

Soil Survey of Elkhart County, Indiana.

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DESCRIPTION OF THE AREA.

Elkhart County is situated in the northern tier of counties of the State of Indiana. It is bounded on the north by Michigan, on the east by Lagrange and Noble counties, on the south by Kosciusko County and on the west by Marshall and St. Joseph counties. It is rectangular in shape and contains 465 square miles, or 297,600 acres.

The topography of the area is characteristic of glaciated country and varies from flat to hilly. The level land lies within a large outwash plain, one branch of which enters the county from the southeast and another from the south at a general elevation of 828 feet. These branches unite just north of New Paris and extend in a northwesterly direction, following in a general way the present course of the Elkhart River. In the vicinity of Elkhart they merge into the main portion of the outwash plain, which embraces the whole northern part of the county. The general slope of this plain is from the south to the north and to the west, there being a difference in elevation of 79 feet between where it enters the county at the south and where it crosses the western boundary south of the St. Joseph River. In the western part of the county south of the outwash plain lies a large area of gently undulating country which extends to the southern boundary. On both sides of the outwash plain and to the southeast the topography is rolling to hilly. The most marked elevations are the moraines north of Middlebury and between that point and Bristol, extending usually in a northeast and southwest direction. The uplands are mainly between 800 to 900 feet above tide, though some exceed that height.¹

The drainage of the entire county, with the exception of a portion in the southwest corner, is affected by the St. Joseph and Elkhart rivers and their tributaries. The St. Joseph crosses the northern part of the county, entering north of Bristol and leaving

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west of Elkhart. The Elkhart River, entering near the southeast corner, flows in a general northwesterly direction, uniting with the St. Joseph at Elkhart. Since the course of these streams lies within the outwash plain practically no bottom land is found. In the sections of the county where the streams are small, especially in the gently undulating portion to the southwest, drainage has been aided by large open ditches. Hydraulic power has been developed in many places along both the larger and some of the smaller streams.

The first permanent settlers of Elkhart County came from Ohio, Pennsylvania and some of the New England States about 1828. The county was organized in January, 1830, and unlike many other counties retains its original size. At the time of organization the total population was 935, while by the census of 1910 it numbers 49,008, about equally divided between town and country.

Goshen, the county seat, is situated in the central part of the county, and is a prosperous manufacturing town of about 10,000 population. Elkhart, near the northwestern corner of the area, is the largest town in the area with a population of 21,028. It also is a manufacturing center, its chief products being automobiles, buggies and band instruments. Other thriving towns and villages are Nappanee, Wakarusa, New Paris, Bristol, Middlebury and Millersburg. There are several springs of mineral water in various parts of the county and artesian wells are found at Wakarusa.

With the exception of the northern part of the county, where the roads are sandy, and so far unimproved, the area is well supplied with gravel surfaced roads. Radiating from the principal towns, roads of macadam and brick are being constructed and the passing of the Lincoln Highway through the county insures continued improvement along that thoroughfare.

Several railroads supply the county with adequate means of transportation. The main line of the Lake Shore and Michigan Southern traverses the area in a southeasterly-northwesterly direction, passing through Goshen and Elkhart. At these points branch lines from the north and east join the main line, affording shipping facilities for Middlebury, Bristol and Vistula. The Louisville-Benton Harbor branch of the Cleveland, Cincinnati, Chicago and St. Louis Railroad enters the county from the south and passes through New Paris, Goshen and Elkhart. The Wabash Railroad crosses the southern part of the area from east to west and the Baltimore and

Ohio Railroad traverses the extreme southwestern corner. In addition to the steam roads, three electric lines afford a convenient passenger and express service. The Chicago, South Bend and Northern Indiana Railroad connects Goshen with points in Michigan and the Winona Interurban affords transportation to Warsaw and Peru. The St. Joseph Valley electric line extends east from Elkhart through Bristol and Middlebury.

CLIMATE.

The table following gives the record of the Weather Bureau Station at South Bend in St. Joseph County which borders Elkhart County on the West. The station at Goshen was not established until in the spring of 1914 and therefore has no satisfactory records. The data compiled from the South Bend Station is, however, applicable to local conditions.

The climate of Elkhart County is characterized by the wide variations in temperature common to inland countries. The mean annual precipitation is a little over 35 inches and is quite equally distributed throughout the year. The average depth of snow for the year is 60.5 inches which affords adequate protection for winter wheat, rye and clover seedings.

NORMAL MONTHLY, SEASONAL, AND ANNUAL TEMPERATURE AND PRECIPITATION AT SOUTH BEND, ST. JOSEPH COUNTY, INDIANA.

MONTH.	TEMPERATURE.			PRECIPITATION.			
	Mean.	Absolute Maximum.	Absolute Minimum.	Mean.	Total Amount for the Driest Year.	Total Amount for the Wettest Year.	Snowfall, Average, Un-melted.
	°F.	°F.	°F.	Inches.	Inches.	Inches.	Inches.
December.....	27.9	61	-15	2.98	8.25	4.92	13.4
January.....	25.2	66	-22	2.60	3.77	3.42	14.4
February.....	21.8	63	-20	2.21	0.82	0.42	13.9
Winter.....	25.0			7.79	12.84	8.76	41.7
March.....	36.5	82	3	3.22	0.75	3.91	8.6
April.....	48.2	88	13	2.50	1.06	3.76	2.1
May.....	60.2	95	26	3.79	1.30	4.13	0.1
Spring.....	48.3			9.51	3.11	11.80	10.8
June.....	68.6	97	37	3.20	1.48	4.83	0.0
July.....	73.4	103	44	3.61	1.59	5.10	0.0
August.....	71.6	97	44	3.26	2.35	3.48	0.0
Summer.....	71.2			10.07	5.42	13.41	0.0
September.....	66.0	98	30	2.81	1.22	4.82	Trace.
October.....	53.3	95	12	2.29	1.49	2.43	0.9
November.....	39.5	74	7	2.80	3.84	2.36	7.1
Fall.....	52.9			7.90	6.55	9.61	8.0
Year.....	49.4	103	-22	35.27	27.92	43.58	60.5 ¹

¹ Included in mean precipitation.

Average date of first killing frost in fall, October 12; last in spring, May 5. Earliest date of killing frost in fall, September 20; latest in spring, May 28

AGRICULTURE.

Permanent settlement of the region now known as Elkhart County started about 1828 although a few settlers had entered the area the previous year. The Pottawattomie Indians who inhabited this section had turned up the sod and grown corn and vegetables prior to this time, but not extensively.

The fertile prairie lands along the Elkhart River in the present townships of Benton, Jackson and Elkhart were the first chosen, as they required less labor to bring under cultivation than the heavily timbered upland soils. Within a short time, however, small wooded patches were cleared and these were planted to corn and potatoes. Frequently the first planting was among girdled or deadened trees which were to be removed later. Mills were built and other conveniences came rapidly. In 1829 and 1833 the first grist mills were located at the mouth of Christiana Creek and Waterford, respectively.

The pioneer farmers brought with them from their homes in the older States the methods and ideas which prevailed then. The ground was plowed with a wooden moldboard plow drawn by several yoke of oxen. Plows with iron moldboards were introduced in a few years, but these were not considered a success at first. Cultivation was done with the hoe at first, but later on the single-shovel plow came and was used for a number of years.

Fall wheat was sown broadcast among the stumps and trees and the grain harrowed in with a wooden toothed harrow. Those who did not possess such an implement would drag it in with a brush. On the prairies, plowing and cultivation were easier and could be done more rapidly. The same methods were used. Frequently the first year's crop of corn was not cultivated from the time it was planted until it was husked.

In harvesting the corn, the prevailing practice was to pull the ear from the stalk and husk it later on. "Husking bees" soon became the fashion.

Wheat was harvested with the cradle and sickle and the thrashing was done either with a flail or the grain was tramped out with horses.

In the early '40s a machine consisting of only a cylinder and operated by horse power was in use. After thrashing it was necessary to separate the grain from the chaff by fanning with a sheet, the wind blowing the chaff away. Later fanning mills were introduced.

Other crops that were grown were oats, rye, potatoes, flax and buckwheat. Only enough oats were thrashed out to furnish seed for the next year's crop, the bulk being fed in the straw.

Flax was grown for many years and manufactured into homespun clothing.

No attention was paid to the rotation of crops. Corn was planted after corn and wheat after wheat, and this succession continued year after year. Sometimes these crops were alternated, for the sake of convenience and not in order to prevent the exhaustion of the soil.

The native grasses furnished an abundant supply of hay for the needs of those located on the prairie soils, but those who settled in the timber were compelled to depend upon marsh hay for their stock feed.

However, in 1835 timothy was successfully introduced and red-top followed in 1838. The latter crop thrived in the wet and shady

places where timothy did not do well. Clover was first grown in 1845 on the soils of the Elkhart prairie, and in a few years it won universal favor. It was not grown as a renovating crop until a few years later.

Apple orchards were set in the late '30s or early '40s and in 1860 fruit growing was started in the now famous fruit section southeast of Bristol.

Wheat was formerly the money crop and was grown more exclusively than any other grain in the early history of the county. Within the past 20 years the profits have greatly decreased and more recently this falling off in acreage has been due to the ravages of the Hessian fly.

At the present time corn is the most important crop grown, and, like hay and oats, the greater part is fed to the live stock.

The following table shows the comparative acreage of wheat and corn.¹

Year 1880.....	Wheat	50,716 acres.
Year 1880.....	Corn	30,589 acres.
Year 1890.....	Wheat	45,832 acres.
Year 1890.....	Corn	37,053 acres.
Year 1900.....	Wheat	51,901 acres.
Year 1900.....	Corn	41,950 acres.
Year 1910.....	Wheat	34,877 acres.
Year 1910.....	Corn	46,845 acres.

Oats are grown quite extensively on the upland soils, while the acreage on the outwash plain is limited. In 1910 there were 21,349 acres of oats as against 10,585 acres in 1880.

Rye is being more extensively grown and is confined chiefly to the lighter textured soils of the county.

The hay crop is an important one in Elkhart County. The hay consists of timothy, clover, timothy and clover mixed, cow-peas, alfalfa and marsh grass. In 1910 there were 19,110 acres planted to timothy alone, to clover alone 4,052 acres, and to timothy and clover mixed, 9,736 acres, making a grand total of 41,659 tons.

Clover is usually seeded in the spring with oats as a nurse crop. Best results are obtained by using the proportion $\frac{3}{4}$ to 1 bushel of oats to 1 bushel of clover. This is sufficient to seed six acres.

Alfalfa is being successfully grown on a number of soil types and the acreage is gradually increasing. Its importance as a feed

¹United States Census.

and a soil renovator is generally appreciated. Inoculation is advisable although it is not always necessary. Soil from an old alfalfa field may be used for this purpose, or introculture may be applied to the seed. Alfalfa may be seeded in the spring with oats as a nurse crop, or it may be sown in August or September without a nurse crop. For its production the soil should be well drained, liberally manured, limed, and in the best physical condition. About 20 pounds of alfalfa seed per acre is sown. Three cuttings, sometimes four, can be obtained each year, the total yield ranging from three to five tons per acre.

Cow-peas are extensively grown particularly in the northern part of the county. They are well adapted to the light sandy soils and furnish an abundance of feed for a section where timothy and clover do not thrive. About three pecks to the acre are drilled in the first part of June and the crop is harvested about the middle of September. Cow-pea hay is nutritious and makes a good feed, and the green vines are sometimes used for ensilage. Cow-peas sell for \$1.75 to \$3.00 a bushel. The New Era and Whippoorwill varieties are in most general use.

Rape is grown in a limited way for hog and sheep pasture. Only small fields of barley and millet were seen during the survey.

The trucking industry has been quite extensively developed in some sections, especially in the vicinity of the larger markets. The sandy soils are well suited to this industry and some well drained muck patches are used.

The growing of tomatoes for canning has assumed large proportions in the vicinity of Middlebury where the only canning factory in the county is located. From five to eight tons per acre are generally obtained and the price, delivered at the factory, ranges from \$8 to \$10 per ton. Much of the crop is grown under contract with farmers. Some of the surplus tomatoes are shipped outside the county.

In the vicinity of Nappanee cabbage is grown more extensively than elsewhere in the area. Since a kraut mill has been established at this point \$5 per ton is the usual price paid for cabbages.

Since 1860 the section south and southeast of Bristol has been favorably known for its adaptability to fruit growing. The industry has been established on a commercial scale for a number of years. The fruit produced is of excellent flavor and quality and as a rule the orchards are generally well cared for. Most of the products are consumed locally. Small fruits, especially raspberries

and blackberries, are grown extensively in the northern half of the county and form the chief source of revenue for this section. The grape industry has attained considerable proportions and is increasing.

For over twenty years the growing of celery at Goshen has been an important industry. Besides supplying the local markets, shipments are made to other points within the State. Three hundred dollars is the maximum amount received from an acre.

Peppermint and hemp form the other special crops. These are principally raised in the southern part of the county on reclaimed marsh lands.

STOCK RAISING.

The stock which the pioneers brought with them were scrubs, but as a rule the cattle were a better type of animals than were the hogs. The breeding of blooded stock was not begun until after 1850. The first swine introduced were white and somewhat resembled the old Chester Whites, but these were considered superior to that breed.

Later Poland China hogs were brought from Illinois and this breed became popular and has continued so to the present time. Duroc Jersey and I. O. C. breeds are also much in favor. Some Berkshire hogs are seen.

Hog raising is an important industry in Elkhart County, especially when carried on in conjunction with dairying is it found profitable. The census of 1910 states that at that time there were sold or slaughtered 25,991 swine. Hog raising is on the increase.

Pure bred or grade Shorthorn cattle were the first improved stock to be introduced. About forty years ago the Herefords were introduced, but this breed did not become very popular. Dairying did not receive much attention until a number of years after the general live stock industry had become established. Ayrshires, Jerseys, Durham and Holsteins have been popular at one time or another. There are more Holsteins in the county than pure breeds of any other class. They are noted for the large quantity of milk they produce and their calves being large bring in more money than calves of smaller breeds when sold for veal.

On many farms dairying is carried on with profit as an adjunct to mixed farming. The average farmer keeps from six to ten milch cows, while others keep a large number and make dairying a speciality. The silo is in general use and a large acre-

age is devoted to corn for ensilage. Several creameries are in operation throughout the county. A condensed milk factory at Goshen affords a ready market for this section. Enough milk is produced in the county to supply the local demands and some is shipped outside.

In 1900 the dairy products, excluding home use, were valued at \$174,819, while ten years later they had increased to \$407,772. Dairy farming is coming into greater favor, and since the conditions in the county are very favorable this important industry should continue to increase.

Sheep were brought into the county by some of the earliest settlers and they continue to be raised. The Merinos were the first blooded sheep to be raised, but this breed has been supplemented by the mutton breeds, including the Shropshires, the Oxfords and Southdowns. In 1910, 15,754 sheep were either sold or slaughtered.

The use of stable manure is general and a liberal supply is usually applied to the plowed land in the fall. Manure spreaders are quite generally used.

What commercial fertilizer is used is confined mainly to the upland soils and to those farms where there is not sufficient barnyard manure. The sandy soils are enriched by growing such legumes as cow-peas and soy-beans, since farmers on these types do not as a rule keep much stock.

The rotation of crops is practiced and its importance recognized by the majority of farmers. The rotation most extensively practiced consists of wheat, clover and timothy one or two years, followed by oats and again to wheat. Where dairying is practiced the system of rotation is corn two years, followed by oats, and one or two years of clover.

The agriculture of Elkhart County is in a prosperous condition, and the crops which are being grown are well adapted to the soils.

The barns and farm buildings are, as a rule, spacious, substantial and well kept. The general appearance of neatness and the modern farm dwellings with latest improvements and conveniences, give evidence of thrift and prosperity existing among the agricultural classes.

Labor is scarce. The average farm wages range from \$20 to \$30 per month, with board. Harvest hands and extra help receive \$2 to \$2.50 per day.

Farm machinery of the latest designs—corn planters, shredders,

wheat drills and harvesters, disc plows, manure spreaders, rollers, ditching machines, needed to handle the soil and the crops are found upon the farms.

As compared with many sections of the country, there is little tenant farming in this county. The census of 1910 states that 71.6 per cent. of the farms are operated by the owners. Leasing is generally on a share rather than on a cash basis. When the owner furnishes the seed, he gets one-half of the products. The tenant must deliver the owner's share.

The average size of farms is 84.9 acres. Ninety-one per cent. of the area is in farms, and of this 91 per cent., 84.2 per cent. is improved. In 1910 the average value of farm land per acre was \$66.58. The value of farm lands in the county varies from \$35 to \$50 an acre for Plainfield sand to \$165 an acre for well improved prairie land—Waukeshia sandy loam. On the Miami loam, gravelly sandy loam and silt loam types, which are highly improved, land values range from \$75 to \$150 an acre. Small desirable tracts situated along the electric line between Elkhart and Goshen and to the south have been sold at high prices.

While there is need of improvement in the agricultural practices of today, they are, as a rule, well adapted to present conditions.

On the Miami loam plowing should be to a depth of at least eight inches. The matter of drainage is an important problem for the farmer of Elkhart County. The cost of establishing a more effective drainage system on some of the soil types would soon be returned through increased crop yields.

Many marshes and areas of wet land remain to be reclaimed and when this is done much valuable land will be added to the resources of the county.

To the present prosperity of Elkhart County much credit is due to the county fairs, the first of which was held in 1851, under the auspices of the Elkhart County Agricultural Society. It is believed that these fairs held from year to year did much to advance the agricultural interests of the county. Later the Farmers' Institute did much to improve the agriculture of the whole county. The first institute held in the county was in the circuit court room in Goshen, January 22 and 23, 1890.

A county agent is at present imparting information to those who are interested along agricultural lines.

SOILS.

The soils of Elkhart County are of foreign origin and show no relationship to the underlying rocks. They are all derived from glacial material in a more or less modified form and fall into two main groups, the uplands and the sand plains. The latter, which represent glacial outwash, cover the northern portion of the county with tributaries from the south.

This glacial drift varies in depth. At Elkhart it is known to be 125 feet deep; at Goshen 162 feet and at New Paris 90 feet.¹

Well borings at Elkhart show the first 25 feet to be of sand and gravel underlain by indurated glacial clay with occasional thin strata of quicksand.

The uplands, locally known as "clay soils", which vary in topography from undulating to hilly are a disorderly mass of drift, sand, gravel, clay and boulders, with a more homogeneous surface covering.

The rough morainic areas are chiefly confined to the eastern part of the county where the highest elevations are attained.

Another feature of topography peculiar to glaciated country, is seen in the holes and areas of muck and peat which mark the beds of former lakes.

In this survey four series of soils have been recognized. All these were originally derived from glacial material, but varying conditions and forces have developed in each distinguishing characteristics.

In the Miami series, light colored upland soils, four types of varying texture were mapped.

Two members of the Clyde series were found occupying depressions and old glacial lake beds. The Plainfield series embracing the light colored soils of the outwash plain, is represented by four types.

The Waukesha series, represented by one member, was found as a prairie soil associated with those of the outwash plain.

Including the miscellaneous types, muck, peat and meadow, fourteen soil types have been mapped in this area.

MIAMI SERIES.

The Miami soils are brown, light brown or grayish, and are underlain by yellowish and brown heavier textured subsoils. Mottlings of brown and light gray are present in the subsoils in

¹Vol. XXV, Indiana Geological Reports.

many places, particularly in the case of the clay loam member. The surface drainage is usually good, but artificial drainage is necessary in some of the heavier types.

The soils are derived through weathering, from glacial till of a generally calcareous nature. The series represents considerable range in texture and its members are adapted to a wide variety of both general field crops and special truck and fruit crops. Dairying is an important industry on the heavier types.

In Elkhart County four types are recognized, the Miami sandy loam, gravelly sandy loam, loam and silt loam.

MIAMI SANDY LOAM.

The Miami sandy loam consists of a brown medium to fine textured sandy loam to an average depth of 10 inches. There is usually present on the surface and mixed with the soil varying amounts of gravel, large pebbles and small boulders. In some places, notably northeast of Goshen, occasional small spots of the Miami sand are found, usually occupying the tops of the hills and ridges. These areas, however, were too small to separate and the Miami sand type was not recognized in this survey.

The subsoil consists of a light-brown to yellowish sand or light textured sandy loam grading into a sticky sandy loam or loam at an average depth of 20 inches. Near the Miami loam areas, the surface soil of the Miami sandy loam becomes heavier and the texture is inclined to be fine. In such locations the subsoil generally becomes heavier with depth, grading into a heavy loam or clay loam in which the sand and gravel content is low. In the rougher areas beds of gravel are found underlying gravelly clay at depths ranging from 4 to 10 feet beneath the surface.

The Miami sand loam in extent and agricultural importance, ranks second among the soils of the uplands. The largest areas of the type occur in the eastern and central parts of the survey, east of the outwash plain. Another good-sized area occurs as a narrow unbroken strip bordering the western edge of the outwash plain. This area broadens southwest of Goshen and embraces the high and rolling country north of Foraker.

The surface varies from gently rolling to rolling and hilly and the soil with its porous and friable texture is thoroughly drained. The steeper areas are excessively drained and on these, as well as on the sandier areas, crops suffer considerably from drought during the long continued dry spells.

Approximately all of the Miami sandy loam is under cultivation and is devoted almost exclusively to general farming. Small uncleared areas supporting a growth of maple, oak, hickory and beech with some elm and walnut remain.

The type produces good yields of corn, oats, wheat, clover, alfalfa and buckwheat. Individuals cultivating this soil estimate their yields of corn at 30 to 50 bushels, with an average of 40 bushels per acre; wheat from 12 to 25 bushels, with an average of 17 bushels per acre; oats from 25 to 50 bushels, with an average of 35 bushels per acre. Hay yields from three-fourths to one and one-half tons per acre. Potatoes of very good quality for fall and winter use are grown for local markets and home consumption. The average yield is about 100 bushels per acre. During wet seasons the yields are better than on the heavier soil and the quality of potato is superior.

Apples, peaches, pears, grapes and small fruits are successfully grown, but not extensively. Trucking is also carried on to a limited extent.

The Miami sandy loam is easily cultivated and requires less labor to secure a pulverent seed bed than on the other upland soils. While the yields are slightly under those secured on the heavier types, the better grades command practically the same price.

The application of barnyard and green manure is particularly important. No commercial fertilizers are used, and the supply of farmyard manure in many cases is insufficient. Cow-peas and clover should be grown more extensively for green manuring.

MIAMI GRAVELLY SANDY LOAM.

The Miami gravelly sandy loam consists of a light-brown medium sandy loam to loam, 8 to 10 inches deep, underlain by a yellowish or reddish-brown gravelly sandy loam often containing enough clay to make the soil particles cohere. Gravel, stones and boulders occur on the surface and mixed with the soil, the greatest amounts being found on the crests of hills and ridges. The gravel content as a rule increases in quantity with depth and frequently a layer of gravel is encountered at 30 to 36 inches.

Areas of the Miami gravelly sandy loam are confined to the northeast part of the county, principally in the vicinity of Middlebury. The type covers only a small proportion of the county. The isolated area southeast of Bristol is much sandier than the typical

soil and in places is a gravelly sand. The same is true of that portion of the large area north of Middlebury which borders the outwash plain. Small areas of Miami stony loam are also included within the type as mapped.

The Miami gravelly sandy loam has a rolling, hilly, and in places hummock topography. It occupies the highest elevations and roughest positions in the county.

On account of the irregular surface and the underlying gravel the natural drainage is good. On the more elevated positions drainage is excessive and the soil often suffers from drought. The steeper slopes are subject to erosion, though it is severe in only a few places.

The type is derived from glacial drift, and consists almost wholly of morainic material.

The Miami gravelly sandy loam is devoted to general farming and to the growing of fruit. The portion of the type too uneven for cultivation is used for pasturage, but this does not exceed 5 per cent.

Corn, wheat, oats, clover and alfalfa are the principal farm crops. The average yield of corn is 35 bushels per acre. Wheat yields from 10 to 20 bushels; oats 20 to 35 bushels per acre. Some rye is grown, the yield averaging 15 to 25 bushels. Clover and alfalfa do especially well. Both are usually seeded with a nurse crop. Clover gives a yield of $1\frac{1}{2}$ to 2 tons per acre and alfalfa 3 to 5 tons.¹

The area of Miami gravelly sandy loam located southeast of Bristol is devoted almost entirely to trucking and the raising of fruits. On account of its higher sand content it is a typical early truck soil, its loose, loamy structure and thorough drainage adapting it to market garden produce. All the varieties of vegetables adapted to the climate are successfully produced. Cantaloupes and watermelons occupy a large acreage. (See illustration.) Strawberries, raspberries, and blackberries are extensively grown and produce abundantly.

In the line of fruits, plums, peaches, apples, pears cherries and grapes are extensively grown, and fruit of very fine quality and flavor is produced. For these fruits the Miami gravelly sandy loam is considered one of the most successful.

Most of the fruit and vegetables are sold to local markets but some are shipped outside.

¹These figures represent averages as obtained in the field

Barnyard manure is almost universally used where general farming is practiced. When combined with green manuring the productiveness of the soil is increased and more easily maintained. Cow-peas, soy-beans, clover and all leguminous crops would do much to improve its productiveness.

Fruit growers and truckers use commercial fertilizers in addition to stable manure. Some use cotton seed meal with success.

Land of the Miami gravelly sandy loam type varies in price from \$65 to \$100 an acre. Orchard land in good condition is valued higher.

MIAMI LOAM.

The Miami loam consists of a brown, mellow loam to heavy fine sandy loam about 12 inches deep, containing a rather high percentage of silt. When moist the soil has a decidedly brownish color, but on drying out, it becomes light-brown to grayish and in some cases whitish.

A few glacial boulders and rock fragments, consisting of granite, quartz, green stone, and syenite are occasionally found scattered over the surface, but the greater part of the larger of these has been removed from the cultivated fields.

The subsoil is a yellowish-brown clay loam containing varying amounts of coarse sand and fine gravel. This material frequently holds throughout the 3-foot section where the type occupies rolling or hilly topography, but generally at about 24 inches it gives way to a brown heavy sandy clay or clay. This material known as boulder clay contains boulders and rock fragments and not infrequently beds of gravel at depths ranging from 10 to 25 feet below the surface.

The Miami loam is the most important and best developed soil in Elkhart County. It is the main upland type and covers a greater proportion of the county than any of the other types of soil. The largest and most typical areas occur in the southwestern and southeastern parts of the area. It does not occur north of an east and west line passing through the city of Elkhart.

The surface features are gently undulating to rolling and even hilly in the eastern part of the county. The roughest phase occurs between Bristol and Middlebury, where it is associated with the Miami gravelly sandy loam. In the vicinity of Wakarusa the surface is level to gently undulating.

Where the type occupies the higher positions there is nearly always present in the soil a greater percentage of medium and fine

sand than is found in the typical soil, and the subsoil also contains more sand and gravel. Boulders and rock fragments are more numerous. On the more level developments there is present in the soil a higher silt content and the subsoil is more plastic and tenacious.

The Miami loam is derived from glacial till and the roughest areas of the type represent morainic material.

For the most part the natural drainage of this soil is very good and artificial drainage is not necessary except in the flatter areas and draws which have been greatly improved by tiling.

The original tree growth consisted of oak, hickory, maple, ash, beech, elm and walnut.

The type is devoted to general farming. All the farm products common to this region are grown successfully.

From those cultivating crops on this type the following figures concerning yields were obtained.

Corn produces an average yield of 50 bushels per acre; wheat yields from 20 to 30 bushels; oats yield from 20 to 60 bushels, and 1½ tons is considered an average yield of clover and timothy hay.

Cow-peas, rye, buckwheat and millet are grown to a limited extent. Alfalfa succeeds well on this soil, but the acreage devoted to it is small.

Difficulty is frequently experienced in securing a good catch of clover and some farmers advise sowing it with oats in the spring rather than with wheat. From clover grown for seed from one to two bushels are secured.

A common rotation practiced on the Miami loam consists of wheat, clover and timothy one or two years, corn, oats and again to wheat.

Truck crops and fruit are grown for home consumption. Apples, peaches, pears, cherries, grapes and small fruits do well.

The type is well adapted to the crops at present grown upon it.

The Miami loam is a mellow, friable soil of early tillage if plowed at the proper time. If plowed when too wet or too dry the soil forms clods which are difficult to pulverize. The soil is usually plowed to a depth of eight inches and considerable fall plowing is done. Practically all of the type is under cultivation, except small forest reserves or woodlots.

Commercial fertilizers are not used on this soil to any extent, but the available stable manure is applied to plow land. Green manuring is a very valuable means of adding organic matter to the soil, and this method should be resorted to when the supply of

stable manure is limited, since the type is naturally deficient in organic matter.

Cow-peas grow readily, and besides furnishing a splendid hay build up the soil and help to maintain its productiveness. The acreage planted to cow-peas should be increased.

Alfalfa and clover also increase the nitrogen content of the soil through their ability to collect this important constituent from the air.

Recent land transfers show that the Miami loam commands a price of from \$85 to \$100 an acre without buildings, and from \$100 to \$125 an acre with improvements.

MIAMI SILT LOAM.

The Miami silt loam consists of a light-brown to grayish silt loam about eight inches deep, underlain by a mottled yellow and gray compact silty clay.

Very little stone or gravel occurs in the soil or on the surface and the subsoil is practically free from coarse material.

The soil mapped as Miami silt loam in this county is not a typical representative of the type. The surface soil is shallower and the subsoil heavier than in other areas. As mapped, the soil of the two largest areas of this type really represents a shallow phase of the Miami silt loam while the small areas adjacent to small drainage ways approximate the standards of a clay loam.

Most of this soil, which is of only limited extent, is included in two areas, the larger at Jonesville in Harrison Township and the other in Olive Township along the county line. Four small areas also occur along small drainage ways in this section of the area.

In surface features the Miami silt loam is nearly level. On this account and also on account of the dense subsoil, the natural drainage is not good.

Tile drains are common, but the type as a whole would be greatly improved by more complete systems of underdrainage.

The soil is devoted to general farming. Practically all of it is used for agricultural purposes, a few woodlots being the exception.

The crop yields vary with the seasons and methods of cultivation, but are usually slightly below those secured on the Miami loam. Timothy and clover, separate or mixed, do very well. Alfalfa is successfully grown, but the acreage at present is limited.

Of the grain crops wheat and oats do best. Under intelligent methods of cultivation good yields of corn may be secured.

Even greater care must be exercised in the cultivation of the Miami silt loam than the loam. Cultivating when wet causes clodding and baking and if plowed when too dry large clods form. By judicious handling, however, a mellow seed bed can be secured.

Deeper plowing and more thorough drainage, to give better aeration, would result in great improvement in this soil. Alfalfa and other deep rooted crops, such as the larger clovers will be found beneficial in aerating as well as keeping up the nitrogen content.

The Miami silt loam is deficient in organic matter. When barnyard manure is not available in sufficient quantities green manuring should be resorted to as a means to keep up the productiveness of the soil. No commercial fertilizers are used at present. Where there is an indication of acidity the application of about 20 pounds of lime per acre will prove beneficial.

Farm values on this type do not vary much on either side of \$100 per acre.

CLYDE SERIES.

The Clyde series comprises dark-brown to black surface soils, with gray, drab, or mottled gray and yellowish subsoils. These soils are derived through deposition or reworking of the soil material in glacial lakes or ponds, the dark color of the surface soils being due to the high percentage of organic matter caused by the decay of plants in the presence of water under swampy conditions. The soils of the Clyde series grade into muck and peat on the one hand and such glacial lake soils as the Dunkirk series on the other, with very sharp boundary lines.

The topography is level and the soils are naturally poorly drained, but when reclaimed they are highly productive and valuable for corn, grass, cabbage, onions and peppermint.

The series in this county comprise two types, the Clyde sandy loam and loam.

CLYDE SANDY LOAM.

The Clyde sandy loam consists of 10 to 15 inches of a grayish-black to black material, varying in texture from a sandy loam to sand or loamy sand, underlain to 36 inches or more by a drab, gray or yellowish sandy loam or slightly sticky sand.

The subsoil contains some calcareous material and small gravel is found both in the soil and subsoil. The relatively high per-

centage of organic matter present gives the soil a dark color and renders it loamy, mellow, and easy to cultivate.

The type occurs in the outwash plain and occupies a physiographic position intermediate between the Muck and the Plainfield sandy loam. The largest areas are found northeast of Elkhart.

The Clyde sandy loam has a level topography and the drainage is poor. When reclaimed this type is a fairly good corn soil, the average yield being about 50 bushels per acre. A large percentage of the type is used for pasture. It is for the most part treeless, although in places willows and hardwoods are found.

The Clyde sandy loam is admirably adapted to small fruits and vegetables. The type as a whole is greatly in need of more efficient systems of drainage.

The price of this land varies from \$75 to \$125 or more an acre, depending upon drainage conditions.

CLYDE LOAM.

The Clyde loam consists of a dark-gray to black heavy sandy loam to heavy loam, underlain at about eight inches by a heavy bluish-drab clay loam or silty clay. In places the subsoil is a dull brown or yellowish and frequently yellow and gray mottlings occur.

There is considerable variation from the typical soil. The surface for a few inches may consist of mucky material while thin layers of fine sand frequently occur in the heavy subsoil. Again it is not uncommon to find muck underlying the clayey subsoil usually at a depth of two feet. Strata of muck, sand and clay may be found within the 3-foot section, but there appears to be no regular order.

The Clyde loam is found most extensively developed in the southwestern part of the county. The areas are of small extent and for the most part occur as narrow strips along the smaller drainage ways, especially in the upper reaches. Other small tracts occur in glacial lake beds and depressions. Because of the nearness to natural outlets most all of the type has been drained and placed under cultivation.

When well-drained the Clyde loam is especially well adapted to corn, peppermint, potatoes and cabbage.

These crops produce well, the average yield for corn being 75 bushels per acre. It is the leading corn soil of the county.

For the improvement of this type better drainage is essential.

The natural growth consists of wild grasses, low-growing bushes, reeds, elm and willow.

PLAINFIELD SERIES.

The Plainfield soils differ from the Waukesha in having lighter color. The surface soils range from brown to grayish yellow, while the subsoils are usually yellow to pale yellow. This series is developed in the deep drift covered areas and comprises soils formed from sandy and gravelly glacial debris washed out from the fronts of the glaciers. It is also developed as deep filled-in valleys. The greater part of the material of the series has been assorted by glacial waters, and consists mainly of sand and gravel. The topography varies from flat to gently undulating. The deposits are deep and the soils are well to excessively drained. Four members of this series are recognized in Elkhart County, the Plainfield sand, loamy sand, sandy loam and gravelly sandy loam.

PLAINFIELD SAND.

The Plainfield sand consists of yellowish medium to fine sand, extending to a depth of six to eight inches, underlain by loose, incoherent yellow sand which becomes coarser with depth. In places the soil is drifted so badly that it is impossible to secure a stand of any of the seeded crops. On account of the loose structure of this soil it is easy to cultivate and can be worked under a wide range of moisture conditions.

The Plainfield sand is confined to the northeastern corner of the county where the larger of two areas occurs in a continuous strip north of the Little Elkhart River. This stream separates this main body from the smaller area near Bristol.

The type occurs as low ridges and knolls with intervening country having a nearly level topography. The elevations are heaps of loose sand to a depth of several feet and in appearance closely resemble sand dunes. These probably owe their origin to wind action and at the present time are materially influenced by this agency.

As may be inferred the type is well to excessively drained. The moisture holding properties of this type can be greatly increased through shallow cultivation and crops when properly handled suffer less from ordinary droughts than those on some of the heavier soils.

Cow-peas, corn and rye are the principal crops but the yields are only fair. For general farming this soil is too light. Cow-peas do best and a considerable acreage is devoted to this crop. Peas yield from eight to ten bushels per acre and usually sell for \$1.75

to \$2.50 a bushel. The vines are cured for hay and afford an excellent feed. Besides furnishing roughage and revenue cow-peas are a splendid soil renovator and especially are they valuable in a locality where but little live stock is kept.

Since the Plainfield sand is naturally deficient in organic matter as much vegetable matter as possible should be returned to the soil.

Small fruits, peaches and apples and vegetables do especially well in seasons of normal rainfall.

The price of land of the Plainfield sand ranges from \$35 to \$50 an acre.

PLAINFIELD LOAMY SAND.

The Plainfield loamy sand consists of a light-brown or yellowish brown, rather loose loamy sand from 10 to 15 inches deep, grading into a yellow, loose, incoherent sand of similar texture. In the few inches at the surface there is enough organic matter, together with fine material, to make the soil more loamy in texture than the Plainfield sand. On the other hand the Plainfield loamy sand is not as heavy as the sandy loam of this series. In structure and agricultural value it occupies an intermediate position.

The Plainfield loamy sand is closely associated with the sand and sandy loam, and like them occupies the broad outwash plain in the northern part of the county. The largest areas occur in the vicinity of Vistula. The surface of the larger areas is gently undulating while the smaller isolated areas occur as low ridges seldom over three feet above the surrounding sandy loam.

The drainage is good, but not as excessive as in the Plainfield sand; consequently there is less leaching, and the organic matter is retained longer.

Soils of the Plainfield loamy sand are better adapted to early truck crops than to general farming. Melons, cucumbers, tomatoes and small fruits are grown successfully and a large acreage is devoted to these and other crops requiring a light textured soil. A large proportion of the truck crops, as well as raspberries, blackberries and strawberries supplying the Elkhart markets is produced on this soil. For these it is probably the best type in the county. Peaches, apples, and plums do fairly well. Grapes are successfully grown. (See photo.)

One grower southwest of Elkhart has installed the Skinner sprinkling system with gratifying results. (See photo.) The growing of wormwood and tansy for extracts is being successfully

conducted northeast of Elkhart. For general farming the Plainfield loamy sand is a little too light, although fair yields are secured with a normal amount of rainfall. Corn, hay, and cow-peas are the principal farm crops. The organic matter content of the soil should be increased for whatever crop intended.

Farms on this type of soil range in value from \$50 to \$125 an acre, depending upon location.

PLAINFIELD SANDY LOAM.

The Plainfield sandy loam consists of a brownish or yellowish medium to fine sandy loam 10 to 15 inches deep, underlain by reddish-brown sticky sandy loam to a depth of 24 inches. The last foot of the 3-foot soil section is a slightly coherent to loose coarse sand and fine gravel. There is a generous sprinkling of fine gravel, and small cobblestones are not of uncommon occurrence.

The texture of the Plainfield sandy loam varies greatly in different parts of the area, but the subsoil possesses greater uniformity. In the northeastern part of the county, and as far south as Dunlap, the soil contains a larger proportion of medium sand and fine gravel than in other parts of the county, while south of Goshen the soil is composed of a more decided brownish colored compact sandy loam or light-textured loam.

The topography is level to gently undulating and the soil with its porous friable texture is thoroughly drained.

The Plainfield sandy loam is devoted largely to general farming, though considerable trucking is also carried on, especially in the vicinity of Elkhart. As previously stated, that type is more sandy in this section and better suited to such crops. On this phase cow-peas are extensively grown. Corn, rye, wheat and potatoes form the main crops. The yields are from 10 to 20 per cent. below those secured from the heavier phase. Strawberries, raspberries and blackberries produce well and are extensively grown. Grapes are grown very successfully.

The heavier phase is devoted largely to the general farm crops. Corn, the leading crop, averages about 50 bushels per acre, wheat 18 bushels, and rye 20 bushels. Barley is grown only to a limited extent, but its acreage, as well as that planted to rye, is increasing. Barley yields about 30 bushels per acre. Oats do not prove satisfactory and very little is grown.

Clover and alfalfa yield well, but timothy is not very satisfactory. The production of such flowers as asters, gladiolas and carnations has been carried on at one or two places.

Commercial fertilizers are used only to a limited extent and then usually when the amount of stable manure is insufficient to meet the demands of the farm.

Present values range from \$75 to \$150 an acre. Along the electric lines small tracts sell at a much higher figure.

PLAINFIELD GRAVELLY SANDY LOAM.

The Plainfield gravelly sandy loam consists of a yellow or brownish gravelly sandy loam from 8 to 10 inches deep, underlain by a yellowish subsoil of the same texture. Both soil and subsoil contain a high percentage of fairly well-rounded gravel, while cobblestones of varying size are numerous. In places the type resembles a stony loam and often as high as 50 per cent. of stone and gravel is found on the surface. (See photo.)

The type is found bordering the St. Joseph and Little Elkhart rivers and occupies terraces or second bottoms slightly below the other Plainfield soils. The largest areas occur on the north side of the St. Joseph River near Elkhart and Bristol. The surface of the type is level to gently undulating and the areas are all well drained.

Fair yields of corn, oats and hay are obtained, but it is rather too droughty for the general crops. Its texture makes it an early soil, well suited to market garden crops and fruit. It is well adapted to potatoes, strawberries, blackberries and raspberries. Apples, pears, peaches and grapes are successfully grown.

WAUKESHA SERIES.

The soils of the Waukesha series are dark-brown to black, underlain by yellow subsoils in which fine gravel is usually present. The color differentiation has been developed under prairie conditions. These soils occur in association with the Plainfield soils in the areas of deep drift in the Central Lake States. The Waukesha soils, like those of the Plainfield series, are derived from water-assorted glacial debris deposited in broad filled-in valleys or as outwash plains and terraces and are sandy and gravelly in general character. They are more productive than the Plainfield soils, on account of their higher content of vegetable and greater moisture holding capacity. The topography is level to gently undulating and the soils are usually well drained. Only one member of the Waukesha series, the sandy loam, is mapped in this county.

WAUKESHA SANDY LOAM.

The Waukesha sandy loam consists of a dark-brown to black medium to fine sandy loam, 10 to 15 inches deep, underlain by a brown sandy loam in which a stratum of gravelly sandy loam is reached at about two feet. Beneath this a slightly sticky yellow sand to loose sand is found extending to a depth of three feet and more. The relatively high percentage of organic matter gives the soils the dark color so characteristic of this type. The surface soil is free from stone and gravel.

This type occupies level topography and represents the only true prairie soil in the county. The largest area occurs southeast of Goshen and is known locally as "Elkhart Prairie." It was upon this tract that the early development of the county was begun. Two areas near Elkhart and one at Bristol constitute the total development of the type.

The Waukesha sandy loam has good surface drainage and underdrainage. When plowed to the proper depth and cultivated frequently it conserves moisture well. It has been found advisable to break the ground to a depth of at least eight inches. Owing to its thorough drainage the soil warms up early and crops mature earlier than on the heavier upland soils.

The soil is more productive than any of the types located within the outwash plain.

The Waukesha sandy loam is devoted to general farming, corn, oats and wheat being the chief grain crops. Corn yields on the average 40 bushels per acre, though as much as 65 bushels are frequently obtained. Oats average 30 bushels and wheat 18 to 20 bushels per acre. Rye is not grown extensively.

A stand of clover can best be secured by sowing with oats as a nurse crop. The average yield is $1\frac{1}{2}$ to 2 tons per acre. Timothy does well and little difficulty is experienced in getting a good stand. Alfalfa succeeds well and this crop is gaining in favor, but the acreage devoted to it is still small.

No definite system of rotation is practiced, but the following one is practiced to some extent: Corn, oats or wheat, clover or timothy. Commercial fertilizers are not used and the soil receives comparatively little barnyard manure. As a rule the land receives an application of manure before being planted to corn.

In the vicinity of Elkhart some trucking is carried on, but not to any great extent. Fruit, vegetables and truck crops are grown for home use and excellent results are obtained.

Farms on this type of soil are valued at \$150 to \$200 an acre. Recently a sale was made south of Goshen, the consideration being \$165 an acre.

MUCK.

Muck, or what is known locally as "Marsh", consists of decayed and decaying vegetable matter to which has been added varying amounts of mineral matter by the wash from the adjoining higher lands. The muck varies in depth from a few inches in small areas and in narrow strips along streams to several feet in the large marshes.¹ There is usually considerably more mineral matter in the smaller areas, especially in the uplands, while in the large marshes much of the material is peaty.

The subsoil of the muck occurring in the uplands consists of a thin deposit of stiff blue to bluish-black clay, which in turn is underlain by grayish fine sand and in places gravel.

The clay stratum is usually absent in those areas found within the outwash plain. Some of these are underlain by marl deposits. Peat, or organic matter in a less advanced stage of decomposition, is frequently encountered below the surface stratum of muck, and this sometimes reaches the surface.

Several good-sized areas of muck occur in Elkhart County. The more important of these are east of Simonton Lake, east of Elkhart, northeast of Jonesville, east of Goshen, and east of Napanee.

These larger areas occupy flat depressions and the natural drainage is poor. These were at one time lakes, and until recently the area east of Simonton Lake contained Mud and Cooley Lakes which have been drained by means of large open ditches leading south. Practically none of this area is under cultivation, but large amounts of marsh grass are cut for hay.

Marl deposits are found throughout this marsh and this material has been used to a limited extent as a fertilizer.

The Goshen area has been planted almost exclusively to celery for the past twenty years and the industry has proved very profitable. However, the lack of rotation of crops and possibly too generous applications of barnyard manure have apparently caused a decrease in yield as well as an inferior quality of celery. This condition has been especially marked within the last two years.

Very few of the celery growers at present use commercial fer-

¹Well borings in the area east of Goshen show the depth of the Muck and Peat to be as great as 40 feet.

tilizers and then only in small quantities. The practice is said to be profitable and is increasing. Commercial fertilizers containing a large percentage of potash are especially beneficial upon the muck soil.

The large development of muck east of Nappanee is devoted to mint, onions and hemp.

Onions yield from 400 to 500 bushels per acre, according to growers, and sell for 28 cents to 50 cents a bushel.

The growing of hemp has recently been introduced, and while of limited extent has proved successful. In the adjoining county of Kosciusko, a large acreage is given over to this crop, and no doubt in the near future this profitable industry will become well established in Elkhart County.

The yield of hemp is from three to four tons per acre and the price paid is \$12.50 per ton delivered to the factory located at Nappanee.

The growing of peppermint is confined almost exclusively to the southern half of the county and a considerable amount is produced on muck soil. The industry is considered profitable.

Mint is planted in the early spring from roots, in rows three feet apart. The cost per acre for roots is \$10. Weeds are usually troublesome and it is necessary to weed by hand after the plants attain some size. Mint is grown upon the same field for a succession of years but finally runs out. Worn out mint beds are frequently planted to corn or potatoes for a year or two before replanting. Mint is cut in the same manner as grass, with the mowing machine. It is allowed to cure for several hours and is then hauled to the distillery. (See photo.) Numerous distilleries are scattered throughout the mint growing section. Two cuttings are sometimes made, but the second yield is light. Harvesting begins the latter part of July or the first of August and continues until October. Peppermint oil sells at \$1.50 to \$3.25 a pound; there are seven pounds to the gallon and the yield per acre is 25 to 50 pounds.

Mint hay taken from the still and dried is relished by stock.

Truck crops are grown on some of the muck areas near the larger markets. (See photo.)

Huckleberries grow wild on some of the marshes in the north-eastern part of the county and when placed on the market sell for \$1.25 to \$1.50 a bushel.

Many of the areas are treeless, supporting only a growth of reeds and wild grass in the wetter portions. Others are heavily

timbered with elm, maple, willow and some tamarack and low-growing bushes.

A great many of the Muck areas remain unclaimed and uncultivated and there is yet room for an extension of the special crops to which the soil is adapted.

Drainage is the first essential in bringing about cultivation.

PEAT.

The Peat soil of Elkhart County consists of three feet or more of coarse, brown vegetable material, in which the percentage of combustible material is high. The decaying vegetable material is fibrous and but partially decomposed. There is practically no mineral matter in the soil.

Only a few typical areas of Peat were mapped in Elkhart County, but where possible these were separated from Muck. Many small patches were mapped along with Muck and in places a mucky-peat, a gradation from the one to the other, was classified as Muck.

The topography of the Peat areas is flat and the natural drainage poor. Some areas have been reclaimed and planted to the same crops as are grown upon Muck, with approximately the same yields. The natural growth consists of wild grasses, weeds, bushes, including huckleberry, and also elm, willow and maple trees.

MEADOW.

In this survey the type Meadow includes poorly drained narrow strips of low-lying land along streams. The soil is quite variable in texture and is subject to overflow.

The limited areas found along the St. Joseph River are the result of backwater caused by the building of dams. These areas together with that at the juncture of Turkey Creek and Elkhart River, near Waterford, are the most poorly drained and at present have no agricultural value.

Owing to the fact that Turkey Creek and several of the other smaller streams have been straightened and the channels deepened, the Meadow along these is at present fairly well drained. A large total acreage has thus been reclaimed to such an extent that it is used for pasturage.

The Meadow soil for the most part consists of a dark-brown to black sandy loam to loam underlain by a heterogeneous mixture of sand, clay and gravel. A coating of Muck a few inches or more

in thickness is not uncommon and in places the mucky material is frequently three feet or more in depth.

Some areas along the Elkhart River in the vicinity of Benton and others bordering Turkey Creek near New Paris, mapped as meadow, are a brown, medium to fine sand or loamy sand.

With the exception of a few better drained spots which are usually planted to corn, the type is devoted to pasturage. The timber growth consists of elm, oak, maple, sycamore and willow.

SUMMARY.

Elkhart County is located in the northern part of Indiana and has the State of Michigan as its northern boundary. It comprises an area of 465 square miles or 297,600 acres. The surface consists of level plains and rolling to hilly uplands.

With the exception of the southwest corner which drains into the tributaries of the Mississippi, the entire county is drained into Lake Michigan by the St. Joseph River.

The first settlement was made in 1828, and the county was established in 1830. The pioneers came from Ohio, Pennsylvania and some of the New England States.

Elkhart, the largest city in the county, is about 100 miles from Chicago. Goshen is the county seat and has a population of about 10,000. The entire population of the county is about equally divided between towns and country. Settlement is quite dense except in the northeast part of the area.

Transportation facilities are good and the county is well provided with steam, electric, and wagon roads.

The mean annual rainfall is about 35 inches. The average depth of snow for the year is 60.5 inches. The mean annual temperature is 49.4° F. The maximum range recorded is from 103° F. to -22° F. The average date for the last killing frost in the spring is May 5 and for the first in the fall October 12.

The type of agriculture followed in Elkhart County consists chiefly of general farming in conjunction with dairying. The milk output is utilized by the urban population and by creameries and factories located within the county. Some milk is shipped outside. Dairying is steadily increasing and the quality of the cattle is being steadily improved.

The principal farm products are corn, hay, wheat, oats, rye, live stock and dairy products. A large per cent. of the corn, oats and hay is fed to live stock. Much of the corn is grown for en-

silage, since the silo is in general use. Alfalfa grows successfully and the acreage is increasing.

The light sandy soils in the northern tier of townships are devoted to truck crops, small fruits and cow-peas.

The region between Bristol and Middlebury has a reputation for fruit production. Celery, peppermint, onions and hemp are special crops grown on the more poorly drained soils. As a rule, fruit and truck are grown on the lighter soils while the heavy soils are used for hay and grains.

The importance of crop rotation is recognized and is practiced, but no definite rotation is adhered to. Stable manure is widely used. Commercial fertilizers are not widely used. Clover and cow-peas are frequently used as green manure.

The average size of the farms is 84.9 acres. About 71.6 per cent. of the farms are operated by the owners. Labor, when engaged by the month, is paid from \$20 to \$30 per month with board.

The value of farm land ranges from about \$35 an acre for the most sandy land to from \$100 to \$125 an acre for heavier upland soils. The prairie land of which there is but a comparatively small amount, has recently been sold for \$165 per acre.

The soils of Elkhart County have all been formed from glacial drift material which covers the entire area.

Two main soil series occupy nearly all of the county. These are the Miami and Plainfield. The former occupies the uplands while the latter is found in the level to gently undulating outwash plain.

Fourteen types, including Muck, Peat and Meadow, were mapped.

The Miami series is represented by four types. The loam is the most extensive soil type in the area and is well adapted to general farming and stock raising. The sandy loam is considered a fair general farming soil, but the crop value is generally below that of the loam. The silt loam is the heaviest soil of the county. It is well suited to grass and grain. The gravelly sandy loam is of limited extent, occupying rolling to hilly country in the north-eastern part of the county. Portions of this type are devoted to the successful growing of fruit. The Miami soils are light colored.

The Plainfield series is represented in this survey by three types. The sandy loam is a fair to good general farming soil. The loamy sand and sand are too light for general farming, but when properly handled are ideal soils for all truck crops and small fruits. The soils of the Plainfield series are light colored.

Two Clyde soils, the loam and sandy loam, are found. They

are dark colored and contain a high percentage of organic matter. The loam occurs as depressions and poorly drained areas in the uplands. The sandy loam is found in the outwash plain and the natural drainage is poor.

The Waukesha series in this area is represented by the sandy loam. It is a well drained, dark colored type of the outwash plain. It is the prairie soil, with a level surface and well suited to general farming. This was the first of the soils to be placed under cultivation and today commands the highest price.

Muck areas when reclaimed proved remunerative for growing corn, truck and special crops. Celery, onions, peppermint and hemp prove especially profitable.

Peat, when drained, is adapted to similar crops.

Meadow land is usually too wet and uncertain for cultivated crops and is best suited to pasturage.