

SOIL SURVEY OF ALLEGAN COUNTY, MICHIGAN.

By ELMER O. FIPPIN and THOMAS D. RICE.

LOCATION AND BOUNDARIES OF THE AREA.

Allegan County lies in the southern part of the lower peninsula of Michigan and borders on Lake Michigan. It is situated between latitude $42^{\circ} 25'$ and $42^{\circ} 46'$ north and longitude $85^{\circ} 40'$ and $86^{\circ} 11.3'$

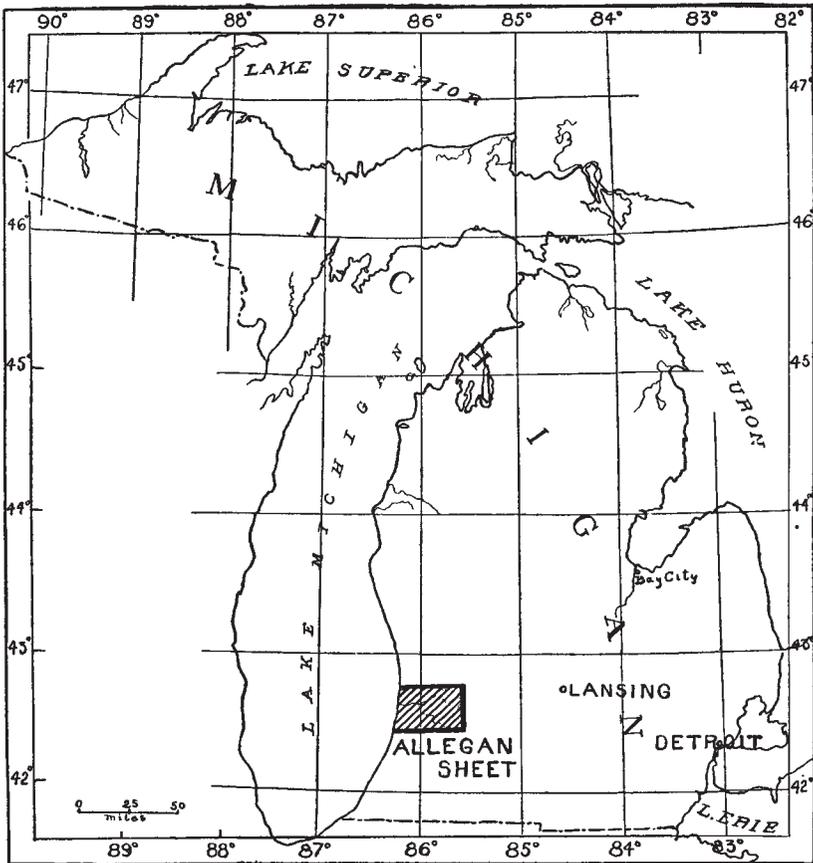


FIG. 3.—Sketch map showing area surveyed in Michigan.

west. (See fig. 3.) Its extent from east to west is 35 miles and from north to south 24 miles, and its area is 840 square miles, of which 828 square miles are land surface. The county is divided into 24 townships.

HISTORY OF SETTLEMENT AND AGRICULTURAL DEVELOPMENT.

The first settlement in the county, which occurred in the summer of 1831 and during the succeeding two years, was made in Gunplains Township. In 1834 Elisha Ely, of Rochester, N. Y., purchased land within the present site of Allegan. He was followed by several of his Eastern friends, and these men together laid the foundations of the village. The settlement at Otsego, a few miles farther up the Kalamazoo River, was made about the same time. All these places were soon connected with Kalamazoo, Grand Rapids, and the outside world by means of a regular stage route. In the early days these villages formed the centers from which the pioneer population, drawn in the main from New York and Ohio, found their way into the surrounding region. These men found the country in pine and hard-wood forests, interspersed with marshes and swamps.

Following only the most general differences, the pine forests, generally containing some beech, soft maple, and oak along the borders, were indicative of the lighter sandy loams. The heavier soils and lowlands were covered by a dense growth of hardwood forest, prominent among which were beech, maple, elm, hickory, black and white ash, and tulip poplar, while filling in the intervals was a heavy undergrowth of brush, sprouts, and saplings. This greater luxuriance of the vegetation upon the heavier soils was effective in directing the first attempts at cultivation to the lighter sandy soils of the uplands, which were the more readily cleared. The occupation of the clay soils took place more slowly. However, the two decades following 1835 saw rapid advances made in the occupation and clearing of the land. The conditions were favorable for the production of the grains, grasses, and forage plants in large quantities, and agriculture in all its branches thrived. Stimulated by high prices and rich land, wheat farming was at first the leading feature, but in more recent years wheat has been largely supplanted by forage crops.

In 1835 the first white settler on the lake shore found a small peach orchard on "Peach Orchard Point" near Saugatuck, probably set out by early French traders. In the early forties the cultivation of peaches was begun, and the industry, centering in Ganges Township, was extended from year to year. For a long time, however, the production of fruit was hampered by lack of transportation facilities, which were not adequate until about 1875, when the Chicago and West Michigan Railroad was completed, and a regular line of steamers was put on the lake. The completion of these lines of communication resulted in a large increase in the acreage of fruits, the increase in the peach orchards being particularly notable.

The "yellows" appeared between 1872 and 1875 and a series of severe losses resulted, which somewhat checked the ardor of the peach

growers, but after a few years the industry regained something of its former proportions and the acreage now far surpasses that in any former year. Within the past six or eight years the "little-peach" disease has appeared and is now quite widespread. In 1872 the production of peaches amounted to 32,737 bushels, and of apples to 169,293 bushels, while in 1898 the output of these fruits in the county was 417,086 and 192,683 bushels, respectively.

Some idea of the growth of the county may be gained from the fact that the population in 1840 numbered 1,783 and in 1854 it was 7,804, while by the Twelfth Census it is shown to be 38,812.

The immense forests of pine which existed at the time of the first settlement were rapidly cut off by lumbermen, and by 1870 this kind of timber had been almost entirely removed. Much of the area formerly occupied by it remains in the condition in which it was left by the woodmen, except that a shrubby growth of white and red oak, sassafras, poplar, and other species has sprung up among the pine stumps.

In the northwestern part of the county development has been largely due to the growth of a colony of Dutch, established at Holland in 1847, and now occupying parts of five townships. These people practice general farming, and their methods are according to the best modern usages.

The advent of railroads in the eastern part of the county in 1868-1870 was a great stimulus to the industries of the section. Previously to that time shipping had been largely by water down the Kalamazoo River and its tributaries and thence over the lake to market, but the draining of the marshes and swamps has so lowered the water level in these rivers that navigation is no longer practicable.

CLIMATE.

The elevation of the area above tide level varies from 700 to 900 feet and above Lake Michigan from 10 to 210 feet. The table on the next page, compiled from records of the Weather Bureau, gives the normal monthly and annual temperature and precipitation as recorded at four stations selected to represent, as nearly as may be, the climatic conditions of the county.

The mean annual temperature is about 48° , with a range of 106.8° along the lake as compared with 109.2° over the eastern part of the county, these figures being derived from records covering the last five years. The average maximum temperature is 95.9° , while the average minimum is -12.1° . The last figure is reduced somewhat below the general average by the exceedingly cold winter of 1899, when the thermometer registered -43° at Holland (Waverly). The warmest month is July and the coldest is February. The prevailing winds are

westerly, and the area near the lake shore is less subject to severe variations in temperature than sections 10 miles or more inland. This is due to the modifying action of the large body of water. The average annual precipitation is about 30 inches, of which 14.5 inches falls during the six months from April to September, inclusive. The snow fall is a few inches greater inland than on the lake shore, the annual average being 60 inches.

Normal monthly and annual temperature and precipitation.

Month.	Holland.		South Haven.		Allegan.		Kalamazoo.	
	Temperature.	Precipitation.	Temperature.	Precipitation.	Temperature.	Precipitation.	Temperature.	Precipitation.
	°F.	Inches.	°F.	Inches.	°F.	Inches.	°F.	Inches.
January.....	26.0	3.60	24.5	1.38	23.7	2.42	23.3	2.46
February.....	21.2	1.94	23.1	1.31	24.2	2.32	25.1	2.32
March.....	31.8	3.18	30.9	2.00	33.8	.....	32.4	2.54
April.....	.....	.....	46.7	1.80	.....	2.66	47.2	2.57
May.....	55.6	2.58	57.0	2.14	.....	4.50	58.1	4.29
June.....	.....	.....	66.1	1.78	.....	3.53	68.4	4.38
July.....	.....	.....	70.5	2.55	.....	2.51	72.4	3.01
August.....	69.3	1.22	68.6	1.54	69.9	1.84	69.9	2.51
September.....	61.6	4.20	63.3	3.54	63.0	2.98	62.9	3.24
October.....	49.4	2.13	51.0	1.98	50.0	2.66	50.8	2.83
November.....	37.0	3.11	39.3	2.18	38.1	2.98	37.3	2.66
December.....	28.3	2.59	29.6	3.92	30.1	2.84	28.1	2.72
Mean annual.....	.....	.....	47.6	26.22	.....	.....	48.0	35.63

There are undoubtedly marked local differences in climate in the eastern, central, and western parts of the county not shown by records. The fruit growers by the lake are aware that the tempering influences of that body of water greatly add to their success.

The large inland area of sand plains and the lowlands along the Kalamazoo River lie at considerably lower elevation than the adjoining sections. These regions are almost completely surrounded by highlands that prevent the free circulation of air and render them regions of late and early frosts and of excessive cold in winter. The leaves of shrubs are said to have been killed there as late as the latter part of May.

In the eastern part of the county the frosts are less erratic than in the central section, though the annual extremes of heat and cold are probably a few degrees greater than on the lake shore.

PHYSIOGRAPHY AND GEOLOGY.

The surface of Allegan County is generally rolling and uneven, with few marked irregularities and only limited sections of level land. This configuration is due in the main to glacial action altered by the

agency of water. The entire region was overspread by glaciers. Two systems of moraines traversed the eastern half of the county, while the preglacial boundaries of Lake Michigan extended far over the western part. From these forces there has been derived three general areas of soil extending in a southwesterly direction across the county. The first is a broad strip of clay loams found in the northwestern part of the county and on the lake shore at the south, where it occurs in cliffs 40 to 60 feet in height. These clays are bordered on the east by a stretch of sand, widest at the center and narrowing on the north and south, and this gives way to a series of heavy clays and loams occupying the eastern half of the county.

These soil formations are cut in a northwesterly direction by the Kalamazoo River, which enters the county a few miles below Plainwell, emptying into Lake Michigan at Saugatuck, and which with its tributaries, the Rabbit and Gun rivers, receives the drainage of almost the entire area. While following a generally straight course, in detail it is very irregular. Along much of its earlier course in the county there is a series of well-defined terraces, while in lower reaches its recent wanderings over a wide flood plain are marked by marshes and swamps. Throughout its entire course the river is very rapid, and it furnishes a large power supply, which has been extensively developed. The sand area mentioned is widest along the course of the river where this soil extends outward to the lake, forming the sand dunes which line that part of the lake shore.

One peculiarity of topography developed by the glacier is seen in the low areas and kettle holes of great and small extent, which form innumerable lakes, swamps, and muck areas. These lakes, which are generally small, are scattered throughout the area, and the beds of muck and peat, which may reach many feet in depth, mark the former existence of many others. There are three general regions of marshes and swamps. One area, which is located in the sands in the western part of the county, was formerly known as the Clyde Swamp. It is now almost entirely drained and only a wide expanse of muck marks its position. Beginning in the region of Wayland and extending southwestward to Minor Lake, and thence eastward, finally draining into the Kalamazoo River, is a second region, known in part as the Bear Swamp. The swamp conditions are less marked than in the former area, and a less expanse of muck remains, but in the original condition the land was very marshy. The draining of this area has left a series of rich loams of the highest agricultural value.

The third region borders the Gun River, lying in broad strips of muck which loop well down into Gunplains township and extend into Berry County on the east. Only a small part of this region has been reclaimed. It should be mentioned that the soils of the adjoining

county appear to follow out the alternating succession noticed in Allegan County, for on the eastern extremity of this area the sands again appear. The gradation from the light sands to the heavy clays is by a series of loams of varying texture. Interspersed with the sands and clays are glacial boulders and beds of gravel, which, by the variation in their distribution, influence the character of the soils.

SOILS.

The soils of Allegan County are quite varied, passing into one another so gradually as to make it a matter of some difficulty to define clearly their limitations and classification. Fifteen types, not including Meadow, were found, the relative extent of which is shown in the following table:

Areas of different soil types.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Allegan sand.....	117,480	22.2	Allegan fine sandy loam.....	13,260	2.5
Allegan clay.....	107,850	20.3	Allegan black clay.....	12,460	2.3
Allegan stony loam.....	76,790	14.5	Allegan gravelly loam.....	4,810	.9
Allegan sandy loam.....	60,020	11.3	Plainwell stony loam.....	4,150	.8
Clyde sand.....	38,600	7.3	Elmwood loam.....	3,810	.7
Muck.....	33,770	6.4	Dunesand.....	3,130	.6
Saugatuck sand.....	24,120	4.6			
Meadow.....	15,510	2.9	Total.....	529,920	.....
Kalamazoo gravelly loam..	14,160	2.7			

DUNESAND.

Stretching along the shore of Lake Michigan from the mouth of the Kalamazoo River northward into the next county, and extending at no point more than 1¼ miles inland, are large and more or less parallel ridges of sand. In texture these sands do not differ essentially from the Allegan sand, but by reason of their great irregularity of surface and light character they have scarcely any agricultural value at present. They comprise the sand dunes proper and are sometimes spoken of as the "modern" sand dunes. Their formation has undoubtedly been due to wind action, and the line of their advancement inland is sharply defined. In height they range from 20 to 175 feet, and their surface is for the most part overgrown by vegetation consisting of a few scattered pines and a variety of other trees, including beech, soft maple, occasional hemlocks, and sassafras. Interspersed with the tree growth are shrubs and underbrush, and in the more open stretches a light turf of grasses. In general there is scarcely a perceptible movement of the sand, but in some places, notably on the southern boundary of Laketown Township, the winds are now at work and extensive exca-



ENCROACHMENT OF THE SAND DUNES OVER THE CULTIVATED FIELDS, ALLEGAN COUNTY, MICH.

These dunes move slowly inland, driven by the wind, covering alike orchards, forests, and cultivated crops. They are fortunately found only near the lake shore. (Photograph by M. B. Waite, Div. Veg. Phys. and Path.)



FOREST TREES PARTIALLY COVERED BY THE SAND DUNES. ALLEGAN COUNTY, MICH.

Frequently only the tips of the forest trees are exposed above the encroaching dunes. (Photograph by M. B. Waite, Div. Veg. Phys. and Path.)



CHARACTERISTIC TOPOGRAPHY OF THE SAND-DUNE REGION, ALLEGAN COUNTY, MICH.

At the first opportunity grasses and shrubs take hold, and if allowed sufficient time, eventually check the shifting of the sand and begin preparing it for future agricultural use. (Photograph by M. B. Waite, Div. Veg. Phys. and Path.)

vations have resulted, the sands being transported inland. On the leeward side of the ridge large trees have been almost completely buried. Singapore, a small village at the mouth of the Kalamazoo River, has been almost entirely buried by these shifting sands. "Bald-head," the highest of the dunes, occupies part of the "oxbow" of Kalamazoo River.

The sands comprising these dunes are of the medium and fine grades, the particles being rounded and smooth, and slightly stained by iron, which has imparted to the soil a yellowish tinge. Occasionally traces of small gravel may be found. Along the shore, within reach of present wave action, the sands emit a peculiar creaking sound when anything is moving rapidly through them, giving rise to the term "musical sands," or "singing sands."

Cultivation of the Dunesand has been attempted only to a very limited extent, and has not met with marked success, probably from lack of readily available plant food. Peaches and grapes were the crops tried. Except for slight accumulations in the first 2 or 3 inches of soil, organic matter is absent. It is notable, however, that even on the top of the highest dunes, and during the most extended drought, moist sand may be found at a few inches below the surface.

In the following table are given the mechanical analyses of samples of the Dunesand:

Mechanical analyses of Dunesand.

No.	Locality.	Description.	Soluble salts, as determined in mechanical analysis.		Organic matter and combined water.	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 0.0001 mm.
			P. ct.	P. ct.								
6108	1 mile NW. of Saugatuck.	Light sand, 0 to 36 inches.	0.00	0.40	Tr.	6.20	44.26	48.42	0.62	0.36	0.26	
6068	Sec. 4, Saugatuck Township.	Medium sand, 6 to 36 inches.	.01	.80	0.00	.48	12.90	81.24	1.68	.78	.75	

SAUGATUCK SAND.

The larger areas of the Saugatuck sand occur in the townships bordering the lake, particularly in Saugatuck and Laketown. They occur in low and generally level or slightly undulating places where natural drainage is not very good. The soil consists of a medium and fine sandy loam with a depth of from 9 to 14 inches, underlain by medium and fine sands. The character of the sand of this type does not differ

from that of the Allegan sand, but the depth to clay seldom exceeds 6 feet, and in local areas is often not more than 3 feet. The distinguishing feature of the type is the spotted appearance of the soil at the surface, due to the accumulation of iron and the formation of iron crusts. Where these crusts reach the surface the soil is of a deep-red or brown color. These areas vary in extent from one to several rods. Alterhating with the red spots are gray, yellowish, or black sands, and in this the iron crust may be found at varying depths, from a few inches to several feet below the surface, or it may be entirely absent.

The formation of these iron crusts, which vary in thickness from a few inches to more than a foot, is probably due to poor and irregular drainage and the accumulation and desiccation of iron-charged waters from surrounding slopes. The formation is locally known as "hardpan." It is seldom found at the surface of the clay, but may be expected at any point from the surface of the ground to the line of contact with the clay. The exact chemical process by which these depositions take place is still a matter for investigation.

Undoubtedly the presence of the iron crust, if near the surface, would interfere with plant growth, and rather on account of its effect upon drainage than because of any physiological or chemical properties of iron. The existence of an iron crust at a point a few inches below the surface always results seriously for shallow-rooted summer crops in the case of drought, as the supply of moisture from lower depths is thus cut off. Again, when winter crops are planted on areas where the iron crust reaches the surface serious damage is likely to occur from heaving. The red iron oxide in a finely divided state retains large amounts of water, and in the alternate thawing and freezing heaving results. The remedies to be applied must be sought first in the removal of the source of the formation of the crusts and second in their breaking up. Thorough drainage, deep plowing, and subsoiling are the most efficient means now at command. The application of lime to the surface, in the autumn, would also probably prove beneficial. Considering the nature of the iron compound the process of its removal must naturally be gradual.

The Saugatuck sand is generally considered to have a fair agricultural value for fruit, truck, and general farm crops. Along the lake it is extensively planted to peaches, cherries, and other fruits, such as strawberries, raspberries, and currants. It also produces corn, wheat, rye, grass, and potatoes fairly well, but the crops, like the color of the soil, are inclined to be uneven and somewhat spotted. Owing to the light character of the soil it requires careful management to maintain fertility, and heavy applications of organic matter, either as green or stable manure, are always necessary.

Mechanical analyses of samples of this type of soil are given in the following table:

Mechanical analyses of Saugatuck sand.

No.	Locality.	Description.	Soluble salts, as determined in mechanical analysis.		Organic matter and combined water.	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 0.0001 mm.
			P. ct.	P. ct.								
6065	Sec. 10, Monterey Township.	Medium sandy loam, 0 to 9 inches.	.01	1.80	Tr.	3.36	31.88	49.42	3.32	6.50	1.93	
6067	Sec. 10, Saugatuck Township.	Medium white sand, 0 to 12 inches.	.01	1.18	0.90	9.20	36.18	38.38	4.16	7.46	4.37	
6059	Subsoil of 6057....	Medium sand, 26 to 36 inches.	.01	.94	1.26	16.96	44.68	30.82	1.02	.74	2.61	
6066	Subsoil of 6065....	Medium sand, 9 to 18 inches.	.01	3.56	Tr.	2.50	28.98	54.78	5.96	7.04	2.65	
6068	Subsoil of 6057....	Medium sand, 12 to 26 inches.	.01	2.02	.36	10.30	43.80	37.52	.84	.92	3.29	

CLYDE SAND.

This soil consists of a black sandy loam, having a depth of from 10 to 15 inches. The sand particles are mainly of medium size, though in a few places there is a small percentage of small gravel. The soil also contains small amounts of clay. The subsoil consists of medium and coarse sand of a gray to bluish color, containing from 0 to 8 per cent of gravel; traces of clay and nodules of blue clay are sometimes found. Clay generally occurs at a depth of 3 feet, and is nowhere at a great depth below the surface. In a number of places in the largest areas of this soil there occur bands of clay in the upper part of the subsoil, which probably represent changes in the process of deposition of the material. Such strata are generally only a few inches in thickness, but in section 20 of Clyde Township they are over a foot thick and have rather more the characteristics of a clay loam than of a clay. In the southwestern part of Watson Township some clay has been carried in and mingled with the sand, rendering the soil somewhat heavier than the typical soil.

The Clyde sand is found in the flatter areas of sand occurring in the light, sandy areas, and in depressions in clay areas that receive wash from sandy slopes. In such locations the natural drainage is usually defective and the land is swampy. The fertility of the soil is due to large accumulations of decaying vegetable matter. These areas occur

in all parts of the county, but most extensively in the southwest, in what was formerly the Clyde Swamp.

From the process of their formation and the nature of the materials it follows that this soil and the Saugatuck sand are very similar, but they differ in that the Clyde sand contains far more organic matter and is not accompanied generally by the iron-crust hardpan, although this occurs to some extent along the borders of the areas. After many years of cultivation the humus may be so depleted in this soil as to give it much the appearance of the Allegan sandy loam.

Artificial drainage is always necessary in reclaiming the Clyde sand, but with the surplus water removed it is one of the most productive soils in the county, giving large yields of corn, wheat, oats, rye, hay, and truck. It is especially suited to growing sugar beets, which yield heavily and have a high sugar content. Small fruits also yield well. For tree fruits, especially peaches, its elevation and drainage are not favorable. The soil is best adapted to beets, potatoes, carrots, cucumbers, and similar crops.

The texture of samples of soil and subsoil is shown in the following table:

Mechanical analyses of Clyde sand.

No.	Locality.	Description.	Soluble salts, as determined in mechanical analysis.		Organic matter and combined water.	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 0.0001 mm.	
			P. ct.	P. ct.		P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.				
6085	Sec. 26, Ganges Township.	Medium sandy loam, 0 to 11 inches.	0.03	2.76	0.34	6.06	20.58	53.48	5.10	7.68	3.51								
6088	Sec. 36, Leighton Township.	Sandy loam, 0 to 12 inches.	.02	4.34	1.10	5.26	25.96	36.92	5.52	14.90	5.56								
6087	Subsoil of 6085....	Sand, 28 to 36 inches.	.02	.44	.50	19.40	33.68	42.24	1.14	.74	1.70								
6086	Subsoil of 6085....	Medium sand, 11 to 28 inches.	.01	1.52	.16	7.54	42.32	39.46	1.58	3.26	2.65								
6089	Subsoil of 6088....	Sand, 12 to 36 inches.	.01	1.14	.94	6.46	37.12	44.88	2.30	4.44	2.73								

ALLEGAN SAND.

The Allegan sand occupies 22.2 per cent of the area of the county and is the most extensive of the soil types of the area. The surface material to a depth of from 6 to 10 inches consists of medium and fine sand that is not sharp and angular, but composed of rounded particles. The amount of organic matter varies and is always highest in those

parts subject to cultivation. The sand sometimes has a loamy appearance, which is determined in large measure by the accumulation of vegetable remains. Differences in cultural methods produce differences in this feature. The subsoil to 36 inches in depth is a light, loose sand of medium and fine grades. With scarcely an exception there is considerable iron in the soil, which imparts to it a slightly yellowish to reddish color. Rarely a small pebble and small amounts of fine gravel may be found, but there is not enough of this material in the surface 3 feet to affect the agricultural value of the land. The main body of the type extends from Allegan westward along the Kalamazoo River for 12 miles, from which it expands northward and southward, dividing the county into two parts. The general direction of this strip is northeast by southwest. The greatest width is along the river, where the area extends outward to Lake Michigan and connects with a second area which skirts the lake shore in the northern half of the county. Other detached areas are found in nearly all parts of the county, one in Wayland Township being particularly noticeable. The surface conformation consists of low, rounded hills and ridges and broad, shallow valleys, though in places there are quite large expanses of comparatively level land. The most extensive level area, which occurs in Manlius and the adjoining township, has received the name of "pine plains." The ridges and hills are locally termed dunes. Along the lake shore and on the smaller detached areas in the eastern part of the county cultivation is generally practiced, and especially south of the Kalamazoo River the system of agriculture is somewhat intensive, the production of peaches and other fruits forming the chief industry. The large inland area noted is but sparingly cultivated, the farms being detached and poorly equipped. In fact, the greater part of the area is wild land.

Within the areas of the Allegan sand there are differences of agricultural development, and there are general differences in the crop-producing power of the soil, as shown by the crops grown and by the original timber growth. The areas might be classed as follows: Those on which grew hard wood (beech, maple, and other species); those covered by hard wood, interspersed with pine; those distinctively heavy pine lands; and lastly that area which supported only a sparse growth of "buckwheat" pine.

The first phase occupies the lake shore south of the Kalamazoo River and comprises the peach belt proper. The areas are not particularly large, are separated by other types, and have evidences of clay at an average depth of 6 or 8 feet below the surface. This is an excellent peach soil, and good also for plums, cherries, and small fruits generally. This part of the county is thickly settled, the farms being small and carefully cultivated. The sands are light, but have been so heavily fertilized with stable manure and by plowing under green

manuring crops that the surface 6 to 10 inches of the soil contains much organic material, which gives it something the appearance of a loam. Below that depth, however, the sand is loose and free from fine material. For wheat, grass, and other general farm crops the soil has a low agricultural value, the yield being almost invariably small. Rye is widely used as a cover crop and for green manuring, and occasionally a crop is harvested, from 12 to 22 bushels being the average return. Corn is grown to a considerable extent. The highest ridges are much less productive than the lower levels.

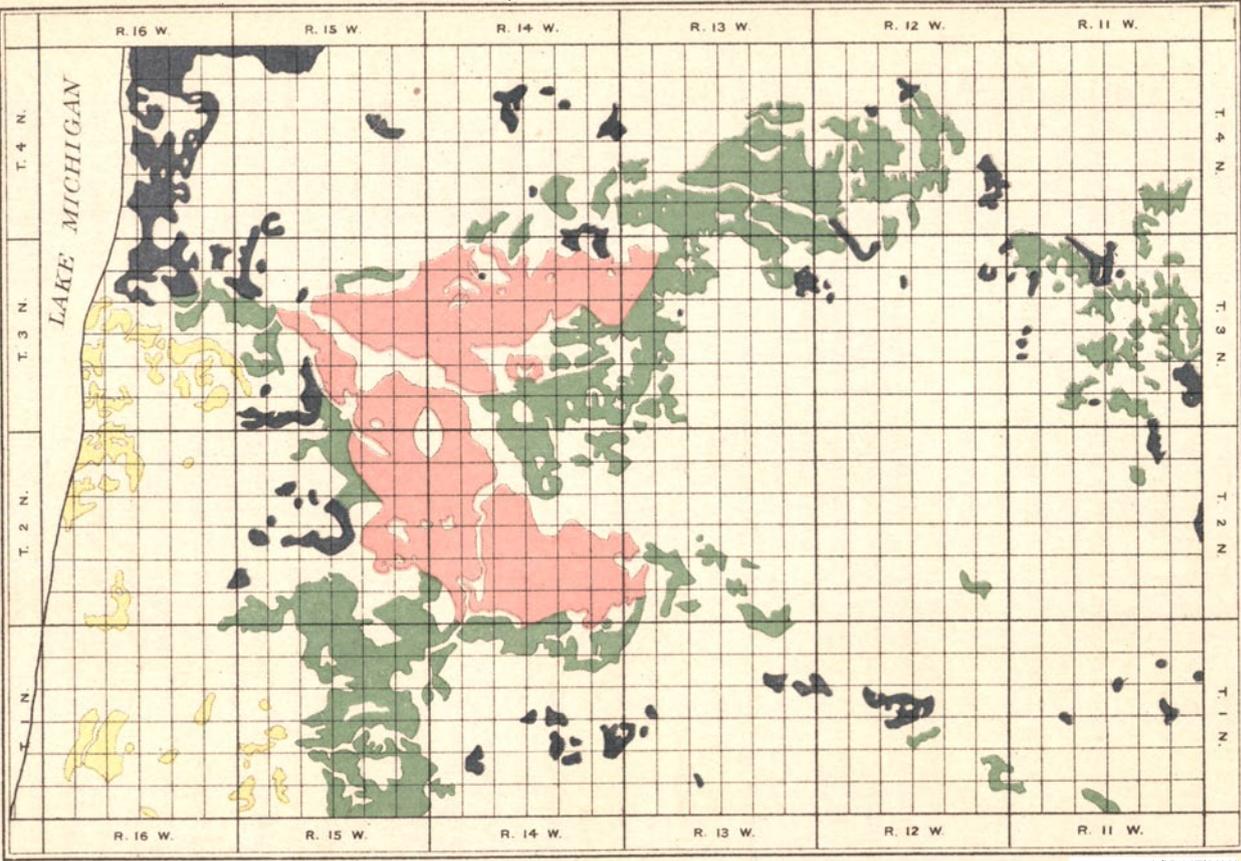
The second phase, indicated by a former growth of hard wood and pine mixed, occupies detached areas over the eastern half of the county, that part of the lake shore which lies north of the Kalamazoo River, and to some extent the border of the large inland area of the type. In Laketown Township the surface is particularly irregular, consisting of a series of ridges and knolls from 10 to 25 feet in height, with clay occupying many of the intervening depressions. The sand averages a few feet deeper than south of the river, and while cultivated to fruit the phase is not as good a peach soil as that in the former section. The natural fertility appears to be somewhat less, and the orchards do not appear as thrifty as those south of the river. In other parts of the county the soil occurs on knolls and bars in the midst of areas of heavier soil. The central parts of the sand areas may be occupied exclusively by pine; the borders are always the more productive. This phase is generally cultivated to peaches along the lake, and farther inland to grain, with some attention given to certain truck crops—cucumbers, beans, etc. Rye yields 12 to 20 bushels. The inland areas are also used to some extent for grazing.

The third phase, originally covered by a heavy growth of pine, occupies the northern and southern extremity of the large inland area of the type. It also fringes the whole of the area, and extends well to the east and west along the Kalamazoo River. The surface is rolling, and the drifting of the sand is particularly noticeable. The original timber growth was heavy and consisted of white and yellow pine. Since its removal saplings of oak and other species have formed a thick growth among the pine stumps. The areas are only partially cultivated, the farms being poorly equipped and devoted primarily to corn, rye, buckwheat, clover, and potatoes. The yield of corn varies from 15 to 40 bushels, and of rye from 8 to 15 bushels. The soil is particularly droughty, and crop yields are governed largely by the amount and timeliness of the rainfall. The soil is a light, loose sand, as before described, containing small amounts of organic matter, but there appears to be a slight increase in the percentage of the fine sand, which renders the soil somewhat more safe in periods of drought than the above-described phases of the type. Another peculiarity is the presence, usually in the depressions, of occasional small areas of a

ALLEGAN SAND CLASSIFIED ACCORDING TO ORIGINAL TIMBER GROWTH

PLATE X

Report of Bureau of Soils, U.S. Dept. Agr. 1901



LEGEND

-  Hardwood
-  Hardwood and some Pine
-  White Pine
-  Pine Plains

JULIUS BIEN & CO LITH N Y

very white and unproductive sand. These are more numerous in southern Clyde and Lee townships than in other parts of the county, and rarely exceed an acre in extent. In the region of Pearl, Bravo, and Pullman the growing of peaches has recently been introduced, and the young orchards appear quite thrifty. In this same vicinity onions are also grown and phenomenal yields are secured. In Wayland Township, where pine lands prevailed, the surface of much of the area is near the level of standing water, and fair crops of corn, rye, grass, and occasionally wheat are produced. The average depth of this phase of the type is considerably greater than that of the phases formerly described, and in some cases it is probably 30 feet to clay.

The "pine plains" proper extend from Allegan west to New Richmond, north to Diamond Springs, and south to the Clyde Swamp, and comprise the fourth phase of the type. The surface is generally level, though undulations occur at the northern and eastern extremity. The soil at present supports a sparse growth of oak saplings among the pine stumps. The original timber was a light growth of a comparatively small pine locally known as "buckwheat pine." The area is much lower than the adjoining heavy soils, and consequently has poor air drainage. Frosts are said to occur late in the spring and early in the fall, and during the winter the cold is said to be particularly severe.

The sand is very deep, sections of 30 to 60 feet being recorded. It is slightly coarser than the other phases and contains in some areas more fine gravel. The surface few inches contain very small amounts of organic matter.

The attempts at cultivation are few and scattered. In the region of southwestern Manlius Township and in western Valley Township a number of farms have been established with fair equipment, but several of these have been abandoned and new ones taken up more recently. The principal crops are corn and rye, with some buckwheat. The growing of clover and other hay crops has been attempted, but it is difficult to secure a stand. Corn yields from 10 to 30 bushels, and rye from 6 to 15 bushels. It is said that the effort has been made to cultivate peaches on these sands, but always without success. In these trials the trees lived for a few years, but did not fruit, and soon died. Winter killing is claimed to be a common source of loss. The apple does little better than the peach, the trees making a very poor growth and seldom fruiting. Potatoes give light yield, but the product is of fine quality. Sweet potatoes may also be grown with a degree of success. However, the yields of all these crops are uncertain, depending largely on the sufficiency of the rainfall during the growing season. For grazing this soil has little value, as the sands become so heated during the summer that grasses are badly injured. The natural turf is always light and composed of a variety of grasses.

From the foregoing description of the type and its various phases

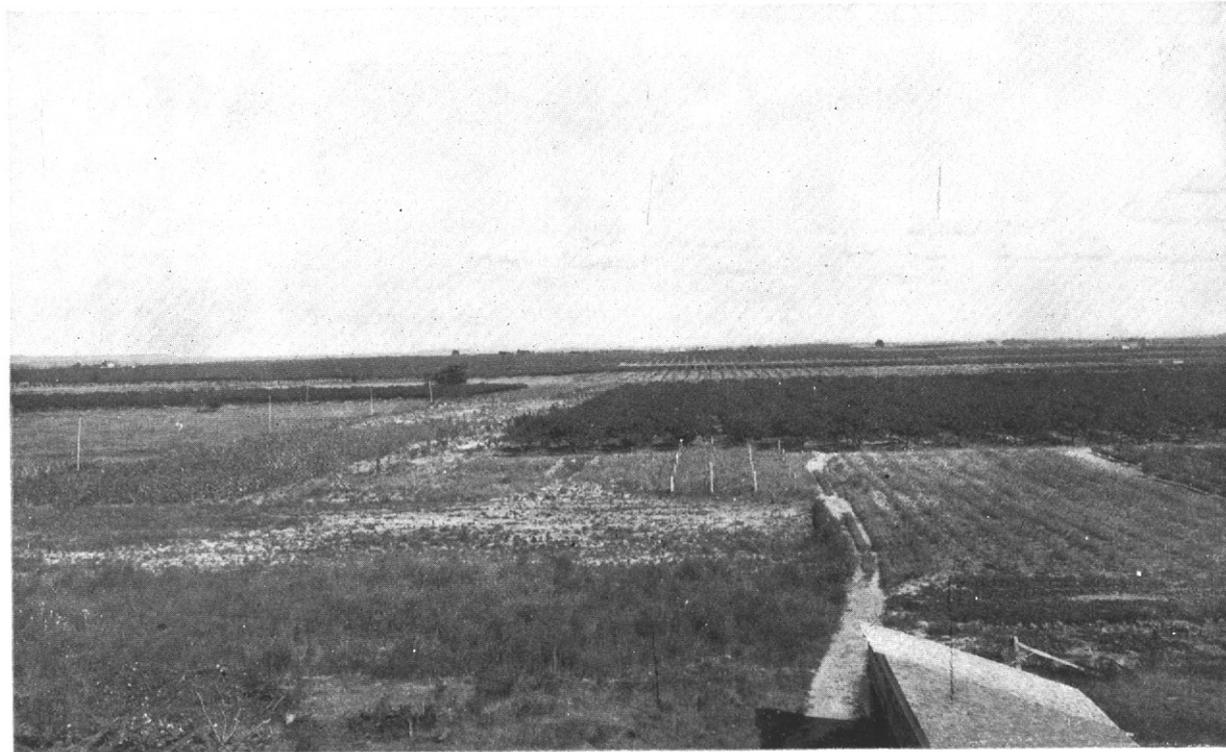
some idea may be derived of the very great similarity of all these areas of soil. Why there should be such marked differences in their crop value is yet to be determined. From all the evidences of the soils themselves they are almost identical, and we can only hope that further investigation may reveal all the reasons for these variable crop values. The type undoubtedly furnishes opportunity for extended and careful study, and the solution of the problem of profitably utilizing some of these sands is one of first importance.

Mechanical analyses of Allegan sand.

No.	Locality.	Description.	Soluble salts, as determined in mechanical analysis.		Organic matter and combined water.	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 0.0001 mm.
			P. ct.	P. ct.								
6096	Sec 20, Saugatuck Township.	Medium sandy, 0 to 12 inches.	0.02	1.78	0.74	11.94	52.30	26.28	1.16	2.94	2.82	
6092	Sec. 18, Heath Township.	Medium and fine sand, 0 to 8 inches.	.01	1.96	.48	9.02	37.42	40.46	1.86	5.06	3.73	
6098	Sec. 11, Saugatuck Township.	Sandy, 0 to 14 inches.	.01	2.12	.62	6.66	38.82	39.82	2.26	5.48	4.33	
6095	1½ miles NE. of Pier Cove.	Medium sand, 36 to 60 inches.	.01	.64	.32	11.70	57.34	27.56	.04	.82	1.39	
6100	Sec. 29, Laketown Township.	Medium sand, 8 to 36 inches.	.....	.66	.28	2.98	21.38	70.66	1.60	.58	1.48
6105	Sec. 12, Clyde Township.	Sand, 36 to 72 inches.	.01	.66	1.66	14.32	47.20	33.10	.94	.60	2.09	
6097	Subsoil of 6096....	Medium sand, 12 to 36 inches.	.02	1.14	.20	10.40	54.90	29.24	.20	1.34	2.30	
6099	Subsoil of 6098....	Medium sand, 14 to 36 inches.	.01	.94	.44	6.16	47.10	39.42	1.46	1.68	2.57	
6093	Subsoil of 6092....	Medium and fine sand, 8 to 36 inches.	.01	1.00	.86	7.88	28.68	54.54	1.54	2.30	2.95	
6101	Sec. 25, Wayland Township.	Medium sand, 10 to 36 inches.	.01	1.10	.80	20.40	43.66	26.50	1.72	2.48	3.43	

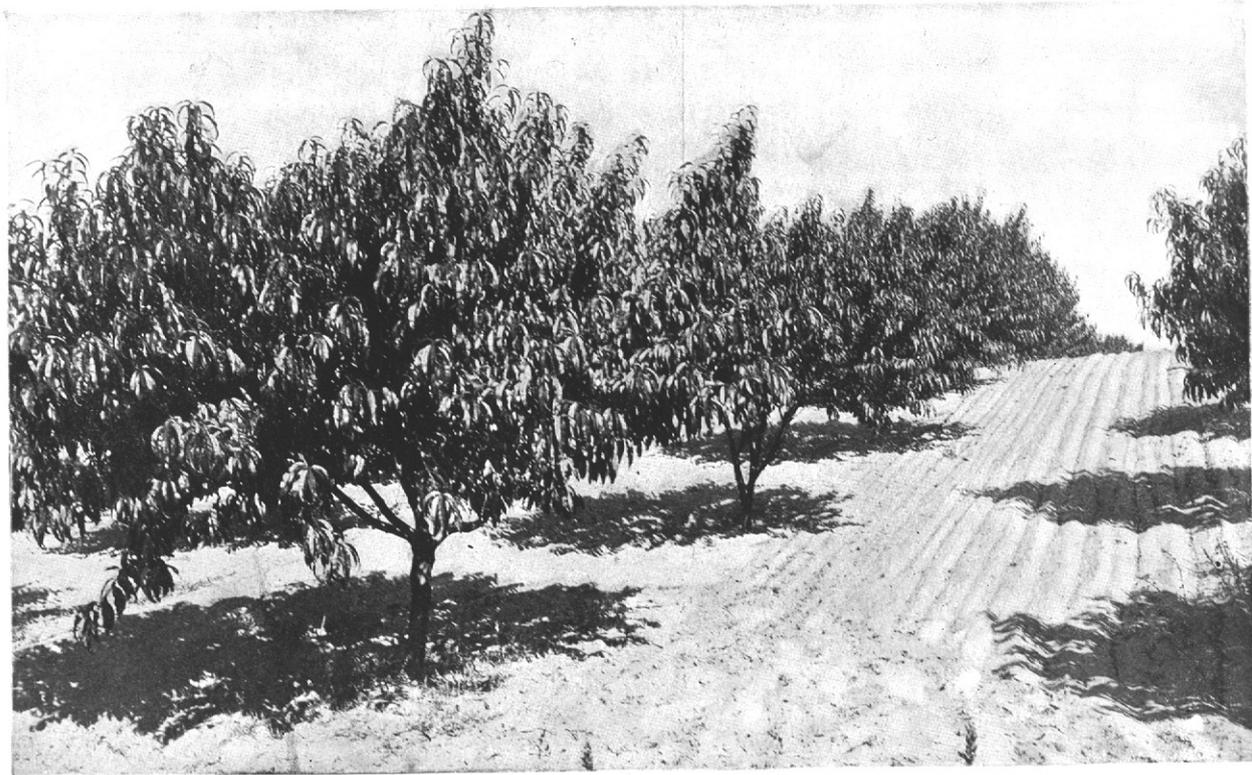
ALLEGAN SANDY LOAM.

In Allegan County the gradation from sand to clay is commonly through a type the composition of which is intermediate between the two extremes. This type has been termed Allegan sandy loam, and while the largest areas are found in Ganges and Casco townships, others are found, in all parts of the county, bordering streams or marking sand and clay contacts at higher levels. The type lies upon



GENERAL CHARACTER OF THE COUNTRY IN THE PEACH BELT, ALLEGAN COUNTY, MICH.

The peach industry is confined to a strip about 10 miles wide, adjoining the lake, and to sandy and sandy loam soils. (Photograph loaned by the Div. of Pomology.)



TYPICAL PEACH ORCHARD ON ALLEGAN SAND.

This shows the very light character of some of the best peach soils. (Photograph loaned by the Div. of Pomology.)

rounded hills, among which are occasional kettlelike depressions, or extends as level lowlands bordering water courses. In the former position the soil is doubtless of glacial origin, while along the stream courses it is more probably the result of subsequent erosive action and deposition by water.

The soil consists of a silty and sandy loam, 10 to 14 inches in depth—the sand consisting of coarse and medium grades—and generally having a grayish-yellow to dark color, depending on the quantity of organic matter present. The content of clay is usually about 5 to 8 per cent, although it occasionally may reach 20 per cent, the average being about 6 per cent. The subsoil to 30 inches or more is a grayish-yellow medium to coarse sand, containing generally about 4 per cent of clay and fine material, which renders it slightly coherent. In the eastern part of the county the color is a darker red or brown, due to the presence of quantities of iron. Below 30 inches occurs a variety of material consisting of sand, clay, or gravel, but by far the greater proportion of the area is underlain by clay at no great depth. In the more undulating areas in northern Ganges and Casco townships gravel beds are of frequent occurrence, and here the surface is strewn with bowlders and pebbles. In road cuts or sections the material stands up well, having much the appearance of clay, and on the surface it has a slight tendency to bake and form clods, although it is generally quite mellow and easily cultivated. The areas lying along stream courses are mainly the result of the mixing action of water and are to be regarded more a variation than the true type. They are usually free from bowlders and are distinguished from swamp sand by their much lower percentage of organic matter and consequent lighter color.

Allegan sandy loam produces excellent crops, not only of fruit and truck, but also of grain and grasses. Along the lake shore it is largely devoted to the culture of peaches, and many of the finest orchards of the area are to be found on this soil. In addition, apples, pears, cherries, and plums thrive, while the small fruits, such as currants, blackberries, raspberries, and strawberries, are seldom more productive than on this sandy loam. The natural fertility of the soil is sufficient to allow fruit trees to attain a vigorous growth and to enable them to withstand more successfully the diseases and enemies that are so troublesome on lighter types of soil. On the areas of sandy loam beyond the lake influence corn, oats, wheat, grasses, potatoes, and other general farm crops are chiefly cultivated. Corn yields from 40 to 70 bushels, wheat from 15 to 25 bushels, and hay from 1 to 2 tons per acre. Clover catches and lasts quite well. This soil is generally not as productive as the Allegan stony loam or the Allegan fine sandy loam, to be described later. The drainage is usually good, except in occasional low-lying areas.

In the following table is shown the texture of samples of the Allegan sandy loam from various parts of the county:

Mechanical analyses of Allegan sandy loam.

No.	Locality.	Description.	Soluble salts, as determined in mechanical analysis.	Organic matter and combined water.	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 0.0001 mm.
			P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.
6069	Sec. 36, Wayland Township.	Silty and sandy loam, 0 to 10 inches.	0.01	2.38	1.08	3.68	21.10	31.72	11.12	23.10	5.09
6071	Sec. 30, Martin Township.	Sandy loam, 0 to 10 inches.	.01	2.72	1.26	9.40	24.52	33.74	5.30	16.88	5.53
6070	Subsoil of 6069....	Medium sandy loam, 10 to 36 inches.	.01	1.10	2.36	7.18	18.90	35.62	10.62	19.96	4.07
6072	Subsoil of 6071....	Sandy loam, 10 to 36 inches.	.01	1.42	3.54	13.14	23.44	31.70	5.26	14.82	6.89

ALLEGAN FINE SANDY LOAM.

Associated with the Allegan sandy loam, particularly in the southwestern part of the county near the lake, is a soil which differs from that type in consisting of much finer grades of sand. In topographic features and probable derivation they resemble each other at every point, but the differences in texture are quite marked. This type occurs upon rounded hills and in low, flat positions where swamps formerly existed. Its extent in the county does not exceed 15 square miles, and the largest areas are found in Ganges and Casco townships, where it is characterized by a hilly surface, and also extends for some distance into the Clyde Swamp, as if the fine material had been carried in from the adjacent slopes.

The soil consists of a fine and very fine sandy loam 10 to 14 inches in depth, of grayish to chocolate-brown color, being quite dark where the situation is low, by reason of accumulation of organic matter. This is underlain to 30 inches or more by a fine and very fine soft sand, often reddish-brown in color, and containing on the average from 4 to 6 per cent of clay, although sometimes as high as 15 per cent of such material is present. This, in turn, rests on a variable material of clay, sand, and gravel, the changes often occurring within short distances. Certain distinctions in the different areas of the type are to be noted. In the upland sections of Casco and Ganges townships the content of clay is on the average higher than elsewhere, and gravel and boulders are found on the surface and scattered through

the material in limited amounts. On this phase peaches are the leading crop, the orchards all having a particularly thrifty appearance. In fact, the best peach soil of the lake shore is found at this place, though the land is not greatly superior to the sandy loam. In addition to peaches some attention is given to apples, cherries, plums, pears, and small fruits, and the yields of these are likewise good. Where grain crops are cultivated the returns are quite satisfactory. Another phase occurs in Manlius Township on each side of the Rabbit River, and in southeastern Overisel Township. Here the soil and subsoil contain a very much less amount of clay, and hence are correspondingly lighter. On the north bank of the Rabbit River in Manlius Township excellent crops of grass are produced, while south of the river the area is generally undeveloped, and in part is wet and marshy. In Overisel the soil lies upon ridges and is yellowish brown in color, having the appearance of the Saugatuck sand, with which it is associated at that point. It is devoted to grain crops, small fruits, and truck, but is not considered highly productive. Where it occurs at low levels and is marshy, the reclaimed areas give excellent crops of grain and truck.

The texture of representative samples of this soil is shown in the table given below:

Mechanical analyses of Allegan fine sandy loam.

No.	Locality.	Description.	Soluble salts, as determined in mechanical analysis.		Organic matter and combined water.	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 0.0001 mm.
			P. ct.	P. ct.								
6047	Sec. 35, Ganges Township.	Fine sandy loam, 0 to 12 inches.	0.02	3.14	0.00	0.84	7.10	69.46	9.16	6.94	3.20	
6049	Sec. 29, Leighton Township.	Fine sandy loam, 0 to 12 inches.	.02	3.08	1.88	2.54	3.50	40.74	26.46	16.86	4.86	
6048	Subsoil of 6047...	Fine sand, 12 to 36 inches.	.01	1.18	Tr.	1.00	4.60	80.14	6.70	3.26	2.13	
6050	Subsoil of 6049 ...	Fine sandy loam, 12 to 36 inches.	.02	1.40	0.90	1.38	1.88	41.22	36.50	11.38	4.70	

ALLEGAN CLAY.

The Allegan clay is a heavy yellow or grayish clay loam with an average depth of 12 inches. It contains considerable organic matter, which as it varies in amount imparts a more or less dark and mellow appearance to the soil. The proportion of sand varies from place to place, but is never high. Under the action of rain and sun the soil is

inclined to bake and readily forms clods. The subsoil to 3 feet or more is a heavy blue, drab, yellow, or red impervious clay.

Alleghan clay extends diagonally across the county in the eastern and western parts in two very irregular areas, intersected by other soil types, and represents in a general way the exposure of the glacial clays. As a basal material it probably underlies the greater part of the region, as it is found in small areas throughout the county. While seldom forming any very sharp and uneven topography, it is generally rolling and irregular, the hills having a gently rounded outline. These hills stand out as bold cliffs along the shore of the lake south of the mouth of the Kalamazoo River, where a considerable thickness of clay is exposed. The thickness of the material varies greatly in different parts of the area and often in short distances. Glacial bowlders of all sizes are scattered throughout and over the surface of the soil, sometimes being so numerous as to interfere with cultivation until removed, though this is not generally the case. In the hills local beds of gravel occur, and small strata are occasionally found elsewhere.

The forests once covering this soil consisted of a mixed growth of hard woods, in which beech and maple were common.

The Alleghan clay is naturally adapted to grain farming, dairying, and stock raising. The average yields are generally fair, approximating 50 bushels of corn, 20 bushels of wheat and rye, and 1½ to 2 tons of hay per acre. These, of course, vary with the farm practices and the length of time the soil has been under cultivation. Because of the heavy subsoil, in sections not having proper slope there is a marked tendency of the soil to be wet and cold and to heave seriously during the winter. Underdrainage is generally advisable. This, besides carrying off the excess of water, serves to aerate the soil, thereby hastening decomposition. Carefully planned crop rotations and generous additions of organic matter should be the leading features in the management of this soil.

There are some variations to be noted. In the low areas in Hopkins Township both soil and subsoil are more sandy. While the subsoil is in the main composed of light-colored clays, extensive areas in Leighton Township consist of a very tenacious red clay, overlain by a soil that is slightly more silty than the average of the type. This phase is more productive than the typical clay.

In the interior of the larger areas of the type there sometimes occur other areas of irregular extent, where the soil is a clay and the very heavy subsoil approaches to within 4 or 5 inches of the surface. In the aggregate these probably amount to 8 square miles. They are found commonly near the crests of ridges, as if the original soil covering had been eroded away. Broken areas were noted on the ridge extending for several miles north and south from East Saugatuck; in section 25, Fillmore Township; sections 10, 12, 14, and 30,

Overisel Township; sections 21 and southeast part 27, Trowbridge Township; southern part of sections 31, 32, and 33, Watson Township, and in section 2 and northwestern part of sections 3 and 4, Otsego Township. Those in Watson Township are low and flat and represent more probably a hindrance of the weathering processes. From the impervious nature of the soil in these places and the difficulty with which it is cultivated, it follows that it has a low agricultural value. The surface breaks up into large clods under the least unfavorable conditions, and after a rain bakes and becomes very compact. During the winter the injury from freezing is always most severe at these points. This phase is generally cultivated to grain and the grasses, the yields being low.

The texture of samples of the Allegan clay is given in the following table:

Mechanical analyses of Allegan clay.

No.	Locality.	Description.	Soluble salts, as determined in mechanical analysis.		Organic matter and combined water.		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 0.0001 mm.
			P. ct.	P. ct.	P. ct.	P. ct.							
6041	Sec. 1, Leighton Township.	Medium clay loam, 0 to 12 inches.	0.01	3.66	0.26	4.22	7.54	18.08	8.76	42.06	15.77		
6045	Sec. 35, Trowbridge Township.	Clay loam, 0 to 12 inches.	.01	2.56	.75	4.46	16.34	19.92	2.44	34.04	17.79		
6042	Subsoil of 6041....	Heavy clay, 12 to 36 inches.	.01	2.66	.80	4.16	8.84	22.28	7.60	21.62	31.89		
6046	Subsoil of 6045....	Heavy clay, 12 to 36 inches.	.08	3.68	Tr.	.56	1.62	3.60	1.82	52.50	35.46		

ALLEGAN BLACK CLAY.

The Allegan black clay is a rich black clay loam, owing its color to the presence of large amounts of humus. The soil has a depth of from 10 to 15 inches and is underlain by a heavy, impervious blue clay, in which there are generally few pebbles or boulders.

In the uneven topography of the areas occupied by the Allegan clay low and consequently poorly drained areas occur, generally small in extent and of irregular outline, where marshy and wet conditions prevail. These may be in stream valleys or, because of the impervious nature of the subsoil clay, wherever depressions occur. In such places the mold from decaying plant remains has accumulated and united with the wash from the surrounding slopes to form a rich black loam.

The most prominent areas occur in what was formerly the Bear Swamp, in the region of Minor Lake, in Allegan Township. Areas in other parts of the county are of less extent.

The type is one of the most productive of the soils of Allegan County, withstanding droughts admirably and giving large yields of all general farm crops, truck, and small fruit. It is also particularly well suited to the growing of sugar beets. Thorough drainage, however, is necessary before cultivation is practicable.

Mechanical analyses of typical samples of soil and subsoil are given below:

Mechanical analyses of Allegan black clay.

No.	Locality.	Description	Soluble salts, as determined in mechanical analysis.	Organic matter and combined water.	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 0.0001 mm.
			P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.
6039	Sec. 21, Leighton Township.	Black clay loam, 0 to 12 inches.	0.05	14.52	3.52	5.74	5.72	12.66	6.34	40.94	9.61
6040	Subsoil of 6039.....	Heavy clay, 12 to 36 inches.	.07	7.84	.54	1.06	.54	1.74	4.50	54.32	27.99

ALLEGAN GRAVELLY LOAM.

Allegan gravelly loam occurs only in limited and detached areas in different parts of the county, and is situated for the most part upon ridges and knolls of gravel. It is also found in local exposures in the areas of stony loam where the covering material has been removed. It occupies only a very small part of the total area, not exceeding 8 square miles in the aggregate. The type is characterized by a gray or chocolate-colored soil 8 to 12 inches in depth, consisting of a large percentage of small bowlders and pebbles intermixed with coarse and medium sand, in which is mingled a dark silty material. The stones are rounded or angular and of a variety of materials, with iron or clay stones of concretionary origin particularly noticeable. While the soil is loose and easily stirred, the lower subsoil, consisting of gravels and gravelly material, is quite coherent and contains much iron. Areas in section 1, Wayland Township, and in southeastern Leighton Township have less of the larger stones, and in sections 4 and 5 of the latter township the soil represents the exposure of gravel beds. The underlying gravels present little evidence of stratification.

On the lake shore the type is regarded as an excellent peach soil, being fertile and having suitable drainage and aeration. In the east-



HARVESTING SUGAR BEETS ON THE ALLEGAN BLACK CLAY.

This heavy clay soil is one of the best soils for sugar beets, as well as for general agricultural purposes.

ern part of the county it is used in general farming, the crops yielding well.

The texture of samples of this formation is given in the following table:

Mechanical analyses of Allegan gravelly loam.

[Fine earth.]

No.	Locality.	Description.	Soluble salts, as determined in mechanical analysis.	Organic matter and combined water.	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 0.0001 mm.
			P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.
6053	Sec. 17, Saugatuck Township.	Sandy loam, 0 to 10 inches.	0.02	3.30	3.18	19.58	32.88	24.56	2.42	9.72	4.40
6054	Subsoil of 6053....	Sand, 10 to 36 inches.	.01	1.92	4.62	26.72	28.98	21.88	2.04	7.48	6.65

KALAMAZOO GRAVELLY LOAM.

The Kalamazoo gravelly loam occurs upon low, rounded hills in the eastern part of Wayland Township, and along the Kalamazoo River as a succession of more or less distinctly marked terraces. The material resembles the Allegan gravelly loam, but differs from it in two essential features. The loose, dark-colored coarse sandy and silty soil, 10 inches in depth, contains only small gravel and pebbles, varying in amount from 10 to 40 per cent, with very few bowlders present, except in a few local areas. In the second place, the subsoil consists of coarser, reddish sands and small gravel, with a few bowlders, and, instead of being heavy and coherent, is loose and open to a depth of 3 feet or more. Heavier gravel beds may occur below 3 feet. The open character of the subsoil permits free drainage, and the crops suffer from lack of moisture, except in particularly wet seasons. In the eastern part of Wayland and Leighton townships the timber growth was mainly oak, the white and the red oaks predominating, and on the river terraces the same growth is found to-day. The term "oak openings" is locally applied to such areas.

This soil is devoted mainly to grain farming, but the yields are only moderate. Along the river rye is a prominent crop, yielding 15 to 20 bushels per acre. The wheat yield is somewhat less. Where the elevation is sufficient the soil is adapted to some extent to fruits, particularly cherries and peaches, while truck crops thrive on the terraces along Kalamazoo River. The area in southeastern Manlius and adjoining townships lies within the "pine plains" region, and is a

distinct variation. While the sand is very loose and light it contains from 3 to 10 per cent of fine gravel, and for this reason has been mapped as belonging to the gravelly loam. It is flat, and was formerly cultivated quite extensively. The oak growth is heavier than on the sandy soils in the vicinity, and the crop producing power is greater. Crops of corn, rye, and truck were noted in this section.

The following table shows the texture of typical samples of this formation:

Mechanical analyses of Kalamazoo gravelly loam.

[Fine earth.]

No.	Locality.	Description.	Soluble salts, as determined in mechanical analysis.	Organic matter and combined water.	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 0.0001 mm.
			P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.
6055	Sec. 18, Allegan Township.	Medium to coarse sand, 0 to 10 inches.	0.01	2.42	3.18	19.20	30.02	33.84	2.24	4.56	4.19
6051	Sec. 13, Wayland Township.	Coarse, silty sand, 0 to 12 inches.	.01	1.78	13.58	30.82	19.70	17.12	3.14	8.86	4.79
6056	Subsoil of 6055....	Medium to coarse sand, 10 to 36 inches.	.01	1.04	3.00	19.70	28.94	40.30	1.84	2.00	2.25
6052	Subsoil of 6051....	Coarse sand, 12 to 36 inches.	.01	1.46	6.80	29.20	23.18	18.76	1.44	11.28	7.43

ALLEGAN STONY LOAM.

Allegan stony loam represents a peculiar phase of glacial soil formation and probably owes its origin to morainic material. It occurs extensively in the northeastern part of the county and has a topography distinctly its own, which, however, is subject to marked variations, ranging from gently rolling country to large rounded hills. Among the hills are numerous kettlelike depressions of varying extent, which often contain lakes or beds of muck. Many of the hills reach an elevation of 100 feet, and in the most irregular sections several rise to 200 feet above the level of the Kalamazoo River.

The soil consists of a reddish or light chocolate-brown silty loam 10 to 14 inches in depth, containing considerable amounts of organic matter and a variable though usually small quantity of clay and sand. The subsoil to a depth of 30 inches is made up of very tenacious red clayey and somewhat silty material, which is in turn underlain by firmly indurated red gravels and sands. The upper part of the



GENERAL CHARACTER OF THE ALLEGAN STONY LOAM.
This is one of the best soils of the area for general crops.

gravel is heavily impregnated with iron and contains much clay, but grades downward into less coherent and more uniform material. The surface of the soil is strewn with bowlders and small stones of all shapes, which are so numerous in many parts that they must be removed before the land can be cultivated. Certain areas, usually of small extent, have few stones. Where the stones are numerous they are plowed up from year to year, and the fields have to be cleared frequently.

The depth of the material overlying the gravel and sand is by no means uniform. The clayey subsoil may extend to more than 3 feet, over limited areas, and the soil may be slightly less silty and stony than the average of the type. This condition is found on high tablelands and is seen in the northern half of Monterey Township. Local bars of clay also extend downward into the gravel to a depth of several feet. The underlying gravel beds exhibit little evidence of stratification, the material varying widely, and while rounded bowlders may occur at one point, at another a few yards distant the material may be fine gravel and sand. Huge bowlders, often weighing tons, are found embedded in this finer substratum. The sands are of medium to coarse grades, grayish yellow, and slightly coherent. From the crests and steeper slopes of some of the hills the soil and subsoil material has been removed, exposing the underlying gravel and sands at the surface. This feature is pronounced in northwestern Watson and southeastern Hopkins townships, where the land exhibits the most irregular topography. In northern Martin and eastern Leighton townships the soil contains a considerable quantity of fine gravel, and in the more level areas are low gravel knolls and kettle-like depressions.

The original timber consisted of a luxuriant forest of many species, the most prominent of which were beech and maple, intermingled with elm, tulip poplar, and basswood, and with oak and black walnut in some places. The soil may be regarded on the whole as the most productive in the county. Grain farming and dairying and other live-stock interests are generally followed, while some attention is given to fruits, particularly to apples and peaches. The crop yields are almost invariably high, and in earlier years, when wheat farming was more general, a yield of from 30 to 40 bushels per acre was not uncommon, while corn, oats, and hay yielded proportionally well. The soil still retains its original fertility to a remarkable extent, and responds readily to careful management. The natural drainage is good, by reason of the many surface slopes and the underlying gravel, and little difficulty is experienced from the alternate freezing and thawing of the soil. The natural fertility of the land and the varied topography adapt the soil to a wide variety of truck, horticultural, and general farm crops. Potatoes yield well and are of fine quality. The sugar beet has not

been given thorough trial, but the soil conditions indicate that this crop may be produced on the flat areas. Peaches thrive particularly well when properly located with reference to both water and air drainage, and apples are a promising possibility. Around Monterey Center may be found many old orchards still thrifty and bearing excellent crops. The trees are generally of the standard winter varieties, from which returns are regular and generous. There is certainly good opportunity for the extension of the production of fine winter apples on the Allegan stony loam.

Mechanical analyses of typical samples of the formation are given below:

Mechanical analyses of Allegan stony loam.

No.	Locality.	Description.	[Fine earth.]									
			Soluble salts, as determined in mechanical analysis.	Organic matter and combined water.	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 0.0001 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>	<i>P. ct.</i>	<i>P. ct.</i>	
6073	Sec. 7, Martin Township.	Silty loam, 0 to 10 inches.	0.02	6.14	0.46	0.74	0.66	3.34	6.32	71.42	10.66	
6080	Sec. 10, Watson Township.	Silty loam, 0 to 10 inches.	.04	2.74	5.50	11.88	6.76	3.72	7.17	47.38	13.32	
6074	Subsoil of 6073....	Silty loam, 10 to 36 inches.	.01	4.04	3.00	2.10	1.84	8.68	8.90	54.64	16.27	
6081	Subsoil of 6080....	Loam, 10 to 24 inches.	.01	2.24	10.58	31.74	16.98	9.60	2.94	8.86	16.81	
6082	Subsoil of 6081....	Gravelly, silty loam, 24 to 36 inches.	.02	2.02	11.24	18.26	8.32	5.04	6.54	33.66	14.96	

PLAINWELL STONY LOAM.

Plainwell stony loam occupies an area about 6 miles long and 1 mile wide, extending in a northeast and southwest direction in eastern Gunplains Township. In its topographic features it resembles Allegan stony loam most closely. The soil is a very light, loose, sandy loam, normally yellow, but sometimes of a slightly brown color, due to the presence of organic matter in the surface few inches. At a depth of 6 or 8 inches this passes into a light yellow sand.

The texture of both soil and subsoil varies from that of Allegan sand to that of Allegan sandy loam, but unlike either of these types it is so thickly interspersed with boulders that its agricultural value is seriously impaired. These stones range in size from fine gravel to occasional boulders weighing many tons. Local variations of heavier soil and of

gravel beds are frequent. To the southward the soil becomes heavier and gradually passes into Allegan stony loam. The topographic features and the presence of a large numbers of stones, as well as the light character of the soil, combine to render this type of but low agricultural value. Much of it is given to pasture, and other parts are cultivated in corn, rye, and buckwheat. Naturally the yields of grass and hay are not large. Occasional limited areas in the depressions possess considerable fertility and produce moderate crops. In general, the level areas and gentle slopes have a crop value similar to that of Allegan sand.

The following table contains mechanical analyses of samples of the Plainwell stony loam:

Mechanical analyses of Plainwell stony loam.

[Fine earth.]

No.	Locality.	Description.	Soluble salts, as determined in mechanical analysis.	Organic matter and combined water.	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 0.0001 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>	<i>P. ct.</i>	<i>P. ct.</i>
6106	Sec. 4, Gunplains township.	Sandy loam, 0 to 10 inches.	0.01	1.78	1.92	8.34	20.64	46.66	6.36	9.26	4.73
6107	Subsoil of 6106....	Sand, 10 to 36 inches.	.01	.78	3.06	8.86	17.76	45.10	7.44	9.82	5.89

ELMWOOD LOAM.

Near the border of the clay and sand soils there are areas where the sand is comparatively shallow. Where the sand is from 1 to 2 feet in depth the type of Elmwood loam has been mapped. The soil consists of from 10 to 20 inches of medium and fine sandy loam, yellowish or gray in color, and in some parts heavily charged with organic matter. This is underlain by several inches of rather compacted medium sand, in turn resting upon a heavy, impervious clay. The type does not occupy large areas, and is found chiefly in the northwestern part of the area surveyed. The surface may be low, level, or rolling. The near approach of the heavy subsoil to the surface must affect the crop-producing power of the soil. It is cultivated to fruit and general farm crops. Peaches, plums, pears, and cherries thrive fairly well, and apples are more successful than on the deeper sands. Yields of corn, wheat, rye, and hay are generally moderate. It sometimes resembles the Saugatuck sand in that it contains iron crusts, but the quantity of such material is usually small.

MEADOW.

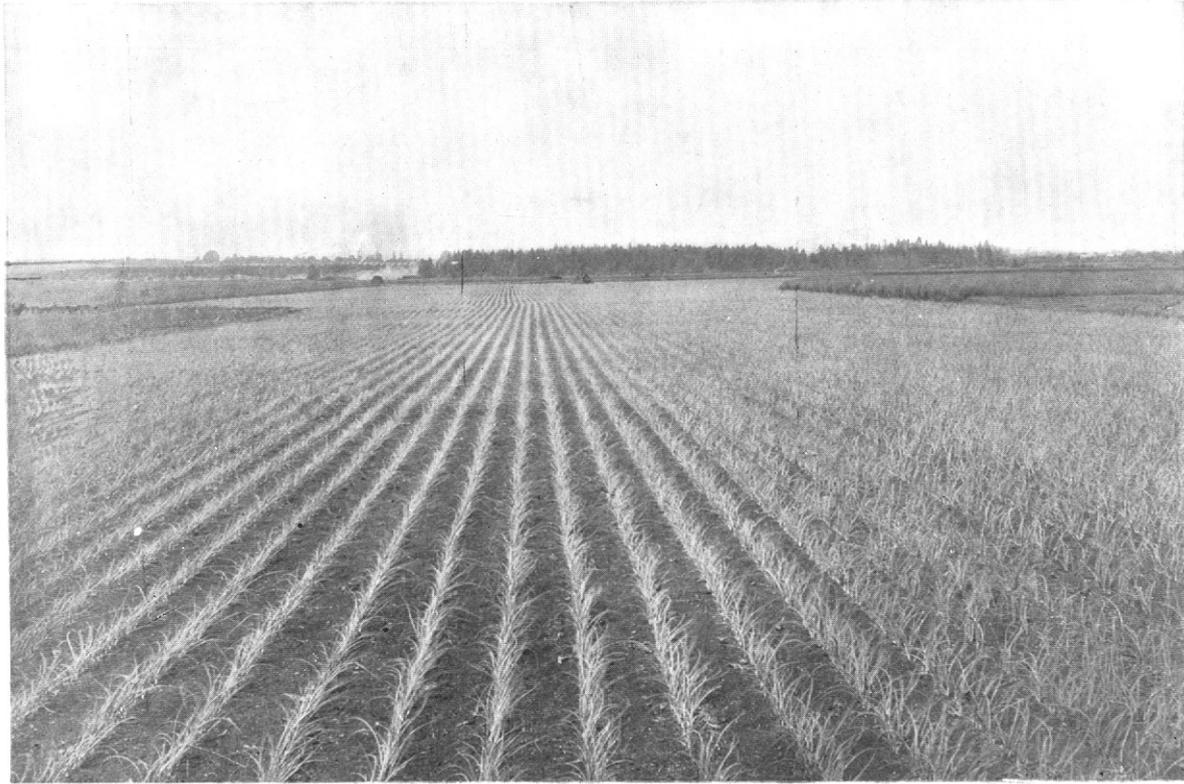
Bordering Rabbit River, the Kalamazoo River in its lower reaches, and all the smaller streams are narrow areas built up by the deposition of material in times of overflow. These are usually highest next to the water and lowest at the point where they connect with the upland, and are commonly traversed by old stream courses and flood channels. Consequently they are never perfectly level, but gently undulating. The material may consist of clay, silt, sand, and muck, indefinitely intermingled, or it may be essentially clay.

The deposits vary in depth from one to several feet, and commonly contain considerable organic matter. Along Kalamazoo River the type grades back to muck areas at a distance from the water. It is covered by a heavy growth of elm, black ash, birch, basswood, and a number of other kinds of trees. At the mouth of Rabbit River and at several points along the Kalamazoo River, where the elevation is considerably above the water level, the meadows are cultivated to corn, wheat, grass, hay, and potatoes, though not without risk of loss. In the main the areas are suited for little else than pasture land.

MUCK.

Distributed throughout the county and associated with every other type of soil are areas of greater or less extent where the absence of proper drainage has developed conditions favorable to the accumulation of plant remains. Wherever these deposits have accumulated to a depth of 8 inches or more they have been mapped as muck. This formation occurs at all elevations, and ranges in thickness from a few inches to 50 feet or more. The greatest depths are usually developed in the small, kettlelike depressions occurring in the uplands. The largest areas are to be found in the former Clyde Swamp in Clyde Township and parts of the adjoining townships, where its wide extent over a flat country in connection with shallow lakes indicates the probable presence of a large lake in former times. Other large areas are found in the eastern part of the county in two extensive strips along Gun River, along the Kalamazoo River in the lower part of its course, and associated with Minor Lake in Allegan Township.

The greater part of the material mapped as muck consists of finely divided and well-decomposed vegetable remains, black in color, derived largely from mosses, but also from other plants. While the muck areas are generally flat they sometimes extend over knolls and up slopes. An impervious clay subsoil is generally responsible for the retention of the water, but a layer of sand may intervene between the muck and the clay. In many places large beds of marl occur. From the native timber growth and from its absence have been derived several descriptive terms. "Dry muck" is applied to very well preserved vegetable tissue in reality peat, which becomes so dry and



CROP OF ONIONS ON MUCK SOIL, ALLEGAN COUNTY, MICH.
The muck soil is specially adapted to onions, cabbages, peppermint, and celery.



CROP OF CABBAGES ON MUCK SOIL, ALLEGAN COUNTY, MICH.

porous that no vegetation is supported—a condition occurring only in small areas. In the main the larger areas of muck have been covered by a heavy forest growth, consisting largely of white elm, black ash, birch, beech, hemlock, maple, and tamarack or larch. “Tamarack swamp” is a term applied where the muck is quite deep and only partially decomposed, and where the wet conditions are found that usually border open waters.

In its wanderings over a broad flood plain the Kalamazoo River has formed several large bayous, the most extensive of which, the Great Daily and its tributaries, in Manlius Township, have been omitted from the base map used in the present survey. These bayous form a sharp scarp with the uplands, and there is meadow along the present channel of the river, and the encroachment of muck has almost filled the courses connecting with the river. In times of high water, however, these bayous still serve to conduct considerable volumes of water, and at other times are so charged with water that flags and rushes are the chief vegetation, and in Manlius and Saugatuck townships the conditions are practically those of a swamp.

Within recent years large areas of these muck lands have been drained and reclaimed and are now under systematic cultivation. The Clyde Swamp has been almost entirely drained within the past eight years, and is now laid out in extensive farms cultivated to peppermint, truck crops, grains, and grasses. In Allegan County the production of peppermint oil is the most prominent industry on the muck soils, and in the particular area just mentioned this crop forms part of a rotation of rough feeds for cattle. Gun Marsh is only in small part reclaimed, and the other scattered areas are variously utilized. Along the rivers and streams heavy cuttings are made of a coarse swamp grass, which is used as winter forage for cattle and horses. Where the soil is thoroughly decomposed excellent crops of corn, hay, and barley may be grown, but one difficulty with the corn crop on muck soil is the tendency to late fall growth and consequent damage by early frosts. Wheat is not produced by reason of its great tendency to winter kill or lodge. Among truck crops, cabbage, and onions are prominent, the former yielding 16 to 20 tons per acre, the latter from 600 to 900 bushels. Besides these, small quantities of other vegetables are produced. Sugar beets are not a success, their greater size being had at the expense of sugar content and purity. Potatoes are not extensively grown, but they yield heavily and merit more attention. While the crops mentioned will probably continue of prime importance, there seems no reason why celery should not be produced on a large scale in Allegan County as profitably as in other sections of the State. At present scarcely any attention is given to the crop. Large areas of muck convenient to the railroads still await improvement.

AGRICULTURAL CONDITIONS.

The agricultural interests may be grouped broadly into three general classes—fruit growing, general farming, and the production of special crops. The county has gained prominence chiefly through its fruit interests, and of these peach growing is the most important. In 1898 the total acreage of peaches was 9,141, yielding a crop of 417,086 bushels, which is more than one-sixth of the acreage and more than one-fifth of the total yield of that fruit in the State, placing Allegan County first among the counties. Of the total product all but 22,000 bushels were produced in the four townships bordering on Lake Michigan. Here occurs a series of light sands and sandy loams which have shown themselves to be well adapted to the growth of this fruit. Added to suitable soils is the tempering influence which the extensive waters of Lake Michigan exert on the climate of this region. The commercial production of peaches in the county dates from about 1858, and since that year the industry has made constant growth. The tier of townships bordering the lake has come to be known as the "peach belt." This area produces more peaches than any other area of equal size in the State. Named in the order of their acreage and yield, the townships are Ganges, Casco, Saugatuck, and Laketown. The first named has an acreage $1\frac{1}{2}$ times as large as that of any other township in the State. The four townships have 6,047 acres out of the 9,141 acres in the county, or about two-thirds of the whole. In size the orchards range from 5 to 100 acres, and the majority of them contain from 20 to 50 acres. The orchards of the inland areas are successful where situated in well elevated positions. In the eastern part of the county, Wayland Township has the largest acreage, but small orchards are scattered throughout the area. The industry continues to increase in importance from year to year, as is indicated by the setting out of new orchards. Broadly speaking, the production of peaches has been an unqualified success, but there have been minor discouragements and losses. In the early days of the industry transportation facilities were inadequate, and more recently two diseases have given much trouble. These are the "yellows" and "little-peach." Thousands of trees have been removed because of infection with these diseases, and in some cases whole orchards have been taken out. Each orchard is now visited annually by a peach-disease commissioner, who marks all infected trees for destruction. In this way the diseases are held in check. Each year finds more careful methods of culture and management practiced, and these all result in increased returns.

The commercial production of apples has received considerable attention, and just at present interest in that fruit is becoming more marked. In 1899 the production was 247,744 bushels, from 7,432 acres, placing the county fourth in the State in acreage and yield.

This crop was mainly from old orchards. The leading townships are Casco, Ganges, Cheshire, Monterey, Saugatuck, and Leighton, in the order named, with an acreage of 3,382 acres. The orchards in the region of Monterey Center appear unusually thrifty, as do all the apple orchards on the Allegan stony loam type of soil.

In connection with the production of peaches the fruit farmers devote limited areas to cherries, plums, and pears, the aggregate acreage of the three fruits in the county being 1,338 acres in 1899. The cherries are marketed early in the season before the peaches ripen, while pears come in later in the fall, and have the added advantages of ripening slowly after their removal from the tree, standing packing well, and thus having a wider market than many other fruits.

Considerable areas are devoted to small fruits, in which are included strawberries, raspberries, blackberries, and currants. These are grown on the heavier sandy loams, and the strawberries in particular are quite productive on much of the area of Saugatuck sand. Grapes are given but limited attention, some few vineyards being located on the more clayey Allegan stony loam slopes.

General farming is commonly practiced throughout the northern and eastern half of the county, where the soils are quite uniformly composed of heavier clays and loams. The intervening sandy areas commonly receive the same management. The farms are comparatively small, the region being quite thickly settled. Within recent years there has been a decrease in the acreage of wheat, which used to be large, and a corresponding increase in the acreage of forage crops and in the number of live stock. This is particularly true on the Allegan stony loam, to whose natural fertility the production of unusually large crops of wheat was due. The reduction in the fertility of the soil has brought about the new methods and the substitution of live stock for grain. The common rotation is corn, followed by oats, wheat, and grass for at least two years. Rye is sometimes utilized, especially on the sandy soils, as a fall pasture crop, and occasionally it is turned under as green manure in the spring. Both dairy and beef cattle are kept, and as a rule the dairy cattle are grades, only a limited number of pure blood herds being owned in the county. There are several herds of Jerseys, and in Leighton Township is a herd or two of well-bred Angus cattle. Little attention is given to the breeding of fine cattle, the more general practice being to maintain herds of what may be termed general-purpose stock—animals suited for producing milk, while at the same time possessing considerable value for beef. Throughout all the section of general farming the dairy interests are particularly prominent. The butter and cheese are usually manufactured in central factories, which are scattered over the area. They are operated both under cooperative and individual ownership. The usual custom is to charge the patrons a certain fixed price per pound for manufacturing the product.

The third class of the agricultural interests comprises the specialties which have been developed, as a rule, on the varieties of soil resulting from marsh conditions. In the last few years several beet-sugar factories have been erected throughout the State, and three of these are located in or near Allegan County. The most convenient of these is situated at Holland, about 2 miles from the county line on the northwest.

The largest yields and most profitable crops after three years' experience are now obtained from two types of soil. These are the Allegan black clay and the Clyde sand. Of course it is to be understood that the beet may be grown on other types, namely, the clay loam and the Allegan stony loam, but the success on these soils is directly in proportion to the amount of organic matter present. The Michigan experiment station designates a clay loam soil as the most profitable for sugar-beet culture. The facts are that the crop demands a fertile soil that is comparatively easily penetrated by the roots, and yet one that furnishes a large supply of moisture. The black clay and the Clyde sand meet these requirements, and the heavier phases of the latter are particularly desirable, as the root may expand freely while the moisture supply is usually abundant. The muck soils are not desirable, for while they produce an unusually large tonnage the beets are always low in sugar content, with a low index of purity. The light sands are unsuited for this crop from their lack of fertility and insufficient moisture supply, which give a product of small yield and low sugar content.

The ordinary yield of beets on good soil, properly cultivated, is said to be from 14 to 18 tons per acre, and the content of sugar will range from 13 to 16 per cent, with a purity index of 80 or 85 per cent. These figures are considerably above the average of those obtained for the crop received by the Holland factory, which places the yield at from 8 to 10 tons. The industry is still somewhat uncertain, but as the cultivation of the crop comes to be more fully understood by the farmers it will probably be given a permanent place in their system of rotation.

On the large cultivated areas of muck in Clyde Swamp and in other parts of the area by far the most prominent crop is peppermint. In fact the county is said to control the markets of the country by the bulk of its distilled product of that plant. In the Clyde Swamp area the greater part of a large farm of 1,750 acres is devoted to the growing of this crop. Neighboring farms add to this output, and there are also two or three areas in the eastern part of the county, notably in southeastern Leighton Township, where peppermint is produced.

The crop is set by strewing the root stems of the plant in rows early in spring. The young plants soon appear and during the first one or two seasons are cultivated. Subsequently to that time they occupy the ground completely. Crops are removed annually and the oil distilled

in a special still. The product of oil averages about 40 pounds per acre, but varies greatly, ranging from 25 to 85 pounds.

The peppermint stalks are used as roughage for cattle, and in connection with corn and hay they form a very good ration for beef cattle.

Cabbage and onions are other crops grown to some extent on muck soils. Both are more or less profitable, depending largely on market facilities. The former yields from 16 to 20 tons per acre, the latter from 600 to 900 bushels per acre. The price of onions fluctuates widely, rendering them a somewhat uncertain crop, but they are undoubtedly a profitable crop, taking one year with another. It is remarkable that in an area so closely associated with the famous celery area of Kalamazoo, and possessing such extensive areas of muck soil, there should be no celery grown. It is unnecessary to more than call attention to the possibilities of extension of this industry in this area.

The centralization of the pickling industry under the management of a few large concerns has led to the establishment of pickle-salting houses throughout the country. In the State of Michigan there are more than 36 such houses under the direction of one company, besides many others, and there are three plants in Allegan County, located at East Saugatuck, Hamilton, and Pullman, which have a combined capacity of about 100,000 bushels. Contracts are made with the farmers for small areas, and the crop is grown on both sandy and clayey soils. Generous crops are frequently obtained from very light sands, often of the Allegan type, especially where they are located in low positions with the water-table near the surface. Any moderately fertile truck soil gives good results.

The growing of small white beans (navy beans) is practiced on the sandy types of soil embraced by the Allegan sand, the Allegan sandy loam, the Allegan fine sandy loam, the Saugatuck sand, and the Clyde sand. The yield is usually from 20 to 30 bushels per acre. This crop is most important in the fruit belt in the western section of the county.

The farms are generally small, especially in the fruit districts, ranging from 10 to 120 acres. In the fruit sections and through the northern and eastern parts of the county the farm buildings are usually adequate and substantial. Quite general use is made of wind motors. In the region of Wayland comparatively shallow artesian wells are used to furnish water for live stock.

Only in that section of the county west of Allegan, known as the pine plains and pine lands, is development particularly backward. Throughout that region the farms are few and scattered, with generally poor equipment. Large areas here are owned by the State and are open to homestead settlement.

The roads are laid out on the rectangular system. Throughout the eastern part of the county, especially where the stony loam types prevail, there are ample supplies of gravel of excellent quality for road making. The roads are generally well graveled, especially through

the sections of heavy soil; and in the fruit belt, where road materials are lacking, the most used roads have been improved through the cooperation of the farmers with the railroad companies in bringing road material into the area. The county is traversed from north to south by four lines of railroad, one cutting the county at a point about 10 miles from the lake front, or at the eastern border of the peach belt. This is a direct line to Chicago, which, besides being accessible from the fruit farms, passes through very large areas of marsh and swamp lands that are being rapidly reclaimed. In addition to the railroads, the lake boats are made use of in shipping all kinds of fruit and vegetables to Chicago. Piers are located at a number of convenient points, and, during the growing season, boats leave daily from each of the several shipping centers.

Naturally, the leading market for the products of the area, especially fruits, is Chicago. Occasionally a consignment of produce reaches some other point on the lake. The local markets and small towns north and south also consume considerable quantities of the products of the area.

Within the past year the necessity of securing more extensive markets and more perfectly utilizing the peach crop has led to the erection of two canning factories. One is located at Pier Cove, on the lake front, and the other near Wayland. The plants are in a measure experimental, and, if successful, will probably lead to the introduction of others. Their capacity is 1,000 bushels of peaches each per day, and they can also handle a variety of other fruits and some vegetables.

After a careful survey of the soil variations and agricultural conditions of the area the conclusion is inevitable that extensive developments are possible, mainly along the lines of horticulture and special crops. The methods of fruit culture are continually being improved; more attention is being paid to the selecting of the proper soil, to furnishing plant food to the young trees, and to improving the quality of the fruit by pruning and thinning. A beginning has been made in reclaiming the immense muck areas, which are capable of yielding annually, when brought under cultivation, thousands of dollars worth of cabbage, peppermint oil, onions, and celery. To make these most successful, careful attention must be given to proper fertilizers, and this is one of the problems open to solution. Crops and methods of management adapted to the "pine plains" remain to be worked out. That region is one of wide expanse, and the successful growth of some crop upon it will add greatly to the wealth of the county, and not alone of Allegan County, but of extensive areas of the same soil in other parts of the State. On the heavier soils of the eastern part of the county, particularly on the Allegan stony loam, there is great chance for the extension of the production of apples on a commercial basis. Capital may find here numerous opportunities for profitable investment.

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