform distribution of the soil moisture, better yields and better quality of crops, and also tends to promote the health of the community.

The material from which this soil type is derived consists almost entirely of lacustrine sediments deposited in the ancient Lake Saginaw. The clay was deposited in rather quiet water, and the sand of different grades found in this soil is probably the coarser material brought in by the streams and deposited over the floor of the lake during periods of high water.

This type was formerly covered with a heavy growth of white elm, black ash, hickory, oak, maple, and other hardwoods. In some places quite a large amount of vegetable mold is found on the surface, due to the accumulation of the decayed foliage from this growth, giving the soil in places an oily consistency. Some tests have been made with lime on the Clyde loam, and beneficial results were secured. It will doubtless make the soil looser and serve to correct its acidity. In some of the wetter areas the soil is cold and sour, and the sweetening of such areas would cause an increase in the yield of crops.

The Clyde loam is an easily tilled soil if cultivated at the proper time, but if worked either too wet or too dry it breaks up into lumps and is apt to remain in a rough condition for the entire season. When the county was first settled this type of land was considered worthless, but since it has been drained and cleared it is the most productive soil in the area surveyed. The greater part is now under cultivation, and it will be only a short time before the entire area of the type is converted into productive fields.

This soil is especially adapted to the production of sugar beets, corn, oats, wheat, and hay. The beets have no trouble in penetrating the subsoil, and a large, long, smooth beet is the result. It is an excellent all-around grain soil. Corn yields in favorable seasons from 30 to 50 bushels per acre; wheat, from 20 to 30 bushels; oats, 35 to 70 bushels; hay, from 1½ to 3 tons; sugar beets, from 8 to 18 tons; beans, 18 to 25 bushels. Potatoes, barley, cabbages, buckwheat, pumpkins, and garden vegetables do well. Apples, cherries, plums, and pears also thrive. Grapes give fair returns on the better drained areas, while the same soil in the lake zone is peculiarly adapted to their production.

The Clyde loam land, with improvements, ranges in price from \$40 to \$80 an acre, depending on location and distance from railroads, while some unimproved land of this type can be bought at from \$20 to \$25 an acre.

The table following shows the results of mechanical analyses of typical samples of the Clyde loam.

Mechanical analyses of Clyde loam.

No.	Locality.	Description.	Fine gravel, 2 to 1	Coarse sand, 1 to 0.5	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0 mm.
			P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.
11222	5 miles NE. of Ithaca.	Black loam, 0 to 8 inches.	1.5	4.4	8.0	25.7	15.7	27.1	17.5
11446	3 miles NW. of Breckenridge.	Black loam, 0 to 7 inches.	1.1	4.6	9.3	26.2	11.7	25.7	21.3
11444	1 mile NW. of Rathbone.	Black loam, 0 to 9 inches.	1.0	5.4	8.8	22.8	12.5	27.0	21.9
11223	Subsoil of 11222	Mottled loam, 8 to 36 inches.	1.5	4.6	8.1	23.9	16.0	25.6	20.2
11445	Subsoil of 11444	Stiff clay loam, 9 to 36 inches.	1.0	4.5	8.2	21.7	11.7	23.2	29.0
11447	Subsoil of 11446	Yellow clay loam, 7 to 36 inches.	1.1	3.8	7.7	22.1	9.6	23.9	31.6

The following samples contain more than one-half per cent of calcium carbonate (CaCO₃): No. 11223, 7.4 per cent; No. 11445, 2 per cent; No. 11446, 0.54 per cent.

MIAMI FINE SANDY LOAM.

The surface soil of the Miami fine sandy loam, to a depth of 6 to 18 inches, is a light-brown medium to fine sandy loam. In many places the amount of silty material found in this soil is particularly noticeable. Gravel and cobblestones are usually present in the soil, but not in sufficient quantities to interfere with cultivation. Some of these cobblestones have been picked up and piled in heaps. Occasionally large granitic and schistose erratics are seen on the surface. Many areas, however, are practically free from stones and gravel.

The subsoil, to a depth of 36 inches, is a brown or chocolate-colored loam or clay loam, increasing in clay content with depth. In a very few small spots this clay loam is underlain by coarse sand and gravel at from 4 to 6 feet.

In addition to the typical areas of the Miami fine sandy loam there occur some variations of importance. In the northwestern part of the area surveyed the surface soil is deeper and somewhat more sandy than the areas found elsewhere. This is probably due to its topographic position, and also to its connection with the Miami sand. Pockets of sand are not uncommon in the Miami fine sandy loam, while many spots of silty and claylike material are observed throughout some areas of this soil. There are, moreover, many small spots of Meadow and kettle holes of Muck scattered here and there, which are too small to be represented on the soil map. These variations,

caused largely by topography, give this soil a somewhat varied texture and a rather spotted appearance.

The Miami fine sandy loam is confined to the central and western parts of the area surveyed, except for a few narrow strips in Lafayette Township. It occurs in large bodies of irregular outline, usually running in a north and south direction, in Pine River, Seville, Sumner, and Arcada townships, and on the west side of Emerson and Bethany townships.

The surface features of this soil give the type a more diversified character than that possessed by the other soil types in the area. It occupies morainic topography, consisting of rolling uplands, knolls, sharp ridges, and gently rolling to level areas. A "kame and kettle" topography is markedly distinct in the area north of Ithaca, and also in Seville Township. In the vicinity of Elwell and in a few other localities the surface is practically level to gently rolling.

The Miami fine sandy loam for the most part possesses excellent natural surface drainage, due to the position it occupies, combined with the rather loose character of the soil. However, there are a number of kettle holes here and there, of very small extent, which are wet and swampy, and which can not be drained at a reasonable expense. In the more level and gently rolling areas open ditches are sometimes seen. These are quite serviceable, as the clay loam subsoil stands up well in the banks. In a few areas tile drains have been put in and good results are obtained.

This soil type owes its origin to the weathering of glacial moraines. The material as left here by the glacier probably contained a considerably greater amount of clay than at present, but the fine material has been in a great measure carried away in suspension, leaving a light, loose, sandy loam soil. The surface has been eroded to a marked degree, and wide variations in the texture of this soil are the results of this unequal erosion.

All the crops common to the area are grown upon the Miami fine sandy loam. Those that give best results are corn, potatoes, oats, hay, beans, fruits, and berries. The surface of the soil in some places is too uneven and the texture too varied for the profitable production of sugar beets. The more level and gently rolling areas, with a uniform textured soil, produce good yields of beets, and such areas are recommended for this crop. Beets average from 7 to 12 tons per acre; hay, from 1 to 2 tons; potatoes, 60 to 150 bushels; corn, 25 to 40 bushels; while oats, wheat, barley, rye, and clover do fairly well. Beans average from 12 to 15 bushels. Some buckwheat is also grown. Apples do very well, and also plums, pears, and cherries.

The following table shows the results of mechanical analyses of the fine earth of both soil and subsoil of this type:

Mechanical analyses of Miami fine sandy loam.

No.	Locality.	Description.	Fine gravel, 2 to 1	Coarse sand, 1 to 0.5	Medium sand, 0.5 to	Fine sand, 0.25 to 0.1	Very fine sand, 0.1 to	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0 mm.
			mm.	mm.	0.25 mm.	mm.	0.05 mm.		
			P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.
11436	3½ miles N. of Elwell.	Brown fine sandy loam, 0 to 14 inches.	1.1	7.0	11.5	33.3	13.6	21.9	11.1
11216	3 miles N. of Ithaca.	Fine sandy loam, 0 to 12 inches.	1.7	6.5	9.9	26.1	15.1	29.0	11.7
11437	Subsoil of 11436	Brown loam, 14 to 36 inches.	1.5	5.0	9.8	26.2	10.3	28.1	18.6
11217	Subsoil of 11216	Brown clay loam, 12 to 36 inches.	1.2	2.8	4.8	15.3	13.8	32.7	29.3

MIAMI SAND.

The Miami sand consists of a fine to medium sand to a depth of 5 to 8 inches. It varies considerably in color, but the largest areas of it are usually of a light-brown or gray color. The more rolling areas of this type possess only a small percentage of organic matter, while the gently rolling and level bodies contain considerable in the surface soil, this being especially the case in the areas adjoining the Clyde sand. The subsoil, to a depth of 36 inches or more, is a yellow, or sometimes a reddish-yellow or gray, medium to fine sand, loose and incoherent. Occasionally a few gravel fragments are found in both the soil and subsoil, particularly in the northwestern corner of the survey, and also adjacent to the Miami gravelly sand areas. This sand is sometimes underlain at from 4 to 6 feet by clay, while small areas of it are underlain by gravel beds.

The largest areas of the Miami sand are found in Sumner, Wheeler, and Seville townships, and in strips along Pine River. Many irregular areas and isolated spots are scattered over the area. It frequently happens that this soil is interspersed throughout the Miami fine sandy loam areas, and this is especially noticeable in Seville Township.

The surface features of this soil type show a much diversified character. The main areas of it, however, have a rolling surface, with ridges, knolls, and intervening gently rolling areas, but in the north-eastern corner of Wheeler Township the surface is level to undulating. The most broken topography of the Miami sand is observed in the northwestern part of the area, where it occupies the knolls and ridges which attain the highest altitude in the area. Along Pine

River this soil varies from a gently rolling to a somewhat hilly surface.

The loose, open texture of both the soil and subsoil, together with the rolling character of the country, insures excellent natural drainage for the greater part of this type. A few of the more level areas, in Wheeler Township and some other localities, should be artificially drained. This would give a warmer soil and cause it to be suited to a greater variety of crops. Open ditches would be of considerable service, even in this sand.

The Miami sand owes its origin to glacial wash sand. This was washed from the glacier during times of swift waters. It has been modified in a great many places, however, by stream action, and along Pine River it has been deposited as deltas. In the eastern part of the area it is found in ridges, which at one time were likely shore lines or shoal water bars, the sand being drifted up by the waves or brought into the former lake by the incoming currents.

This soil is well suited to the production of small fruits, berries, potatoes, and garden truck, and will probably grow good peaches. The growing of leguminous crops to supply this sand with a larger amount of organic matter, as well as the use of coarse manures, is highly recommended. This soil would be considerably improved by applying large amounts of muck to it.

The crops commonly grown upon this type are corn, barley, potatoes, oats, buckwheat, berries, hay and some fruit. A few sugar beets are grown, but this crop should be confined to the heavier soils. A low tonnage is usually obtained, though the beets contain a high percentage of sugar. Grain crops generally give a low yield, although some few areas, which have been heavily manured and properly cultivated, produce good crops in favorable seasons. The soil is too light textured for general farming on an extensive scale. Potatoes, barley, and corn give fairly good yields.

The Miami sand was originally heavily forested with white pine, but now only a few beeches and maples are seen, while the largest forested areas are covered with a dense growth of white poplar brush. There are large bodies of this type that are undeveloped, and this condition is especially noticeable in the northeastern and northwestern corners of the area and also in Sumner Township. The Miami sand sells at from \$10 to \$35 an acre.

The following table shows the results of mechanical analyses of the fine earth of the Miami sand:

Mechanical analyses of Miami sand.

No.	Locality.	Description.	Fine gravel, 2 to 1	Coarse sand, 1 to 0.5	Medium sand, 0.5 to 0.25	Fine sand, 0.25 to 0.1	Very fine sand, 0.1 to 0.05	Silt, 0.05 to 0.005	Clay, 0.005 to 0
			mm.	mm.	mm.	mm.	mm.	mm.	mm.
11218	1½ miles NE. of Sumner.	Gray sand, 0 to 5 inches	P. ct. 1.2	P. ct. 12.6	P. ct. 36.9	P. ct. 41.8	P. ct. 3.2	P. ct. 2.3	P. ct. 1.9
11440	5 miles NE. of Breckenridge.	Brown sand, 0 to 6 inches	1.0	8.2	22.4	56.3	4.1	5.6	2.0
11441	Subsoil of 11440	Yellow sand, 6 to 36 inches	.9	7.7	24.0	60.9	3.9	2.1	.5
11219	Subsoil of 11218	Yellow sand, 5 to 36 inches	.9	6.6	37.4	49.0	1.9	1.6	2.6

MIAMI CLAY LOAM.

The Miami clay loam, to a depth of 6 to 9 inches, consists of a light-brown, gray, or ashy colored loam. In many places, however, the surface soil contains a high percentage of very fine sand, while in other localities a very heavy loam is found, being composed almost entirely of silt and clay. The surface soil of this type before reaching the typical underlying subsoil grades into a layer of whitish silt from 1 to 4 inches in thickness. The subsoil is a brown or chocolate-colored clay loam or clay to a depth of 36 inches or more, increasing in clay content with depth. It is rather stiff, very plastic when wet, cracking open and becoming hard and crumbly when dry, and breaks up into lumps having a somewhat granular structure.

The Miami clay loam is most typically developed in the vicinity of Alma, in the northern part of Arcada Township, and in the southern part of Pine River Township; but a few areas and isolated spots are also found scattered across the western and northern parts of the area. The type occupies rolling ridges, knolls, and gently rolling areas. Sometimes it occurs as a level area in the Miami fine sandy loam, and it is closely allied with that type both in respect to origin and topographic features.

The greater part of the Miami clay loam possesses good natural surface drainage, but the structure of the subsoil is such that tile drains prove beneficial. Underdrainage regulates the soil moisture, aerates the soil, and carries off the excess of rain water that would otherwise remain for a long time in the subsoil. As a rule this soil is wet for several weeks in spring from the melting snow, and a system of underdrains would materially shorten this period, during which the soil can not be worked. Quite a large proportion of the

Miami clay loam has been tile drained already, and actual experience has shown the practice to be profitable in many ways.

The Miami clay loam is of glacial origin, being the true till left here in the form of moraines by the retreating ice sheet. In some places this formation does not appear to have undergone any great degree of erosion, while in others it has been subjected to considerable, thus giving a very rolling surface. In a few places a large part of the clay has been removed in suspension by the rain waters.

Considerable care should be exercised in regard to the time of plowing and the manner of pulverizing this soil in the spring, in order that cultivation may be most easily carried on and that crops may give the best yields. If plowed and harrowed at the proper time, it is an easily tilled soil; otherwise the soil breaks up in clods, and is liable to remain for the entire season in a coarse lumpy condition—a feature very objectionable in the cultivation of sugar beets and other crops requiring intensive methods.

The Miami clay loam is considered a fairly productive soil and one readily improved by manure. The crops grown upon it at present, judging by the yields obtained, seem to be well suited to this soil. The well-improved land of this type, which has been in part tile drained, and which has been cropped in a regular rotation, produces as follows: Corn, 40 to 50 bushels per acre; oats, 30 to 60 bushels; timothy hay, 2 tons; clover hay, 1½ tons, and sugar beets, from 8 to 15 tons per acre. Beans and potatoes do very well on this soil. The success of the few small apple orchards observed on this type would indicate that this industry could be profitably extended on a commercial scale. Pears, plums, and cherries also do fairly well.

The Miami clay loam occupies a unique position as regards town and railroad facilities, as the greater part of it lies within 2 miles of a town. It is held at from \$35 to \$100 an acre.

The following table shows the results of mechanical analyses of typical samples of the Miami clay loam:

Mechanical analyses of Miami clay loam.

No.	Locality.	Description.	Fine gravel, 2 to 1	Coarse sand, 1 to 0.5	Medium sand, 0.5 to	Fine sand, 0.25 to 0.1	Very fine sand, 0.1 to	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0 mm.
			mm.	mm.	0.25 mm.	mm.	0.05 mm.		
			P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.
11448	1 mile SE. of Alma...	Brown loam, 0 to 6 inches.	1.8	4.6	7.9	19.8	10.3	35.0	20.0
11450	1 mile W. of Alma...	Brown loam, 0 to 9 inches.	1.7	4.2	7.9	19.2	13.7	27.4	25.8
11451	Subsoil of 11450	Brown clay loam, 9 to 36 inches.	.0	3.9	4.7	13.9	12.3	30.7	34.3
11449	Subsoil of 11448	Brown clay, 6 to 36 inches.	.7	2.6	4.2	12.5	6.0	29.0	44.9

CLYDE SANDY LOAM.

The surface soil of the Clyde sandy loam consists of a black or brown medium to fine sandy loam, with a depth of from 8 to 15 inches. A few gravel and cobblestones are usually present on the surface and mixed throughout the subsoil. The subsoil is a yellow, sticky sandy loam or a blue clay loam grading into a rather stiff clay. There are many variations of this soil type, but since the type occupies only very limited areas, these variations could not be separated or shown on the soil map. In some localities the soil is a heavy sandy loam which grades into a blue clay. Again, the surface soil may be a black or brown loamy sand for a depth of 18 inches, and underlain by a light, loose sandy loam or sand. As compared with the same type in the Saginaw area, the soil in the Alma area is somewhat finer, and the percentage of clay, especially in the subsoil, is higher. The Clyde sandy loam is often spoken of as the "maple and beech ridge" land.

This type occurs in peculiarly shaped areas and spots scattered irregularly throughout the townships of Emerson, Lafayette, Wheeler, and Bethany, where it is associated with the Clyde loam. Several smaller detached areas are also found in other parts of the survey. These are commonly seen as depressions or swales in the morainic topography. The type has similar surface features throughout, in that it occupies the gently rolling and level areas. It is sometimes found in the form of a slightly elevated ridge or knoll. Owing to the rather open texture of the soil, the type has fairly good natural drainage. The level areas and swales in some places need artificial drainage, while some of the level areas where the blue clay comes near the surface would be improved by tile drains, and these have been laid in some instances.

The Clyde sandy loam consists of glacial material which has been reworked and redeposited in many instances by stream or wave action. Where it occurs in the form of low ridges it probably represents the low beach lines of the old Lake Saginaw. Since its deposition it has accumulated within the surface soil a considerable amount of organic matter, and a black sandy loam of excellent tilth has resulted.

This is an easily tilled soil, and it is also fairly productive. It seems to be best suited to the production of potatoes, beans, and corn, although sugar beets, oats, wheat, and many other crops can be profitably grown. Beans mature more quickly on this type than on the heavier soils, and are less liable to damage by early frosts. At present corn yields from 25 to 40 bushels per acre; oats, 25 to 45 bushels; sugar beets, 7 to 14 tons; hay, from 1 to 2 tons; potatoes, from 80 to 150 bushels, and beans, from 15 to 25 bushels per acre.

Wheat, barley, and clover do fairly well, while apples, cherries, and plums can be easily grown. Berries and garden vegetables are successfully grown in a limited way, and this industry should be extended.

The following table shows the results of mechanical analyses of the fine earth of this soil:

Mechanical analyses of Clyde sandy loam.

No.	Locality.	Description.	Fine gravel, 2 to 1	Coarse sand, 1 to 0.5	Medium sand, 0.5 to	Fine sand, 0.25 to 0.1	Very fine sand, 0.1 to	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0 mm.
			mm.	mm.	0.25 mm.	mm.	0.05 mm.		
			<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>
11220	6½ miles NE. of Ithaca	Fine sandy loam, 0 to 8 inches.	1.9	5.8	9.6	49.4	15.4	13.1	5.0
11442	3 miles SE. of St. Louis.	Fine sandy loam, 0 to 12 inches.	1.3	6.6	12.5	32.4	18.4	23.0	5.3
11221	Subsoil of 11220	Fine sandy loam, 8 to 36 inches.	1.5	6.5	11.3	48.0	12.8	11.9	7.9
11443	Subsoil of 11442	Yellow sandy loam, 12 to 36 inches.	1.0	5.1	11.1	32.0	15.0	18.8	17.1

CLYDE SAND.

The surface soil of the Clyde sand has a depth of 8 to 12 inches, and consists of a black, loamy, medium to fine sand. It contains a large amount of organic matter, which gives it the black color and loamy characteristics. This type is closely associated with areas of Muck, and in some localities a thin covering of mucky soil is frequently found on the surface. In the northeastern part of the area there are bodies of this soil which are a brown to black loamy sand to a depth of 20 inches, resting upon a gray sand. The subsoil of this type is a gray or white medium sand, usually loose and incoherent, but in a few places containing a sufficient amount of clay to make it sticky, as it is commonly wet at 30 inches. Occasionally there are areas of this subsoil which are underlain by a rather coarse sand and fine gravel at 3 feet, while in some other places a blue clay is found at from 4 to 5 feet.

The largest bodies of the Clyde sand are found in the southwestern part of the area, in Arcada Township. Many smaller areas and isolated spots occur throughout the western and northern portions of the area surveyed, especially to the northeast of St. Louis.

Occupying low, flat areas, usually adjacent to the Muck, the surface of this soil is uniformly level. It also occurs as depressed areas along some of the small streams, and as swales in the Miami sand areas. By reason of its low, level position its natural drainage is not good,

but the loose, open character of the soil and subsoil allow a free percolation of the rain waters. An exception occurs in Bethany and Wheeler townships where this soil has excellent drainage. In general the lower lying areas of the Clyde sand need to be artificially drained, as the permanent water table is generally reached at from 3 to 8 feet. These low areas can be drained in most cases by means of large open ditches.

The Clyde sand is very probably formed from glacial wash material, which has been modified in many cases by stream action. It has also been changed largely by the accumulating in its surface of a considerable quantity of organic matter.

Upon the Clyde sand are grown corn, oats, potatoes, hay, sugar beets, and cucumbers. Corn averages from 20 to 35 bushels; oats from 25 to 40 bushels, and hay from 1 to 2 tons per acre. Sugar beets are an excellent crop for the more elevated, well-drained areas of this soil, and often yield as much as 10 to 15 tons per acre. The greater part of the type, however, is not well suited to the production of beets. Corn and oats do exceedingly well in some areas. Timothy, potatoes, and beans give fairly good yields.

This soil is very easily tilled, and the moisture conditions are quite favorable for the greater part of the year. It is probably best suited to corn, oats, potatoes, cabbages, melons, and cucumbers. Celery can also be grown on this soil with a fair degree of success, although its cultivation has not been attempted on a commercial scale.

The following table shows the results of mechanical analyses of typical samples of the Clyde sand:

Mechanical analyses of Clyde sand.

No.	Locality.	Description.	Fine gravel, 2 to 1 mm.		Coarse sand, 1 to 0.5 mm.		Medium sand, 0.5 to 0.25 mm.		Fine sand, 0.25 to 0.1 mm.		Very fine sand, 0.1 to 0.05 mm.		Silt, 0.05 to 0.005 mm.		Clay, 0.005 to 0 mm.	
			P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.				
11438	3 miles NW. of Alma.	Black medium to fine sand, 0 to 9 inches.	0.2	6.8	16.1	46.5	15.1	11.5	3.7							
11214	2½ miles W. of Ithaca.	Black sand, 0 to 10 inches.	.8	7.2	25.9	37.6	9.0	13.3	6.1							
11439	Subsoil of 11438	Gray sand, 9 to 36 inches.	.6	8.6	19.0	48.3	12.5	7.7	2.9							
11215	Subsoil of 11214	Gray sand, 10 to 36 inches.	.6	7.8	28.4	34.3	8.0	11.7	9.0							

MUCK.

The Muck consists of organic matter, more or less thoroughly decomposed and mixed with a small percentage of clay. The Muck is usually from 3 to 10 feet deep, but areas have been mapped as Muck

where the surface covering of vegetable matter was 12 inches or more in depth. These areas are generally underlain by either a blue clay or a white sand. Small spots of typical peat are found in some areas of this soil, but are not of sufficient extent to be shown on the map. In some localities there are evidences of marl deposits.

The largest bodies of Muck occur in very irregular outline to the northwest of Ithaca, in Arcada Township, scattered throughout Sumner Township, and in the northwestern part of Seville Township. Small areas and patches were also found in Pine River Township and in other parts of the area surveyed.

The Muck owes its origin to lack of sufficient drainage. In these depressed, inclosed, poorly drained areas flags, trees—such as cedar and tamarack—and other water-loving vegetation have grown and annually deposited their foliage. The accumulations of this decaying vegetation, together with a small amount of wind-blown and rain-washed fine mineral particles from the surrounding soil areas, constitute the true Muck soil. There are small spots, however, where this vegetation has not become so thoroughly decomposed, and areas of peat have resulted.

The Muck areas are uniformly flat, and natural surface drainage is almost lacking. However, the more extensive areas of this soil can be drained artificially by means of large open ditches, with smaller laterals or tile drains leading into these. The Muck stands up well in banks, and the blue clay also makes permanent walls, so that open ditches can be constructed with safety. There are some places where the Muck is underlain by sand, and judgment must be used as to the depth and location of these ditches. The water table is usually only a short distance beneath the surface. The small spots of Muck occurring in the depressions and kettle holes can not easily be drained, as in nearly all cases no natural outlet exists.

When the area was first settled the Muck was a veritable swamp, covered with a growth of cedar and tamarack, but to-day there remain only a few tamaracks, elms, flags, and coarse grasses. Many raspberries and blackberries were seen growing wild on the Muck. Only a small proportion of this soil is cultivated, while large bodies are pastured. Corn, oats, hay, and sugar beets have been grown to some extent. Hay yields from 1 to 1½ tons per acre. Sugar beets make a large tonnage at the expense of the sugar content. They have extra large tops and do not seem to ripen. Many farmers could use this Muck profitably by applying it in large quantities to the Miami sand where it occurs adjacent to the latter type, thus making the soil more loamy, more retentive of moisture, and richer in nitrogen. When these Muck areas have been artificially drained, reclaimed, and thoroughly cultivated for a few seasons they will be admirably adapted to celery, onions, and cabbages.

MIAMI GRAVELLY SAND.

The soil of the Miami gravelly sand varies from a fine to a coarse sand of brown color, with a depth of 10 inches and containing from 20 to 50 per cent of gravel and small stones. The gravel ranges in size from one-eighth of an inch to 3 inches in diameter, while the stones in some places may be as large as 5 inches in diameter. In a few places the interstitial soil is a dark-colored sandy loam, and areas of this phase are fairly productive. The subsoil, carrying from 30 to 40 per cent of gravel and small stones, is usually a yellow medium to coarse sand, but in some localities the texture is more nearly a sandy loam and the color a reddish shade. It is sometimes underlain by gravel. The typical coarse sand and gravel furnish an excellent grade of road ballast and are used for this purpose where conveniently located.

There are no extensive areas of this type, but the largest bodies occur in Sumner and Seville townships, along Pine River. Smaller spots and narrow ridges are found in several places in the northern part of the area surveyed, being closely allied to the Miami sand.

The surface features of this soil vary somewhat in different localities, but it generally occupies the level, rolling, and hummocky areas. In the vicinity of Riverdale the surface is practically level, while in other places it occurs as knolls and ridges. These ridges, representing former beach lines, are very pronounced near Breckenridge, where some of them rise from 5 to 10 feet above the surrounding soil types. These rolling areas and ridges have excellent surface drainage and, owing to the loose character of both the soil and subsoil, are apt to suffer seriously from drought. The level areas are fairly well drained, but more open ditches through these would prove beneficial.

The origin of the Miami gravelly sand may be traced to the outcrops of sand beds and ridges left here by the glacial ice. These beds have been exposed in many places and mingled with fine sand and silt. Probably some of this type has been reworked and redeposited by the swift currents of the river, as this gravel occurs in some places as terraces and again as former channels of the stream. The soil usually contains a small amount of organic matter.

This type is probably best adapted to barley, corn, beans, berries, and fruits. At present, however, barley, corn, beans, potatoes, hay, and cucumbers are the main products. The more loamy areas in favorable seasons produce fairly good yields of corn and beans. Cucumbers are grown to a considerable extent around Riverdale. The ridges and knolls are best suited to the production of fruit and should be used for this purpose.

The following table shows the results of mechanical analyses of the fine earth of a sample of the soil and subsoil of this type:

Mechanical analyses of Miami gravelly sand.

No.	Locality.	Description.	Fine gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0 mm.
			<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>
11224	8½ miles W. of Ithaca.	Brown sand, 0 to 10 inches.	11.5	27.4	20.3	21.5	5.5	8.5	5.1
11225	Subsoil of 11224	Yellow coarse sand, 10 to 36 inches.	8.4	26.3	19.8	24.4	6.6	8.7	5.7

MEADOW.

The Meadow of the Alma area consists of a variety of material, varying in texture from a loam in depressions to a loose sandy or gravelly loam along the streams. Only small areas of Meadow are found, and these occur chiefly along Pine River in the southwestern part of the survey and to the northwest of Emerson Center. A few small spots and strips are shown elsewhere in the area surveyed.

The characteristic feature of the Meadow is its lack of adequate drainage. It occupies the low, flat areas subject to frequent overflows, which are commonly too wet for cultivation, parts of them being covered with water nearly all the year. Owing to its low position and proximity to the water level of the streams the Meadow areas can not be drained at any reasonable expense. Some of the spots mapped as Meadow were once lakes which have since been filled.

The chief use made of the land is for pasturage. In some places it is covered with a good growth of natural grass, while in others it is forested with elm, ash, and other hardwoods; and the wettest places support a luxuriant growth of flags and coarse marsh grass. Spots of Muck are of frequent occurrence throughout the areas of Meadow.

AGRICULTURAL METHODS.

The agricultural methods practiced in the Alma area vary considerably in different sections, according to the texture and position of the various soil types. The methods used by the majority of the farmers are fairly well suited to the conditions of the area, while others should change their practices considerably. The heavy soils require much more skillful management than the sandy ones, and are also adapted to different crops. A great diversity of crops is grown,

owing both to the favorable climatic conditions and the large number of soil types. The specialization of crops that are adapted to certain soils has not been considered as seriously as it should be, and greater attention to this phase of agriculture would prove profitable to a number of farmers who now plant their crops at random on any kind of soil.

In the general farming operations of this region the use of commercial fertilizer has been almost unknown. Large quantities of barnyard manure are annually applied to the fields. The many cattle, hogs, and other live stock kept on each well-conducted farm produce considerable quantities of manure. In a number of cases this manure is not carefully saved, resulting in an annual loss frequently not appreciated by the farmers. The most careful husbanding of the manure is strongly recommended. During the last year or two some commercial fertilizer has been used by a number of the farmers in the growing of sugar beets. It seems to give the young beets a better start, making the plants more thrifty and hardy, and better able to withstand a wet season or a continued drought. The form of fertilizer most extensively used contains 2 per cent of nitrogen, 8 per cent of phosphoric acid, and 4 per cent of potash. From 150 to 300 pounds of this fertilizer is used to the acre. Some have experimented with 40 to 50 pounds of nitrate of soda. Lime can be recommended for the low-lying wet soils, which are apt to be more or less acid.

Corn, one of the most important crops, is grown on all the soils in the area. Level cultivation is usually practiced, this being done for the most part by sulky cultivators. Ridge cultivation is sometimes seen in the flat areas where the natural drainage features are not good. At maturity the stalks, with the ears, are cut, tied in bundles, and left standing in the field to complete the curing. Wheat is sown in the fall, while oats, barley, and rye are sown in the spring. With the last-mentioned crops timothy and clover are seeded. Seed drills and self-binders are commonly employed. Beans and potatoes are usually cultivated with horse cultivators, and very little hoeing is found necessary. The beans are given level cultivation, while the potatoes are usually grown in ridges. The beans when mature are cut by machinery or pulled by hand, hauled to the barn, and stacked until well cured, and then thrashed by machine as with wheat. The hay, which is chiefly timothy, is cut by horse mowers and raked in windrows. It is either stored in the barns or stacked in the fields. Buckwheat is grown to a limited extent and is considered more of a catch crop than one of the staple products.

The following is the four-year rotation practiced on some of the best farms around Alma: Corn on sod land, well manured, followed by beets, and then by oats or barley, seeding the land at the same

time to clover or timothy. Beets are also an excellent crop to follow potatoes. Another rotation common with some prosperous farmers throughout the area is to manure timothy or clover sod for corn, crush the stubble and plow deep for sugar beets, followed by oats or barley, seeding to clover or timothy, then pasture one year, putting all the rough manure possible on the land. Wheat often follows oats or barley. Some believe that a continual cropping of timothy will soon cause the land to deteriorate in productiveness. A four-year, five-year, or even longer rotation should be practiced by every farmer in this area.

The sugar beet is also one of the important crops, and as it is practically new to the area, it deserves especial mention here. In the preparation of land for beets fall plowing is considered to give the best results. It is also essential that the plowing be deep, because the land then retains more moisture. The land should be plowed again in the spring and well pulverized to a depth of 8 or 10 inches, making a loose, light seed bed. Most of the seed is sown between the 10th and the 20th of May, although some is put in as late as the 1st of June. About 15 to 18 pounds of seed are commonly sown to the acre. The early sown seed should be covered from one-half to three-fourths of an inch deep, while that sown the last of May or first of June should be covered from 1 to 1½ inches deep. The rows are usually from 18 to 24 inches apart. Cultivation should begin as soon as the beets appear above the surface. Bunching and thinning are done when the beets have from three to five leaves. This is very important, in order to give the young plants a good start. Hand hoeing and horse cultivation are necessary until the tops meet in the rows. The harvesting of the beets is begun about the 1st of October. A horse puller, constructed especially for the purpose, loosens the beets and leaves them on the surface. After this they are topped with a knife at the base of the bottom leaf, and, the dirt being shaken from them, they are ready to be delivered to the factory.

AGRICULTURAL CONDITIONS.

The general appearance of the Alma area is that of a successful agricultural community. The soils for the most part are productive and suited to a variety of farm products, and these features, combined with sufficient rainfall, insure fairly stable returns from year to year. The buildings on the well-kept farms usually consist of a well-built house, neatly painted, and a large barn, usually painted red and of sufficient size to hold the hay crop and house the stock during the winter months. Windmills and tanks, supplying water for farm use, corn cribs, and shelters for farm machinery are seen on the best farms. Neat wire fences are taking the place of the rail, board, or

stump fences which were first constructed. Log houses, still common in some parts of the area, are being supplanted by frame or brick buildings, and the general appearance of the farms is being changed with the general prosperity of this part of the county. On every good farm are found large horses to perform the farm work, several milch cows, supplying milk for home use and creameries, beef cattle, sheep, and hogs, with some poultry. The majority of the farmers own labor-saving machinery, comprising binders, mowers, rakes, cultivators, hay tedders and loaders, seed drills, gang plows, harrows, etc.

Probably about one-half of the farms in this area are mortgaged to some extent. These incumbrances were incurred, for the greater part, on account of purchases of more land or of farm implements, stock, windmills, or buildings, or in the installation of drainage systems. The indebtedness, as a rule, is not heavy, and individuals and financial institutions are willing to lend money on the farm lands. The best farm lands of the area, near the towns and railroads, are worth from \$50 to \$100 an acre, including all the improvements, while the same quality of land 10 miles distant from a railroad station will not sell for more than \$30 to \$50 an acre. Some of the more sandy lands in the northeastern and northwestern corners of the area can be bought for from \$10 to \$25 an acre. Lands within a radius of 10 miles of Alma have increased in value several dollars an acre since the sugar-beet industry was introduced. There are some farms in the area upon which a considerable sum has been expended for tile drains.

About 75 per cent of the farms in this area are operated directly by the owners and their immediate families, with one or more hired men. The remaining 25 per cent of the farms are operated through managers, who receive a fixed salary, or by cash or share tenants. The managers usually keep the farms in better condition than the tenants, and several of the best farms around Alma are run by managers. Only a small proportion of the farms are rented for cash, and comparatively few are let for a part of the crop.

The size of farms varies somewhat throughout the area. There are some of 40 acres, some of 60, 80, 120, 160, and some even larger, but 80 acres probably represents the average for the area surveyed. Sometimes one person owns many farms, thus making the average acreage to each landowner somewhat greater than 80 acres.

Labor is occasionally scarce and high priced, but a good grade of white help can generally be secured. Day laborers receive from \$1 to \$1.50 a day, while hired help working from six to nine months or longer in the year receive about \$20 a month, with board and washing. Boys and girls can earn fair wages working in the beet fields. They are anxious to perform this work, and are becoming quite efficient in thinning and weeding beets. Their work is by the

piece, and the usual price paid for thinning beets is 12 cents for a 40-rod row. During the harvesting season for beets men demand from \$1.50 to \$1.75 a day for their labor, and are rather disinclined to work during unfavorable weather.

General agriculture is practiced to a greater or less extent throughout the area. The principal products are corn, oats, hay (timothy and clover), sugar beets, wheat, beans, and potatoes; while the secondary crops are barley, rye, cucumbers, buckwheat, pumpkins, green peas, and garden vegetables, with fruits and berries. A large quantity of corn is annually grown. The acreage devoted to the production of wheat has been gradually decreasing in the last few years. Sugar beets are a money crop, and are now being considered in the regular crop rotation. Much of the navy bean crop grown in the area is contracted for by the wholesale seed dealers. The cucumbers are grown for the pickling factories, and are sold by the bushel. Quite a number of hogs and cattle are raised on every good farm, and many of these are fattened and shipped out of the area. From 1,000 to 3,000 sheep are also raised in each township, and many thousand pounds of wool are annually shorn. Milch cows are kept on nearly every farm, and some dairies were observed. A large quantity of milk is sold to creameries at Alma and Ithaca, while some cheese is made at the former place. Apples are the leading fruit, and a small orchard for home use is usually seen near the well-kept home. A considerable quantity of apples is shipped from the area, and much cider is also made. A few pear, plum, cherry, and a less number of peach trees, were noticed. Raspberries, blackberries, and strawberries are grown to a very limited extent. A few small vineyards are also seen. Some of the most successful and prosperous farmers sell nothing from their farms except sugar beets, cattle, sheep, and hogs.

Transportation facilities are furnished by the Ann Arbor Railroad, which runs across the area, connecting Frankfort and Toledo; and by the Pere Marquette Railroad, running through the area in an east and west direction. Dirt roads, which were laid out along section lines according to the Government land surveys, are found throughout the area, except across some of the more mucky or hilly portions. The roads, which are turnpiked, are constructed of excavated material dug from the drainage ditches on each side. There are a few gravel roads leading into Alma and St. Louis which were constructed by the beet companies. Rural free delivery of mail is in operation over the greater part of the area. It is not an uncommon thing to see a meat or grocery wagon making a house-to-house canvass in the rural districts.

There are no large cities in the area surveyed, and the local markets

are somewhat limited. Alma and St. Louis each have a beet-sugar factory, and these places handle the sugar beets grown in the county, as well as some from the surrounding counties. These towns, together with Ithaca, offer some market for the other products. The hogs, cattle, and sheep are shipped to Buffalo, and all the grain is also shipped to the eastern markets. Grain elevators are located at all the railway stations, and a bean elevator is operated at Ithaca.

The salient characteristics of the soils as classified in the present survey may be stated briefly, as follows:

The Clyde loam, formerly in large part a swamp, is now the most extensive and productive of the soil types in the area surveyed. This soil has to be artificially drained in order to secure the best results. It is well adapted to corn, oats, wheat, and timothy, and is preeminently a sugar-beet soil. The beets have no difficulty in penetrating the clay subsoil, and a large, smooth beet with a fair and even high sugar content is obtained. The farmers recognize that this soil is adapted to beets. The timothy hay grown upon this soil is of a superior quality.

The soil next in importance and extent is the Miami fine sandy loam. It possesses the most varied topographic features of any soil in the area. All the crops common to the area are produced, but corn, oats, potatoes, beans, sugar beets, and apples seem to give the best results, although other crops can be successfully grown.

The Miami sand occupies a fairly large proportion of the area. The drainage of this soil, coupled with the loose, open texture of both the soil and subsoil, makes it an early and very easily tilled soil. It is suited to the production of small fruits, berries, peaches, potatoes, and cucumbers, and to light farming. Barley gives fairly good yields on this sand. Sugar beets can not be profitably grown on a commercial scale.

The Clyde sandy loam is also an easily tilled and fairly productive soil. Potatoes, beans, corn, clover, and berries are excellent crops for this soil. Sugar beets can also be grown with a fair degree of success and are recommended as a crop for this soil. Apples, cherries, and pears do well.

The Miami clay loam occurs most typically developed around Alma. Corn, oats, sugar beets, clover, timothy, and wheat give large yields. Tile drains have proved beneficial in regulating the soil moisture and aerating this soil.

The Clyde sand, owing to its intimate connection with the Muck areas, has for the most part poor natural surface drainage. It is, however, well suited to corn, cabbages, celery, potatoes, and hay, while some of the more elevated areas, where the drainage is good, will produce large yields of beets and other crops.

The Muck soil of this area is as yet undeveloped, except in small spots, but when it is cleared, ditched, exposed to the sun, and cultivated for a few seasons it will produce large yields of onions, cabbages, and celery.

The Miami gravelly sand, by reason of its coarse, open texture, is liable to suffer seriously from drought. However, some of the more loamy areas of this soil along Pine River will produce fair yields of corn, oats, barley, beans, potatoes, cucumbers, and fruits.

The Meadow land of this area is not considered in an agricultural way, except as pasture ranges for cattle. There are no large areas of this type.

NRCS Accessibility Statement

This document is not accessible by screen-reader software. The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at 1-800-457-3642 or by e-mail at ServiceDesk-FTC@ftc.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at <http://offices.sc.egov.usda.gov/locator/app>.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotope, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.